Name ___________________

1 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

PRE-TEST

I. Directions: Fill in the blanks to complete the following statements.

1. Magnetism and ____________________ are related.

2. The ends of a magnet are called _____________.

3. When two magnets are brought close to each other and they try to move apart, we say the two magnets ____________ each other.

4. If two magnets come together, we say they _________ each other.

5. Magnets will not pick up all metals. They respond mainly to metals that have ___________ or _________ in them.

II. Directions: The following questions require a short answer.

1. How can you make an electromagnet?

2. What can be done with an electromagnet that can't be done with a regular magnet?

3. Describe some ways electromagnets are used.

4. If we brought two magnets together, what would you expect to happen if the same poles are facing each other?

5. If we flip one of the magnets around and bring them together, what will happen?

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THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

PROGRAM QUIZ

Directions: At the end of the program, there is a short quiz. You can record your answers on this sheet.

1. If two magnets have opposite poles facing each other, they will be ________.
   a. repelled
   b. attracted
   c. neutralized
   d. opposed

2. If two magnets have the same poles facing each other, they will be ________.
   a. repelled
   b. attracted
   c. neutralized
   d. opposed

3. __________ are controlled by electricity.
   a. Lodestones
   b. Pieces of magnetite
   c. Electromagnets
   d. Permanent magnets

4. Iron nails can be made into magnets because of their __________.
   a. domains
   b. lodestones
   c. magnetite
   d. protons

5. Magnets are used in electric motors and __________.
   a. horseshoes
   b. lodestones
   c. turbines
   d. generators

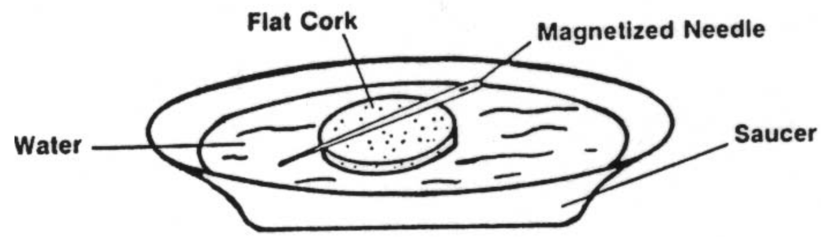
Name ____________________

THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

COMPASS CONSTRUCTION

Purpose: To build your own compass.

Materials:
bar magnet
sewing needle
flat cork
saucer of water
tape



Procedures:

1. Turn the sewing needle into a magnet by stroking it across a bar magnet. Stroke it in only one direction and on only one pole of the magnet. At the end of a stroke, lift the needle off of the magnet and bring it back to the starting point. Stroke the needle across the magnet at least 40 times.
2. Tape the magnetized needle to one of the flat sides of the cork.
3. Pour water into the saucer.
4. Float the cork in the water with the needle on top.
5. Give the cork a spin and make observations. Repeat.

Observations:

1. What happened when you first placed the cork and needle in the saucer of water?

2. What happened when you spun the cork and needle?

Conclusions:

1. Why did the needle and cork behave as they did?

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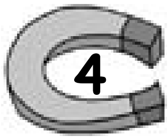

THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

Name ____________________

WHAT DO MAGNETS ATTRACT?

Directions: Set up an experiment to find out what magnets attract. Use the chart below to record your findings.

	Objects tested	**Did the magnet attract it? Yes**	**No**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Questions: Which things were attracted to the magnet?

How are these things different from the others you tested?

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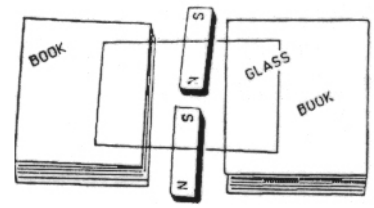
5 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

LINES OF FORCE

Purpose: To see the lines of magnetic force that exist in a magnetic field.

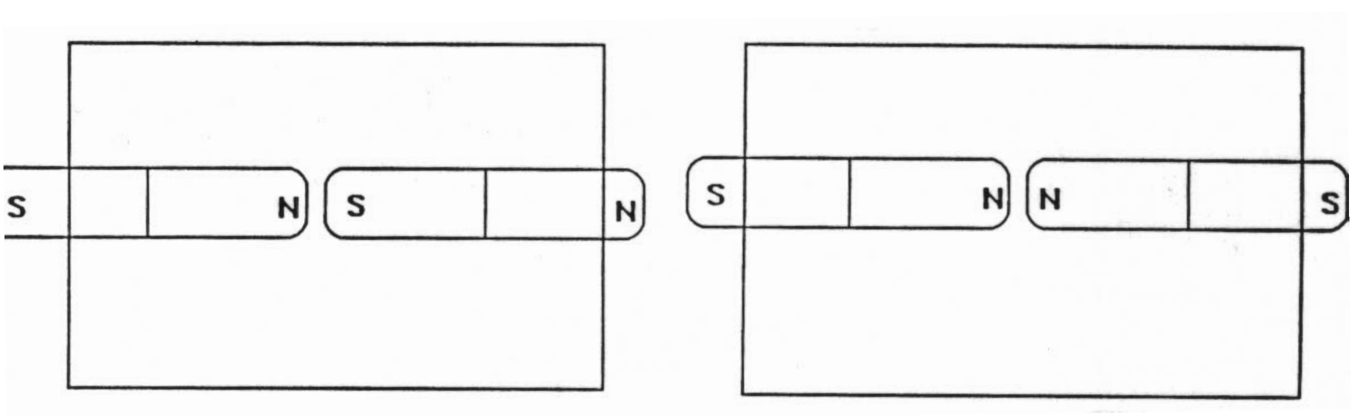
Materials: two bar magnets marked with N and S poles
a piece of glass at least 6" by 6"
iron filings
two identical-sized books



Procedures:

1. Set the two books so that there is a space of at least four inches between them.
2. Place the sheet of glass on the books so that the books become a support.
3. Move the two magnets under the supported sheet of glass and between the books. The magnets should be placed so that the **N** pole of one magnet is facing the **S** pole of the other magnet.
4. Sprinkle iron filings on the top of the glass and make observations.
5. Repeat this experiment; but this time, have identical poles facing each other.

Observations: Draw what you observed from Procedures 4 and 5 above.



Conclusion: What do the lines of filings tell you about the invisible magnetic lines of force?

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6 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

C U T U P

Purpose: To determine what happens when a bar magnet is cut into pieces.

Materials:
strong bar magnet
a thin piece of iron
wire cutters
paper clips or iron filings

Procedures:

1. You can make the piece of iron magnetic by stroking it many times across one of the poles of the magnet. Stroke it in one direction only. After each stroke, lift the iron off the magnet and bring it back for the next stroke. Repeat this for more than 20 times.
2. Bring the piece of iron close to paper clips or iron filings and make observations.
3. Use the wire cutters to cut the piece of iron in half.
4. Test each half to see if the magnetism remains. Make observations next to question 2 below.
5. Cut one of the halves in half and test the new pieces for magnetism. Make observations next to question 3 below.

Observations:

1. Was the original piece of iron made magnetic by stroking it with a bar magnet?

2. Did each half of the cut piece of iron still have a magnetic attraction?

3. Did the small pieces of iron still have magnetism?

Conclusion: What happens when a magnet is cut into smaller pieces?

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7 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

DON'T DO IT

Purpose: To demonstrate why a magnet should never be dropped or heated.

Materials: strong bar magnet
two iron nails
candle and matches
paper clips
towel
pliers

Procedures:
1. You can make each nail magnetic by stroking it many times across one of the poles of the magnet. Stroke it in one direction only. After each stroke, lift the nail off of the magnet and bring it back for the next stroke. Repeat this for more than 20 times.
2. Test the attracting ability of the two nails by bringing each nail to a pile of paper clips. Make observations. If they are not strong, repeat Procedure 1.
3. Drop one of the nails on the floor. Test it for magnetism and make observations.
4. Light the candle and put the remaining nail in the pliers. Hold the pliers with the towel so your fingers aren't burned when you put the end of the nail in the candle flame.
5. Let the nail stay in the flame for a few minutes and then test its magnetic ability. (Don't touch the hot nail - use the pliers.) Make observations.

Observations:
1. Were the two nails magnetized?
2. Was the dropped nail still magnetic?
3. Was the heated nail magnetic?

Conclusion: What are the two ways a magnet could lose its magnetism?

Name ____________________

8 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

MAGNETISM FROM ELECTRICITY

Purpose: To demonstrate that an electric current produces magnetic fields of force.

Materials: compass
nine-volt battery
insulated wire

Procedures:

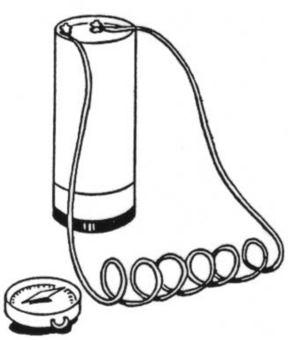
1. Remove about one inch of insulation from the ends of the wire.
2. Curve the wire out into a large circle.
3. Connect it to the nine-volt dry cell.
4. Move the compass to different points along the wire.

Observations:

1. What happens to the compass needle as it is brought near the wire?

2. What happens when the dry cell is disconnected?

Conclusion: What does this illustrate about the connection between electricity and magnetism?



What if the wire were coiled around a toilet tissue tube?

What if a shorter or longer piece of wire was used?

Name ____________________

9

THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

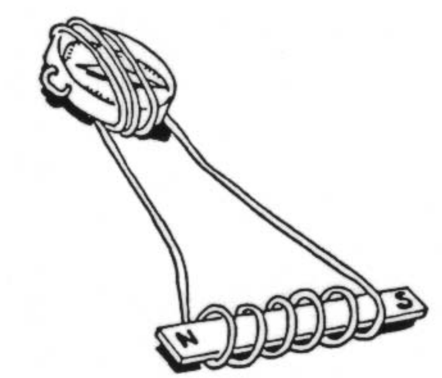
ELECTRICITY FROM MAGNETISM

Purpose: To demonstrate that an electric current can be generated from magnetism.

Materials:
compass
bar magnet
25 feet of insulated wire
toilet tissue tube

Procedures:

1. Cut the insulated wire in half.
2. Make an electric current detector by wrapping a compass with many turns of insulated wire.
3. Wrap the other wire around the toilet tissue tube.
4. Remove the tube so that you have a nice coil of wire.
5. Remove the insulation from the ends of this wire.
6. Connect the compass wire to the toilet tissue tube wire as illustrated here.
7. Move the bar magnet in and out of the coil of wire.



Observations:

1. What did the compass needle do when you moved the bar magnet back and forth in the coil of wire?

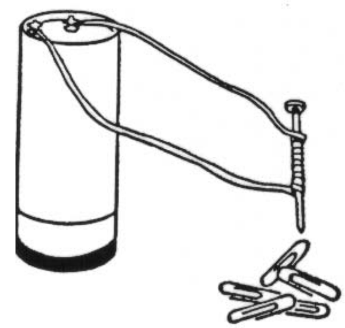
Name ____________________

10 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

ELECTROMAGNETS

Purpose: To construct a working electromagnet.

Materials: iron nail about three inches long
1-1/2 volt dry cell
insulated wire
paper clips



Procedures:

1. Wrap the insulated wire around the iron nail with as many turns as you can. Be sure to leave wire on the ends to allow a hookup with the dry cell.
2. Remove about one inch of insulation from the ends of the wire. Bring the nail and wire close to a pile of paper clips. Make observations. Write an answer for Observation 1.
3. Attach the ends of the wire to the dry cell and repeat Procedure 2. Make observations. Write an answer for Observation 2.
4. Disconnect the dry cell and make observations. Write an answer for Observation 3.

Observations:

1. Are the nail and wire magnetic?

2. When connected to the dry cell, did the iron nail attract or pick up paper clips?

3. What happened to the magnetism of the nail when the dry cell was disconnected?

Conclusion: Under what conditions will an electromagnet pick up things made of iron?

Things to try: What would happen if there were fewer turns of wire?
What about more turns of wire?
What if you add a stronger dry cell or more than one dry cell?

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11 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

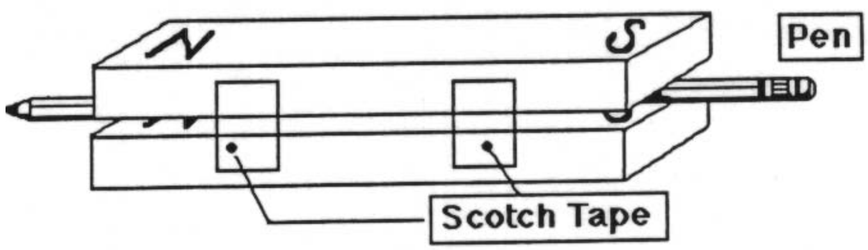
M A G L E V

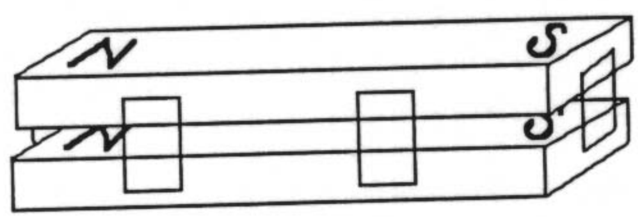
Purpose: To demonstrate the main idea of magnetic levitation.

Materials: two bar magnets the same size and shape
scotch tape
pen

Procedures:
1. Place one magnet on a flat surface.
2. Line up the second magnet so its north side is above the north side of the first magnet.
3. Put a pen between the magnets.
4. Tape the sides of the magnets as illustrated.
5. Remove the pen.

Observations: What happens when you push down on the top magnet?





Name ____________________

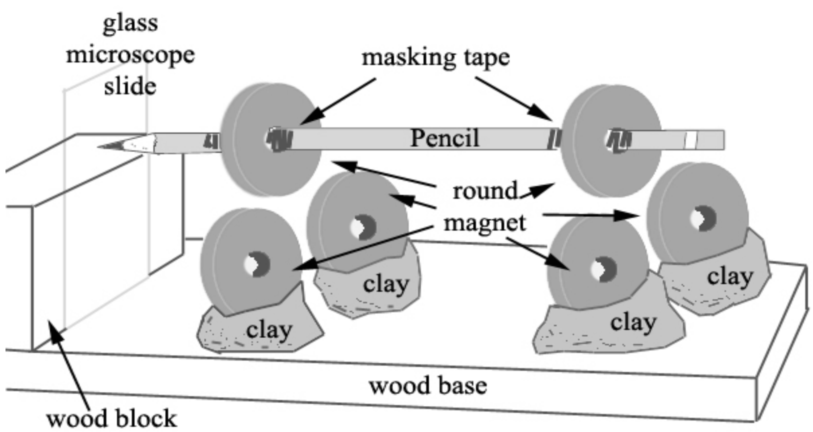
12 THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

MAGLEV VERSION TWO

Purpose: To demonstrate the main idea of magnetic levitation.

Materials:
- pencil
- masking tape
- six round donut magnets
- clay
- microscope slide
- wood base and wood block

Procedures:
1. Tape the glass microscope slide to the block of wood for support.
2. Put the pencil through the center holes of two donut magnets using masking tape to provide a snug fit.
3. Use clay to support the four additional donut magnets as shown in the picture below.
4. Rest the pencil point against the glass microscope slide.
5. Adjust the magnets on the pencil so that they are positioned above the four magnets on the wood base.



Observations: What happens when you spin the pencil?

13

Name ____________________

THE MAGIC OF MAGNETS
from the series *Electricity and Magnetism*

POST-TEST

I. Directions: Define these terms.

1. repel ______________________________

2. attract ______________________________

3. electromagnet ______________________________

4. poles of a magnet ______________________________

5. magnetite ______________________________

II. Directions: Answer the following questions with short answers.

1. How can an electromagnet be made?

2. What are some ways electromagnets are used?

3. What makes electromagnets different from permanent magnets?

4. How can magnetism be used to produce electricity?

5. How can we demonstrate that electricity produces a magnetic effect?

Name ______________________

ELECTRICITY AND MAGNETISM
Unit Test

I. Directions: Pick the definition in column B that best matches the word in column A. Write the letter of the definition on the blank line.

Column A	Column B
1. electricity ________	a. When two objects come toward each other.
2. conductor ________	b. The Greek philosopher who named electricity.
3. insulator _________	c. A positively charged particle found in the nucleus of an atom.
4. attract __________	d. The flow of electrons.
5. repel __________	e. An atomic particle found in the center of an atom. It has no charge.
6. electron _______	f. Material that will not allow the flow of electricity.
7. proton _______	g. A particle found orbiting around the nucleus of an atom. It has a negative charge.
8. neutron _______	h. Material that allows electricity to go easily through it
9. Thales _______	i. When two objects move apart.

II. Directions: Answer the following questions in the space provided.

1. Name three good conductors of electricity.

2. Name three good insulators.

3. Describe some uses for insulators.

4. How does a generator work?

5. Describe how a simple electromagnet could be made.

6. How is an electromagnet different from a regular bar magnet?

7. What three things are needed for a complete circuit?

8. There are two kinds of circuits: series and parallel. Finish the drawings below by adding wires.

series battery	battery parallel

Name ____________________

ELECTRICITY AND MAGNETISM
Unit Test (Page 2)

9. What are the differences between a series circuit and a parallel circuit?

10. How do fuses or circuit breakers help protect homes?

11. Mechanical energy of the spinning turbine and generator produce electrical energy at a power station. Give some examples of electrical energy being changed to other forms of energy around your home.

12. Fossil fuels (oil, coal, and natural gas) are the main sources of fuels used to power the electric plants of today. What are some other sources of energy that can be used to make electricity?

13. If these two magnets were to be brought near each other, how would the lines of force look?

14. If one of the magnets was flipped over, how would the lines of force be changed?

15. Amperage is equal to wattage divided by voltage. Calculate the number of amps for each of these electrical appliances.

a. electric toothbrush	480 watts	120 volts	_____ amps
b. electric blender	960 watts	120 volts	_____amps
c. microwave	720 watts	120 volts	_____amps

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