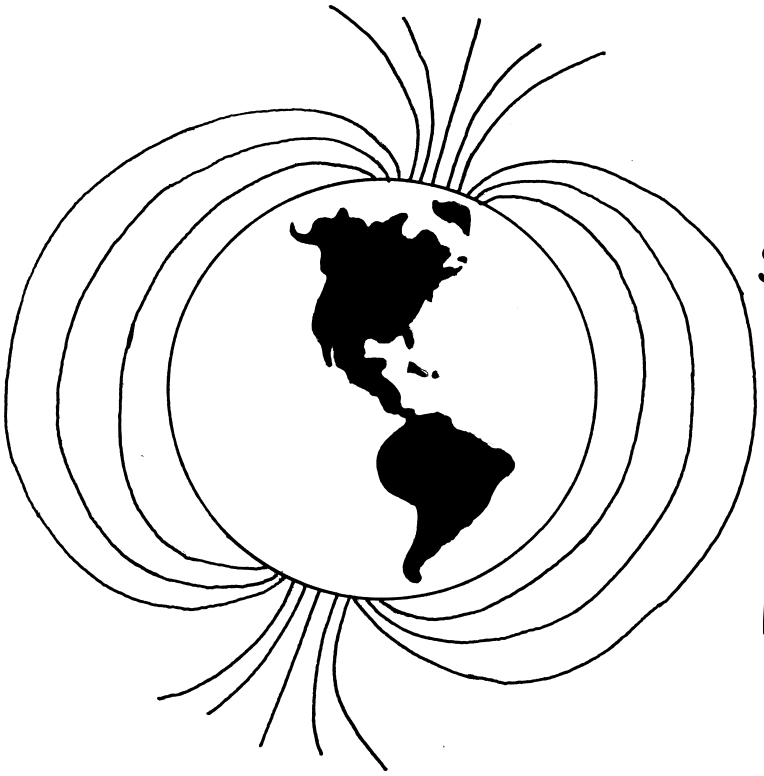
Magnetism

Teacher's Guide
Grades 5-9

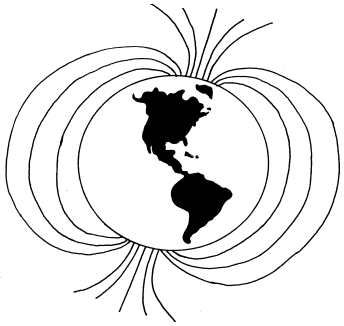


Produced by:
Brian A. Jerome, Ph.D.
Stephanie Zak Jerome

Narrated by:
Nina Keck

Production Assistants:
Anneliese Brown
Erin Berry

Visual Learning Company
Brandon, Vermont
1-800-453-8481
www.visuallearningco.com



Contributors and Reviewers:

Producers:
Brian A. Jerome, Ph.D.
Stephanie Zak Jerome, MPA

Narrator:
Nina Keck

Graphics:
Meredith Patch

Reviewer:
Linda Arnone
Clark Co. Public Schools
Las Vegas, Nevada

Use and Copyright:

082800

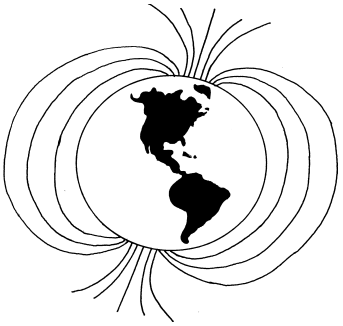
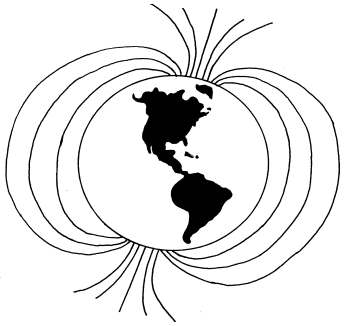


Table of Contents



Viewing Clearances

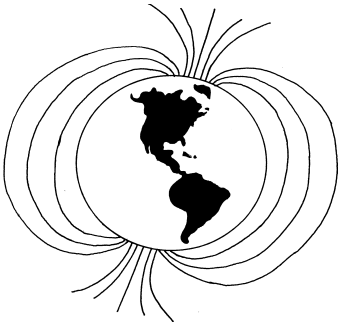
The video and accompanying teacher's guide are for instructional use only. In showing these programs, no admission charges are to be incurred. The programs are to be utilized in face-to-face classroom instructional settings, library settings, or similar instructional settings.

Duplication rights are available, but must be negotiated with the *Visual Learning Company*.

Television, cable or satellite rights are also available, but must be negotiated with the *Visual Learning Company.*

Closed circuit rights are available, and are defined as the use of the program beyond a single classroom but within a single campus. Institutions wishing to utilize the program in multiple campuses must purchase the multiple campus version of the program, available at a slightly higher fee.

Discounts may be granted to institutions interested in purchasing programs in large quantities. These discounts may be negotiated with the *Visual Learning Company*.



A Message from our Company . . .

Dear Educator:

Thank you for your interest in the educational videos produced by the *Visual Learning Company*. We are a Vermont-based, family owned and operated business specializing in the production of quality science educational videos and materials.

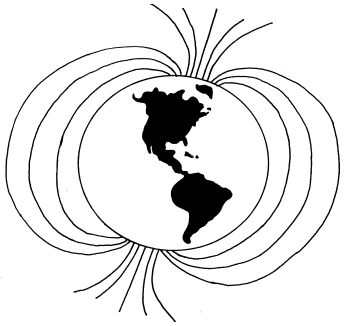
We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, while his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher and to earn a Ph.D. in education, and lead Stephanie to work on science education programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards

(Content Standards: 5-8, National Academy of Sciences, c. 1996)

Science as Inquiry - Content Standard A:

As a result of activities in grades 5-8, all students should develop:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Physical Science - Content Standard B:

As a result of their activities in grades 5-8, all students should develop an understanding of:

- Transfer of Energy

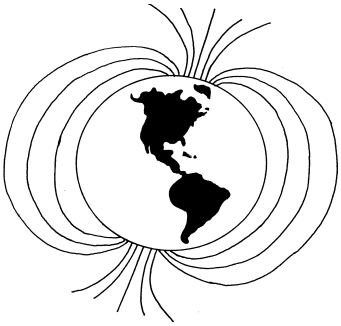
Benchmarks for Science Literacy

(Project 2061 - AAAS, c. 1993)

The Physical Setting - Forces of Nature (4G)

By the end of the 8th grade, students should know that:

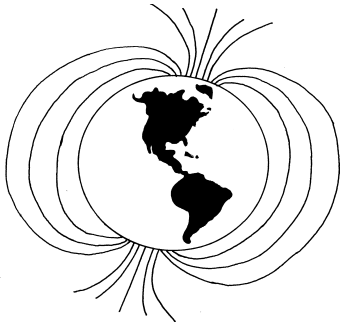
- There are two kinds of charges- positive and negative. Like charges repel each other, opposite charges attract each other.
- Electric currents and magnets can exert a force on each other.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students should be able to do the following:

- Identify many of the everyday uses of magnets;
- Differentiate between the interaction of like and unlike poles;
- Differentiate between the properties of magnetic and nonmagnetic materials;
- Describe and diagram the concept of magnetic fields;
- Identify the north and south poles of a magnet and describe their properties;
- Understand how certain materials are magnetized and demagnetized;
- Discuss the concept of the Earth's magnetic field;
- Understand the role of magnetism in our solar system; and
- Define *magnetosphere* and discuss its role in forming auroras.



Assessment

Preliminary Test:

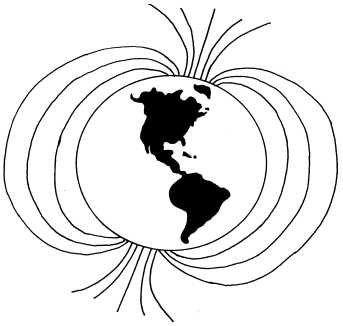
The Preliminary Test, provided in the Student Master section, is an assessment tool designed to gain an understanding of student preexisting knowledge. It can also be used as a benchmark upon which to assess student progress on the objectives stated on the previous page.

Video Review:

The two-part Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. The first part contains questions titled "You Decide" that can be answered during the video. The second part consists of a series of ten questions to be answered at the conclusion of the video.

Post-Test:

The Post-Test, provided in the Student Masters section, can be utilized as an assessment tool following student completion of the video and student activities. The results of the Post-Test can be compared against the results of the Preliminary Test to assess student progress.



Introducing the Video

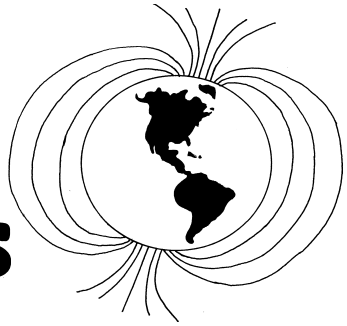
Prior to showing the video, obtain a magnet and a similar looking non-magnetized piece of iron. Hold these objects up to your students and ask them to describe the similarities and differences in their appearances. Then hold a paper clip to each object, demonstrating the magnetic properties of the magnet and the nonmagnetic properties of the piece of iron. Now ask students to identify the difference between the two similar looking objects. Ask students to hypothesize what created the magnetic properties of the magnet. Tell them to pay close attention to the video for the answer to this mystery.

Video Viewing Suggestions

You may want to photocopy and distribute to students the video review provided in the Student Master. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

The program is approximately 20-minutes in length and includes a ten-question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher's guide. You may decide to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



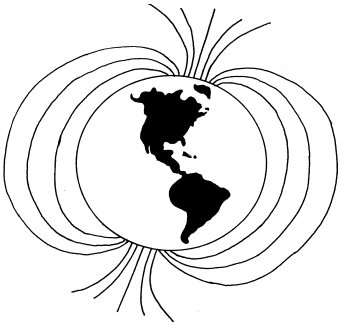
Student Assessments and Activities

Assessment Masters:

- Preliminary Test
- Video Review
- Post-Test

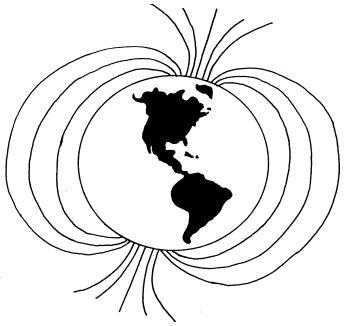
Student Activity Masters:

- Exploring Magnetism
- Magnetic Fields
- The Earth as a Magnet
- Creating a Compass
- Vocabulary of *Magnetism*



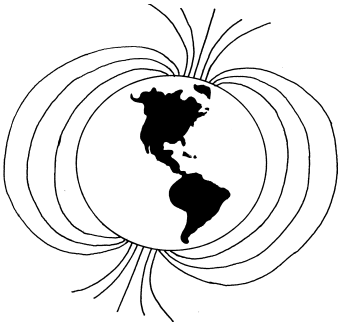
Video Script - *Magnetism*

1. The driver of this dog sled is using one of the oldest navigational tools known to man in order to guide her dog team through the wilderness.
2. The pilot of this small plane uses a similar tool to chart the plane's course.
3. This person's knee injury was diagnosed with a specialized medical machine that uses this tool.
4. And this cow has a device in its stomach to protect it from being injured from metal objects that it accidentally swallows.
5. Do you have any idea what tool each of these uses? If you answered magnets, then you are absolutely right.
6. The dog sled driver uses a magnetized compass needle to help direct her course.
7. The cockpit of the airplane also contains a compass.
8. This large piece of medical equipment, called an MRI or Magnetic Resonance Imaging machine, uses a large magnet to create images of problems within the body in order to help medical staff diagnose ailments.
9. And this cow has a magnet inside its stomach. The magnet collects metal objects such as nails, thus preventing internal damage.
10. You may not realize it, but we use magnets everyday to do things like keeping cabinet doors shut,…
11. ...posting notes on the refrigerator ,…
12. ...and listening to music.
13. During the next few minutes, we are going to explore more of the principles of magnetism and observe many of the ways we use magnets.
14. **Graphic Transition- Magnetism**
15. Have you ever noticed a slight pull or resistance when opening the door of a refrigerator or freezer?
16. This resistance is due to the magnetic strip on the door.
17. The phenomenon that makes this happen is referred to as magnetism.
18. Common types of magnets are called bar magnets.
19. Magnets have two ends called poles.
20. Magnetic forces are the strongest at the poles.
21. Both of the poles have a distinct name. This end is referred to as the north pole.
22. Quite often in bar magnets, the north pole is colored red.
23. This end of the magnet is referred to as the south pole.
24. **Graphic Transition-Magnetism Explained**
25. You Decide! Other than differences in color, what is the difference between these two pieces of metal?
26. Even though they look very similar, the one on the right is a magnet, while the one on the left is a piece of iron.



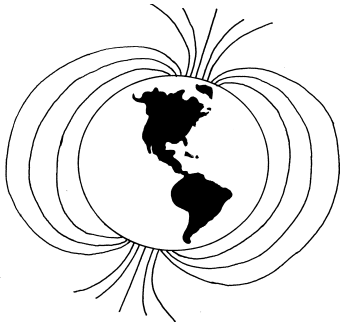
Script

27. The difference between the two lies in the way their atoms are arranged.
28. This is a model of an atom that has been greatly enlarged. The motion of the electrons orbiting the nucleus creates magnetic properties.
29. When atoms join in such a way that their magnetic fields are arranged in the same direction, a magnetic domain is formed.
30. In a magnetic domain, all of the north poles are aligned in one direction, while all of the south poles are aligned in the opposite direction.
31. In materials that are not magnetized, such as this brick, the magnetic domains point in many different directions.
32. Therefore a brick does not have significant magnetic properties.
33. However in magnets, most of the domains are aligned in the same direction,...
34. ...causing the magnet to exhibit magnetic properties.
35. **Graphic Transition- Creating Magnets**
36. This needle is not a magnet and therefore its domains are randomly aligned.
37. You Decide! What could you do to this needle to magnetize it?
38. By placing the needle on top of a magnet, the strong magnetic field of the magnet causes the domains in the needle to rotate in the direction of the field.
39. The needle has now become magnetized and can pick up these iron filings.
40. Objects that have been magnetized can also lose their magnetic field. This occurs when magnets are heated or dropped, causing their domains to become unaligned.
41. **Graphic Transitions- Magnets In Action**
42. As we have discussed, when an object becomes magnetized, one end of the object becomes the north pole and one end becomes the south pole.
43. Each of these poles is surrounded by a magnetic field.
44. You Decide! Predict what will happen when the north poles of these two magnets are drawn toward each other.
45. As you can see, when the north poles are drawn toward each other, they push away from or repel one another.
46. This is summarized by the statement “Like poles repel each other.”
47. Atoms with the same charge exhibit a similar phenomenon.
48. But when the north pole of one magnet and the south pole of another magnet are drawn toward each other, they are attracted to one another.
49. This too is similar to the behavior of oppositely charged atoms.
50. This can be summarized by the statement “Unlike poles attract each other.”
51. **Graphic Transition- Magnetic fields**
53. Through this piece of glass we can see the effect this bar magnet has on iron filings.
54. Notice the pattern of the filings. These filings outline the forces surrounding the magnet.
55. These forces are also referred to as magnetic fields.
56. While magnetic forces tend to be strongest at the poles, the entire magnet demonstrates forces.
57. Their line of force extends from one pole of the magnet to the other pole, as seen in the diagram.



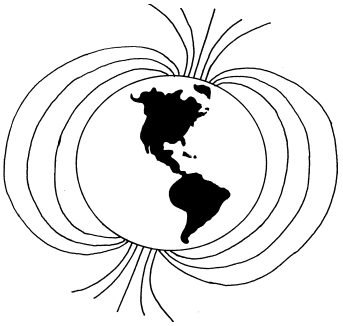
Script

58. When two unlike poles interact, the force draws the two magnets toward each other.
59. And when two like poles interact, the forces repel the two magnets away from each other.
60. By looking at the lines of force, you can see that the like poles repel each other and unlike poles attract each other.
61. **Graphic Transition- Magnetic Materials**
62. You Decide! What happens when a magnet is brought near these plastic checkers?
63. If you guessed that nothing happens, then you are correct.
64. Not all objects exhibit a magnetic attraction.
65. Materials such as plastic, glass and wood do not exhibit a strong magnetic attraction.
66. You Decide! If you draw a magnet near this nail, what will happen?
67. If you guessed that the nail would be attracted to the magnet, you are right.
68. Some materials, especially those containing iron, like these needles, exhibit a strong attraction when brought near a magnet.
69. Other objects, such as this wooden pencil, do not have a strong attraction to a magnet.
70. Graphic Transition- Compasses
71. Have you ever been walking in the woods and suddenly discovered that you do not know where you are?
72. One of the tools that you could use to find your way home is a compass. How does a compass work and how can you use it to find your way?
73. A compass consists of a needle that is magnetized. Like the other magnetic objects we have studied, one end of the needle has a north pole and the other end has a south pole.
74. The north pole of the needle, seen here in red, always points in a northerly direction.
75. Therefore, if you were lost but knew that you had to head east, you could use the compass to get your bearings and walk in an easterly direction.
76. Boats use compasses to chart their courses while at sea . .
77. ...and airplanes, such as this one, use compasses to aid in navigation.
78. **Graphic Transition –Earth's Magnetic Field**
79. The principle that enables a compass to function is related to . . .
80. ...the magnetic field that all of us live in everyday – earth's magnetic field.
81. The earth, like a bar magnet or a compass needle, has a magnetic field.
82. The earth also has northern and southern poles where the magnetic field is the strongest, similar to a bar magnet or to a needle of a compass.
83. Scientists aren't exactly sure of the origin of the earth's magnetic field, but they believe that it has something to do with iron and nickel found in the outer core.
84. The Earth's magnetic field is responsible for this compass needle pointing in a northerly direction.
85. **Graphic Transition – Magnetism in our Solar System**
86. We just discussed the nature of earth's magnetic field, but there are other large magnetic bodies in our solar system.
87. Our sun, the center of the solar system, has a magnetic field. Have you ever observed a solar eclipse?



Script

88. In a solar eclipse, the moon moves in front of the sun. As you can see, the moon appears as a black sphere. Behind the sphere you can see light radiating from the sun.
89. The light radiates irregularly. This is because the sun's rays are affected by the magnetic field of the sun.
90. Strong magnetic fields also occur on some planets in our solar system.
91. Jupiter, seen here, has a magnetic field that is ten times greater than the Earth's and...
92. ...Saturn also has a very strong magnetic field.
93. **Graphic Transition – Earth's Magnetosphere**
94. Magnetic fields potentially have tremendous force.
95. The Earth is continually bombarded with charged particles from the sun, packing huge amounts of radiation. This continual flow of charged particles from the sun is referred to as solar wind**.**
96. Fortunately, most of the radiation carried by the charged particles is deflected by the earth's magnetic fields,…
97. ...protecting us from harmful solar radiation.
98. The magnetosphere is the region around the earth where these magnetic fields are located.
99. The shape of the magnetosphere is continually changing. In some cases, the solar wind is so strong that it creates a tail on the side opposite the source of the solar wind.
100. Graphic Transition – Auroras
101. As we just discussed, the magnetosphere protects earth from the solar wind. However, sometimes charged particles do penetrate earth's magnetic field.
102. These charged particles, trapped in earth's magnetic fields, are found in two main regions called the Van Allen radiation belts.
103. When large volumes of particles get too close to the atmosphere of the earth they cause the air to glow.
104. An aurora is a region where the atmosphere glows as a result of charged particles.
105. Auroras are common at the magnetic poles of the earth.
106. Auroras seen at the north pole are called Aurora borealis, or northern lights.
107. And auroras seen at the southern pole are called Aurora australis, or southern lights.
108. Graphic Transition – Summing Up
109. During the past few minutes, we have taken a look at some of the many uses of magnets in our lives.
110. We have discussed the fact that magnets have two poles . . .
111. ...a north pole and a south pole.
112. And we explored how the poles in magnets are aligned in the same direction.
113. We also investigated how magnets are created or become magnetized.
114. By drawing two magnets close to each other, we saw how like poles repel each other . . .
115. ...and unlike poles attract each other.
116. We discussed the nature of magnetic fields and . . .
117. ...how certain types of materials tend to be attracted to magnets . . .
118. ...and how certain other materials are not attracted to magnets.
119. We also explored how compasses function . . .



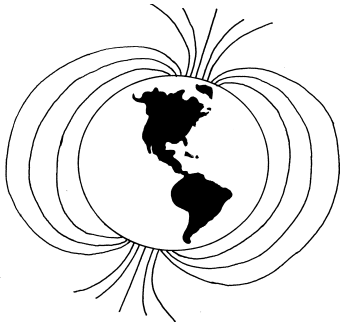
Script

120. ...and some of the many uses of compasses.
121. Finally, we looked at earth's magnetic field . . .
122. ...and the role it plays in forming auroras.
123. So the next time you open the refrigerator door, . . .
124. ...or listen to music, . . .
125. ...or use a compass, think about the...
126. ...many uses of magnets. You just might think about magnetism a little differently.

Video Quiz

Fill in the correct word when you hear this tone. Good luck and let's get started.

1. Bar magnets have two ends called _____.
2. In a magnetic _____ all of the north poles face in one direction, while all of the south poles face in the opposite direction.
3. Like poles _____ each other.
4. The magnetic forces surrounding a magnet are referred to as a magnetic _____.
5. Materials, such as wood and glass, do not have a strong magnetic _____.
6. The needle of a compass points toward the _____ pole.
7. Earth's magnetic field is _____ at the poles.
8. We are protected from harmful solar radiation by earth's _____.
9. An _____ is a region of the atmosphere that glows.
10. A _____ is a magnetic tool used in navigation.



Answers to Student Assessments

Preliminary Test

1. aurora
2. attract
3. magnetosphere
4. solar radiation
5. solar wind
6. compass
7. repel
8. Van Allen
9. magnetic field
10. magnetic domain
11. False
12. True
13. False
14. True
15. False
16. False
17. False
18. True
19. True
20. False

Video Review

You Decide:

A. The one on the right is a magnet and therefore its magnetic domains are aligned in one direction. The one on the left is a piece of iron and has unaligned magnetic domains.

B. The needle can become magnetized by placing it on top of a magnet, causing its domains to become aligned in the direction of the magnetic field.

C. The two magnets will repel one another.

D. Nothing happens when the magnet is brought near the checkers.

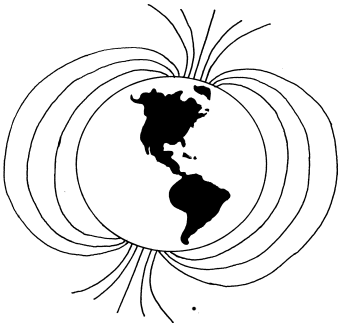
E. The nail will be attracted to the magnet.

Video Quiz:

1. poles
2. domain
3. repel
4. field
5. attraction
6. North
7. strongest
8. magnetosphere
9. aurora
10. compass

Post Test

1. True
2. True
3. False
4. False
5. True
6. False
7. False
8. True
9. False
10. False
11. magnetic field
12. solar wind
13. attract
14. Van Allen
15. magnetosphere
16. magnetic domain
17. solar radiation
18. compass
19. aurora
20. repel



Answers to Student Activities

Exploring Magnetic Poles

Like poles repel each other, while unlike poles attract one another. Answers will vary.

Magnetic Fields

The magnetic forces are strongest at the poles and weakest at the magnet's center. With the two north poles, the filings repel one another. With the north and south poles, the filings attract one another. The pattern created by the unlike poles demonstrates attraction, while the pattern created by the two like poles demonstrates repulsion.

The Earth as a Magnet

You can tell that the magnetic forces are the strongest at the North pole because the lines of filings are closer together than they are at the equator, where the forces are the weakest. The pattern would look the same at the South pole as it does at the North pole.

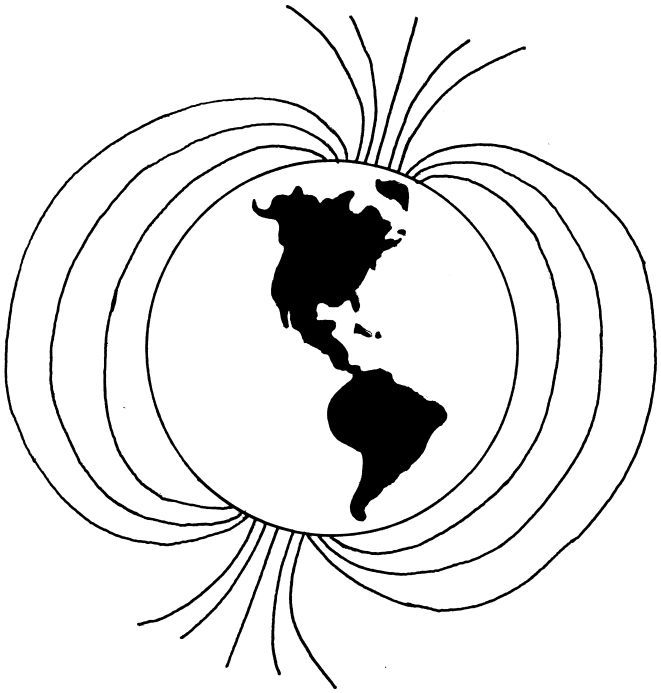
Creating a Compass

The direction of the sewing and compass needles should match. If you used a metal dish, the needle would be attracted to the magnetic field of the dish rather than the Earth's magnetic field, possibly causing the needle to point in a direction other than North. If you stroked the needle in both directions, the atoms would become unaligned, causing the needle to remain unmagnetized.

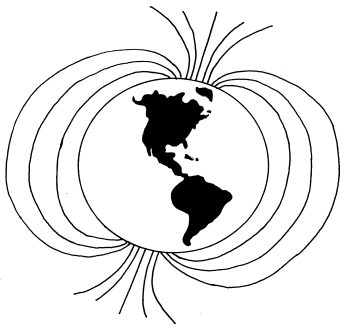
Vocabulary Lesson

1. magnetic poles, b
2. magnetism, e
3. magnetic field, i
4. magnetic domain, d
5. magnetosphere, g
6. aurora, f
7. repulsion, h
8. attraction, c
9. compass, j
10. solar wind, a

Assessment and Student Activity Masters



Name_____



Preliminary Test

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. An _____ is a glowing region of the Earth's atmosphere caused by solar particles trapped in the magnetosphere.

2. Unlike poles _____ each other.

3. The _____ is the region around the Earth where magnetic fields are located.

4. Earth's magnetic field protects us from harmful _____ _____.

5. _____ _____ is the continual flow of charged particles from the sun.

6. A _____ is a tool used to aid in navigation.

7. Magnets _____ each other when the north poles of two magnets interact.

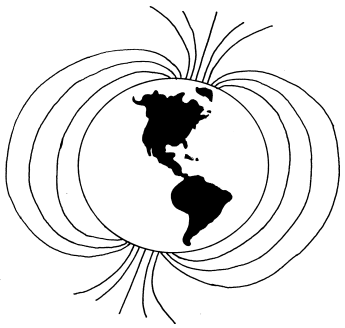
8. The charged particles trapped in Earth's magnetic field are found in two main regions called the _____ _____ radiation belts.

9. The needle of a compass always points in a northerly direction because it is aligned with Earth's _____ _____.

10. A_____ _____ is formed when atoms join in such a way that their magnetic fields are arranged in the same direction.

solar radiation	magnetosphere
repel	magnetic field
aurora	compass
magnetic poles	Van Allen
solar wind	attract
magnetic domain	charged particles

Name_____



Preliminary Test

Directions: Decide whether the answer is True (T) or False (F).

11. Magnetic forces are weakest at the poles. T F

12. In magnets, most of the domains are aligned in the same direction. T F

13. Like poles attract each other. T F

14. It is possible to demagnetize a material. T F

15. A compass consists of a magnetized needle that always points in a southern direction. T F

16. The Earth's magnetic field is strongest at the equator. T F

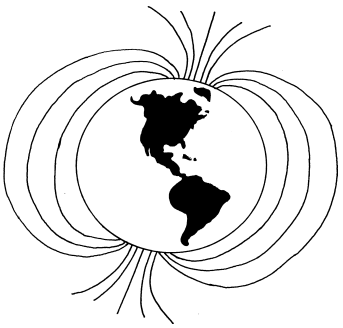
17. The Earth is the only planet in our solar system with a magnetic field. T F

18. Auroras are most commonly seen at the North and South poles. T F

19. Auroras seen at the North pole are called Aurora Borealis. T F

20. Magnets will repel one another when a north and south pole are drawn toward each other. T F

Name_____



Video Review

Directions: During the course of the program answer the "You Decide" questions as they are presented in the video. Answer the "Video Quiz" questions at the end of the video.

You Decide:

A. Other than differences in color, what is the difference between these two pieces of metal? Answer: _____

B. What could you do to this needle to magnetize it? Answer: _____

C. What will happen when the north poles of these two magnets are drawn toward each other? Answer: _____

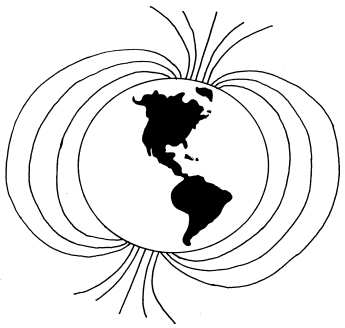
D. What happens when a magnet is brought near these plastic checkers? Answer: _____

E. If you draw a magnet near this nail, what will happen? Answer: _____

Video Quiz:

1. Bar magnets have two ends called _____.
2. In a magnetic _____ all of the north poles face in one direction, while all of the south poles face in the opposite direction.
3. Like poles _____ each other.
4. The magnetic forces surrounding a magnet are referred to as a magnetic _____.
5. Materials such as wood and glass do not have a strong magnetic _____.
6. The needle of a compass points toward the _____ pole.
7. Earth's magnetic field is _____ at the poles.
8. We are protected from harmful solar radiation by Earth's _____.
9. An _____ is a region of the atmosphere that glows.
10. A _____ is a magnetic tool used in navigation.

Name_____



Post Test

Directions: Decide whether the answer is True (T) or False (F).

1. It is possible to demagnetize a material. T F

2. Auroras seen at the North pole are called Aurora Borealis. T F

3. Magnets will repel one another when a north and south pole are drawn toward each other. T F

4. Like poles attract each other. T F

5. Auroras are most commonly seen at the North and South poles. T F

6. Magnetic forces are weakest at the poles. T F

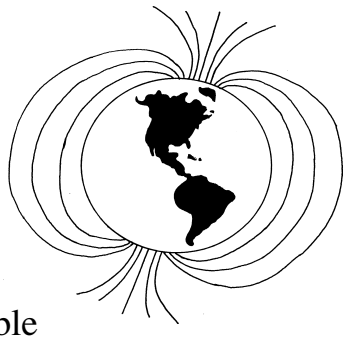
7. A compass consists of a magnetized needle that always points in a southern direction. T F

8. In magnets, most of the domains are aligned in the same direction. T F

9. The Earth is the only planet in the solar system with a magnetic field. T F

10. The Earth's magnetic field is strongest at the equator. T F

Name_____



Post Test

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

11. The needle of a compass always points in a northerly direction because it is aligned with Earth's _____ _____.

12. _____ _____ is the continual flow of charged particles from the sun.

13. Unlike poles _____ each other.

14. The charged particles trapped in Earth's magnetic field are found in two main regions called the _____ _____ radiation belts.

15. The _____ is the region around the Earth where magnetic fields are located.

16. A _____ _____ is formed when atoms join in such a way that their magnetic fields are arranged in the same direction.

17. Earth's magnetic field protects us from harmful _____ _____.

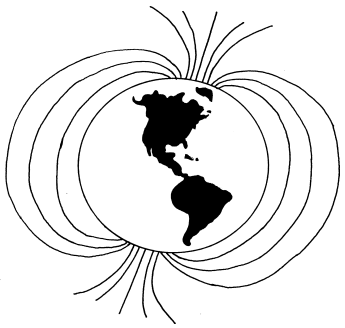
18. A _____ is a tool used to aid in navigation.

19. An _____ is a glowing region of the Earth's atmosphere caused by solar particles trapped in the magnetosphere.

20. Magnets _____ each other when the north poles of two magnets interact.

solar radiation
repel
aurora
magnetic poles
solar wind
magnetic domain
magnetosphere
magnetic field
compass
Van Allen
attract
charged particles

Name_____



Exploring Magnetism

Objective:
In this lab you will observe the principles of magnetic poles and explore the magnetic properties of different materials.

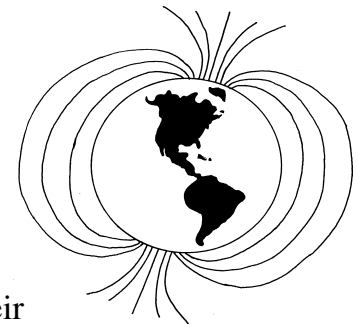
Background:
Many of the objects we use every day of our lives, such as refrigerators and videotapes, depend on the properties of magnets. Have you ever wondered how magnets work? When two magnets are placed near each other, they exert a force on one another. They either attract or repel one another, depending on the relation of their poles. **Magnetic poles** are the two ends of a magnet where magnetic force is the strongest. The end that points North is the north pole and the end that points South is the south pole. Unlike poles attract each other and like poles repel each other.

Materials:
Two bar magnets of the same size
One piece of string
Assortment of ten objects

Procedure:
1. Your teacher will divide you into small groups.
2. Tie a piece of string around the center of one of the bar magnets.
3. Suspend the magnet by tying the other end of the string to an object.
4. Take the second magnet in your hand and bring it toward the hanging magnet. Experiment with different combinations of poles.
5. Next, take an assortment of ten objects provided by your teacher. Test their magnetic properties by touching each object with a magnet. If an object is drawn to the magnet, the object exhibits the force of magnetic attraction.
6. Make a list of the ten objects and state whether or not they exhibit the force of magnetic attraction.

Conclusions:
What force occurs when two like poles are drawn toward one another? What force occurs when two unlike poles are drawn toward one another? In your group, make a list of five everyday objects that make use of magnetic force and determine whether they depend upon the force of attraction or repulsion. Next, use your list from step 6 to determine which types of materials are magnetized and which are not.

Name_____



Magnetic Fields

Objective: In this lab you will observe magnetic fields and explore their properties.

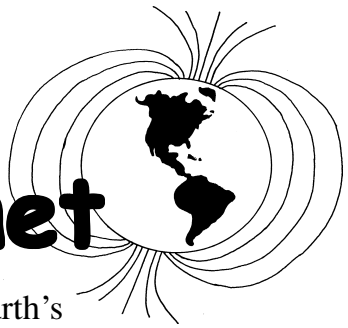
Background: We have learned that magnetic forces are strongest at the poles, but these forces also exist elsewhere on the magnet. In fact, magnetic forces surround the magnet. The area in which these forces act is called the magnetic field. Can you imagine what a magnetic field looks like? It may help to imagine the magnetic field as consisting of magnetic lines extending from the north and south poles of the magnet. The lines are more condensed at the poles, where the field is the strongest, and more spread out at points where the field is the weakest. Attraction and repulsion occurs between two magnetic materials when their magnetic fields come in contact with one another.

Materials:
Two bar magnets
Sheet of paper
Iron powder or iron filings

Procedure:
1. Your teacher will divide you into small groups.
2. Place a bar magnet on a flat surface and completely cover it by centering it beneath a piece of paper.
3. Sprinkle iron filings/powder on the paper and observe. Trace the pattern created by the iron filings/powder.
4. Place two magnets on the flat surface with the north poles facing one another, but with enough distance between them so that they do not move one another. Completely cover the magnets with a piece of paper.
5. Repeat step 3.
6. Now place two magnets on a table with the north and south poles facing one another, but far enough apart so that they do not move one another. Completely cover the magnets with a piece of paper.
7. Repeat step 3.

Conclusion: Where are magnetic forces the strongest? Where are they the weakest? Describe the different iron filing patterns that are created by the north and north poles and those created by the north and south poles. Which pattern demonstrates attraction? Which pattern demonstrates repulsion?

Name_____



The Earth as a Magnet

Objective: In this lab you will learn about and create a model of the Earth's magnetic field.

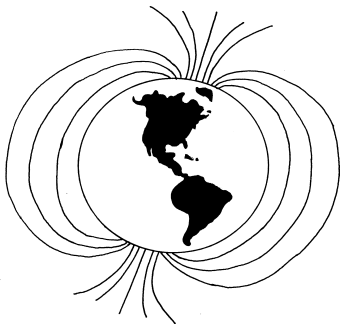
Background:
Have you ever wondered why it is that an airplane pilot can depend on a compass to help her find her destination? Why is it that compasses always point North, making them so reliable? As you know, the needle in a compass is a small magnet that acts in accordance with the Earth's magnetic field. Can you imagine what the Earth's magnetic field looks like? The Earth's magnetic field is similar to the magnetic field of a bar magnet. In fact, it may help to imagine a bar magnet running through the Earth's center, extending from the North pole to the South pole. Although the origin of the Earth's magnetic field is unknown, one popular theory is that it is related to the motion of the Earth's outer core, composed mostly of iron and nickel. This movement may explain why the Earth's magnetic field continues to move, causing the poles to completely reverse every half-million years!

Materials:
Bar magnet
Modelling clay
Cardboard
Tape
Iron powder or filings

Procedure:
1. Your teacher will divide you into small groups.
1. Cover a bar magnet with enough clay to form a ball.
2. Place the clay earth on the table, keeping the magnet upright.
3. To create the equator, cut a strip of cardboard and wrap it around the middle of the model Earth. Attach the ends with tape. Make sure the equator is parallel to the magnet.
4. Sprinkle iron powder or fillings on the clay earth. Observe the magnetic field lines.

Conclusion:
Where are the magnetic forces the strongest? Where are they the weakest? How can you tell? What would the pattern of filings/powder look like if they were allowed to continue toward the South pole?

Name_____



Creating a Compass

Objective:
In this lab you will create a compass using common household objects.

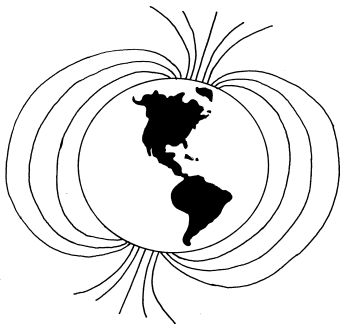
Background:
Imagine you are hiking in the woods and suddenly realize that you have wandered off the trail. You know the road is to the east of the trail, but you have no idea which direction is east. How do you find your way out of the woods? A compass would be able to help you. Have you ever wondered how a compass works? The needle in a compass is a small magnet and is therefore affected by the force of the Earth's magnetic field. Like all magnets, a compass needle has a north pole which always points to the Earth's North pole. Compass needles either balance on a sharp point or float in liquid, allowing them to move freely. Compasses are used in a wide variety of vehicles, such as air planes and ocean liners, to help steer their courses.

Materials:
Sewing needle
Cork
Nonmetal dish
Bar magnet
Compass

Procedure:
1. Your teacher will divide you into small work groups.
2. Partially fill the dish with water, leaving enough room for displacement.
3. Magnetize the needle by stroking it several times in the same direction with the north pole of the magnet. It may be necessary to do this for ten minutes. Be careful not to injure yourself with the sharp needle!
4. Tape the magnetized needle to the top of the cork and float it upright in the dish.
5. Place a compass next to the dish and compare the two needles.

Conclusions:
Does the direction of the sewing needle match the direction of the compass needle? What do you think would happen if you used a metal dish? What do you think would happen if you stroked the needle in both directions?

Name_____



Vocabulary of Magnetism

Directions: Unscramble the following vocabulary words and match each word with its correct definition.

___ 1. genatcim elosp

___ 2. temmgnais

___ 3. natcigme deifl

___ 4. caitngem anoimd

___ 5. sphtenmageroe

___ 6. raouar

___ 7. lseoirnup

___ 8. traatcnoit

___ 9. mpcaoss

___ 10. arosl dwni

a. continual flow of charged particles from the sun

b. two ends of a magnet where magnetic force is the strongest

c. magnetic force found between two unlike poles

d. region of a material in which the magnetic poles of individual atoms are aligned with one another

e. force of a magnetic material linked to the arrangement of atoms

f. glowing region in the sky that occurs when solar particles enter the earth's magnetic field

g. region in which the Earth's magnetic field is found

h. magnetic force found between two like poles

i. area surrounding a magnet in which magnetic force exists

j. magnetic tool used in navigation