ELECTRICITY & MAGNETISM OBJECTIVES

6.2.1a Define magnetic poles, magnetic domain, and magnetic field and investigate characteristics of each

6.2.1b Identify the magnetic properties of Earth and compare magnetic and geographic poles

6.2.1c Describe effects of Earth's magnetic field

6.2.2a Describe the interaction of like and unlike charges

6.2.2b Define and describe static electricity and explain how it differs from electric current

6.2.2c Describe lightening and other forms of static discharge

6.2.2d Investigate and understand the need for safety procedures when working with electricity

6.2.2e Explain how electrical energy can be converted to mechanical energy

6.2.2f Describe how electric current is induced and investigate generators and their energy sources

The goal I have for myself for this unit is _____
_____
_____
_____

ELECTRICITY & MAGNETISM
Chapter 1 Section 1: Pages 6-11
6.2.1a Define magnetic poles and magnetic field and investigate characteristics of each

_____ - any material that attracts iron and materials that contain iron

More than 2,000 years ago, people living in the ancient Greek city of _____ discovered a type of rock that contained _____. This rock attracted materials that contained iron.

_____ - the attraction or repulsion of magnetic materials

About 1,000 years ago, people in other parts of the world discovered that if magnetic rocks were allowed to swing freely from a string, one part of the rock would always point towards the _____.

Any magnet, no matter what its shape, has two ends, each one called a _____
The end that points north is called the _____
The other end is labeled the _____

_____ - the area of a magnet where the magnetic effect is strongest.

magnetic poles that are alike will _____

magnetic poles that are unlike (different) will _____

The attraction or repulsion between magnetic poles is _____

_____ - the region of magnetic force around a magnet

_____ -invisible lines that map out the magnetic field around a magnet, they spread out from one pole, curve around a magnet, and return to the other pole

The _____ between magnetic field lines indicate the strength of a magnetic field. The closer together the lines are, the _____ the field.

A magnet's magnetic field would be strongest at its _____

When the magnetic fields of two or more magnets overlap, the result is a _____

The fields from like poles _____ each other

The fields from unlike poles _____ each other

ELECTRICITY & MAGNETISM
magnet activities

1. Place one magnet on the table. Slide another one towards it with the same pole matching up.
What do you notice?

Why does this happen?

2. Place one magnet on the table. Slide the other one towards it with the opposite pole matching up.
What do you notice?

Why does this happen?

3. Place one magnet on the paper plate. Put the piece of plastic over the top of the magnet so it covers it. Carefully sprinkle iron fillings on the plastic, over the top of the magnet.
(when finished pour filings back into the cup)
Draw what you see

Use your drawing to explain the magnetic field around a magnet

4. DEMONSTRATION
Place two magnets on the paper plate with like poles matching up. Put the piece of plastic over the top of the magnets so it covers them. Carefully sprinkle iron fillings on the plastic, over the top of the magnets.

Draw what you see

Use your drawing to explain the magnetic field around the magnets

continued

5. DEMONSTRATION

Place two magnets on the paper plate with unlike poles matching up. Put the piece of plastic over the top of the magnets so it covers them. Carefully sprinkle iron fillings on the plastic, over the top of the magnets

Draw what you see

Use your drawing to explain the magnetic field around the magnets

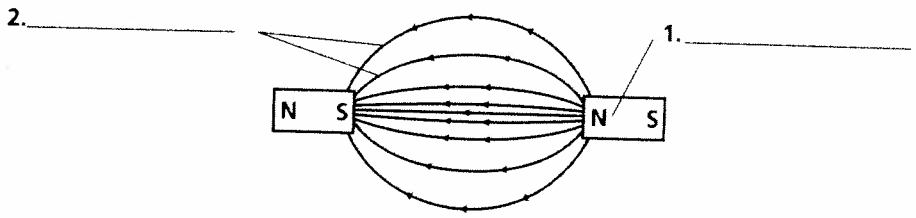
6. List examples of real life situations that would use magnets or a magnetic field

Name _____ Date _____ Class _____

What Is Magnetism?

Understanding Main Ideas

Label the parts of the figure below for items 1 and 2, and then answer items 3 and 4 in the space provided.



3. Are these magnets attracting or repelling each other? How can you tell?

_____

_____

_____

_____

4. What would happen if the magnet on the left were turned around, so that its north pole faced the north pole of the other magnet?

_____

_____

_____

_____

Building Vocabulary

Fill in the blank to complete each statement.

5. Any magnet has two ends, each one called a(n) _____.
6. _____ are the lines that map out the magnetic field around a magnet.
7. A(n) _____ is any material that attracts iron and materials that contain iron.
8. The attraction or repulsion between magnetic poles is _____.
9. The area of magnetic force around a magnet is known as its _____.

ELECTRICITY & MAGNETISM
Chapter 1 Section 2: Pages 14-19
Explain how an atom can behave like a magnet
Describe how magnetic domains are arranged in a magnetic material
Explain how magnets can be changed

_____ - the smallest particle of an element

_____ - one of about 100 basic materials that make up all matter

_____ - the center region of an atom

_____ - a particle that carries a positive charge, found inside a nucleus
_____ - a particle that does not carry a charge, found inside a nucleus

electrons are particles that carry a _____ charge, they move randomly throughout the atom. They are much smaller than neutrons and protons.

Each electron in an atom has a property called _____, so it behaves as if it were spinning.

A spinning electron produces a _____ that makes the electron behave like a tiny _____ in an atom

In most atoms, electrons form pairs that spin in opposite directions, so their magnetic fields cancel. Therefore, most atoms have _____ magnetic properties.

_____ - a cluster of billions of atoms that all have magnetic fields that are lined up in the same way; the entire domain acts like a magnet with a north and south pole

In a magnetized material, all or most of the magnetic domains are arranged in the _____

_____ - a material that shows strong magnetic effects: iron, nickel, cobalt, and gadolinium are common ones; samarium and neodymium are rare ones

Some magnets are made from several different metals. This combination of metals is an _____

Today, the most commonly used magnets are made from a material called _____

Magnets can be _____, _____, or _____

A magnet made from a material that easily loses its magnetism is called a _____

_____ - a magnet made of a material that keeps its magnetism for a long time

continued

Ways to destroy a magnet:

1. _____
2. _____

What happens if you break a magnet into two pieces?

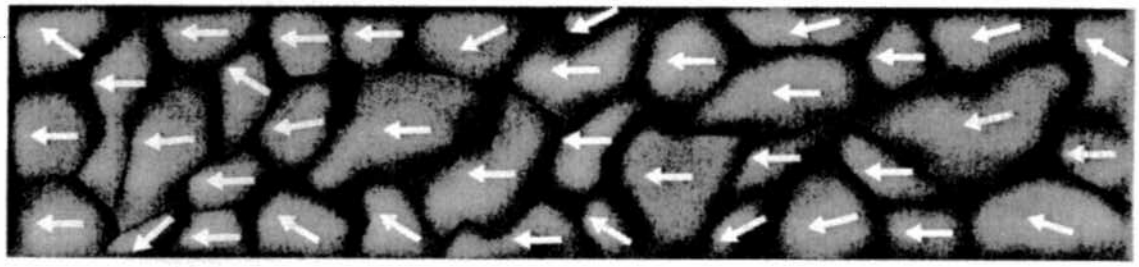
_____

Name _____ Date _____ Class _____

Inside a Magnet

Understanding Main Ideas

Use the figure below to answer the following questions on a separate piece of paper.



1. What do the arrows represent in the figure?
2. Is this material magnetized or unmagnetized? How do you know?
3. How might this figure be different if the material shown were hit very hard or heated?

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

____ 4. magnetic domain	a. the center region of every atom
____ 5. neutron	b. a magnet made of a material that keeps its magnetism
____ 6. nucleus	c. a material that shows strong magnetic properties
____ 7. permanent magnet	d. one of about 100 basic substances that make up all matter
____ 8. atom	e. a particle that does not carry an electric charge
____ 9. proton	f. a tiny, negatively charged particle that usually exists in the outer region of an atom
____ 10. temporary magnet	g. the smallest particle of an element
____ 11. element	h. a magnet made from a material that easily loses its magnetism
____ 12. ferromagnetic material	i. a positively charged particle found in the nucleus
____ 13. electron	j. a grouping of atoms that have their magnetic fields line up in the same direction

Powermediaplus Video

Understanding How Stuff Works for Students

Name_____

Magnetism

What do you remember from the program? After viewing *Magnetism*, fill in the blanks below.

1. According to Greek legend, a shepherd noticed that the iron nails in his boots were _____ to a stone as he walked across it.
2. This stone, known as _____, is a natural magnet. It was discovered in the province _____, which is where magnetism got its name.
3. In early times, people thought magnets to be some sort of _____. Even Hippocrates thought it could cure people.
4. In the thirteenth century, Petrus Peregrinus discovered that all loadstone, if allowed to _____, would always point in the same direction.
5. Using this knowledge, the compass was developed. Its magnetized iron needle spins freely and always points _____.
6. About 400 years ago, William Gilbert discovered that the needle on a compass not only points north, it also _____.
7. Gilbert was right in theorizing that the Earth is a giant magnet. Needles on compasses point north/south, in line with Earth's _____.
8. Atoms are comprised of a _____ and electrons. The moving electrons create a magnetic field.
9. This magnetic field has two poles, _____ and _____. When the poles are lined up, the entire material becomes magnetic.
10. When the opposite _____ of two magnets are placed together, they repel each other and push apart.

WORD BANK

poles	north	Magnesia	
spin freely	loadstone	nucleus	
north	east	slants down	
molecule	attracted	magic	
magnetic field	force	south	

ELECTRICITY & MAGNETISM
Chapter 1 Section 3: Pages 22-27
6.2.1b Identify the magnetic properties of Earth and compare magnetic and geographic poles
6.2.1c Describe effects of Earth's magnetic field

_____ - a device that has a magnetized needle that can spin freely, it usually points north

The earth is a giant _____ - its core is molten _____

Geographic poles and magnetic poles are not the _____

_____ is the difference (angle) between the geographic pole and the magnetic pole

The magnetic declination of a location _____. The magnetic poles do not stay in one place

Since Earth produces a strong magnetic field, Earth itself can make _____ out of ferromagnetic materials.

Earth's magnetic field also acts on rocks that contain magnetic rock, such as rock on the _____

Molten material seeps up through the ocean floor. When the rock is molten, the iron in it contains _____ As the rock cools and hardens, the iron is locked in place. This creates a _____ of the magnetic field.

As scientists studied this rock, they've discovered that the direction and strength of Earth's magnetic field has _____ _____ _____ every million years or so.

Earth's magnetic field extends into _____ which contains electrically charged particles

Earth's magnetic field affects the _____ of electrically charged particles in space. Charged particles also affect Earth's magnetic field.

_____- two doughnut-shaped regions, between 1,000 and 25,000 kilometers above Earth's surface. They contain electrons and protons traveling at very high speeds

continued

_____- a stream of electrically charged particles flowing at high speeds from the sun - pushes against Earth's magnetic field and surrounds the field

_____- The region of Earth's magnetic field shaped by the solar wind

When high-speed, charged particles get close to Earth's surface, they interact with _____ in the atmosphere. This causes some of the atoms to give off _____.

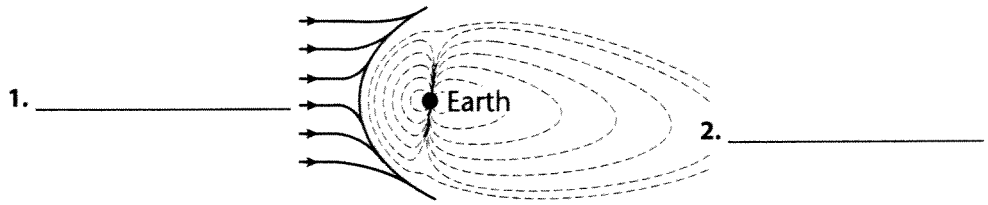
_____ - a glowing region in the atmosphere caused by charged particles from the sun

Name _____ Date _____ Class _____

Magnetic Earth

Understanding Main Ideas

For items 1 and 2, label the parts on the following figure in the blanks provided.



Answer the following questions in the spaces provided.

3. How is Earth like a bar magnet?

_____

_____

4. If you follow a compass pointing north, will you reach the geographic north pole? Explain your answer.

_____

_____

Building Vocabulary

Fill in the blank to complete each statement.

5. A(n) _____ is a device that has a magnetized needle that can spin freely.

6. _____ is the angle between geographic north and the north to which a compass needle points.

7. A(n) _____ is a glowing region in the atmosphere caused by charged particles from the sun.

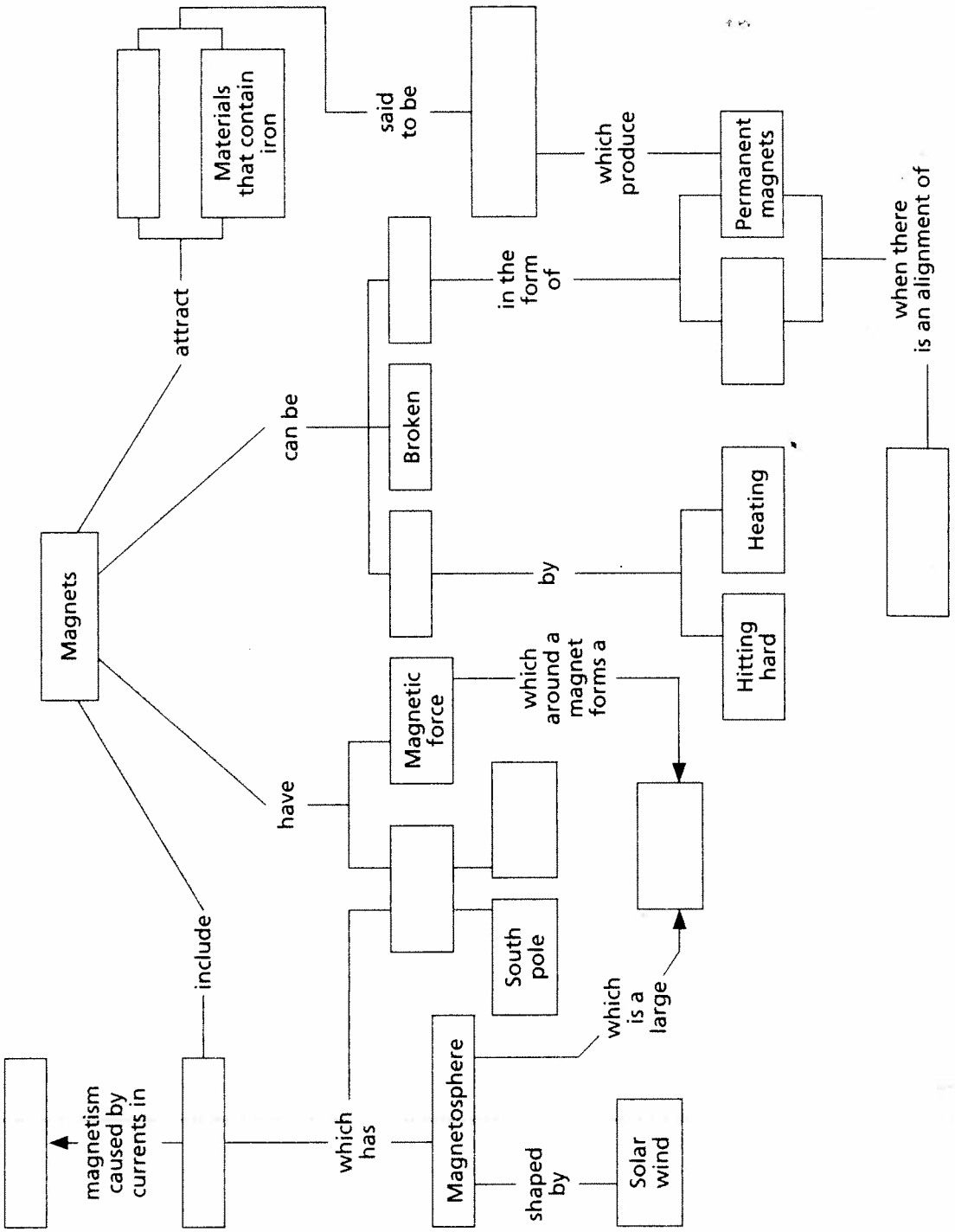
8. The _____ are two doughnut-shaped regions above Earth's surface that contain electrons and protons moving at very high speeds.

9. The region of Earth's magnetic field shaped by the solar wind is called the _____.

10. The _____ is a stream of electrically charged particles flowing at high speeds from the sun.

Connecting Concepts

Develop a concept map that uses Key Concepts and Key Terms from this chapter. The concept map shown is one way to organize how the information in this chapter is related. You may use an extra sheet of paper.



ELECTRICITY & MAGNETISM
Chapter 2 Section 1: Pages 34-41
6.2.2a Describe the interaction of like and unlike charges
6.2.2b Define and describe static electricity and explain how it differs from electric current
6.2.2c Describe lightening and other forms of static discharge

Protons and electrons have _____ charges

Protons have a _____ charge

Electrons have a _____ charge

The names *positive* and *negative* were given to charges by _____ in the 1700s

Charges that are the same _____

Charges that are different _____

The interaction between *magnetic poles* is called _____
The interaction between *electric charges* is called _____

One important difference between electric charges and magnetic poles is that _____
_____

In electricity, _____ is the attraction or repulsion between electric charges

_____ - is a region around a charged object where the object's electric force is exerted on other charged objects.

When one charged object is placed in the electric field of another charged object, it is either _____(if they have same charge) or _____(if they have opposite charges)

The strength of an electric field is related to the _____ from the charged object
The greater the distance, the _____ the electric field is

When there are two or more charges, the resulting electric field is _____

_____ is the **buildup** of charges on an object, the charges do not flow
_____ means "not moving or changing"

An object becomes charged only when electrons are _____ from 1 location to another

continued

_____ -the transfer of electrons from one object to another by **rubbing**

_____ -the transfer of electrons from a charged object to another object by **direct contact**

_____ -the movement of electrons to one part on an object by the **electric field** of another object

_____ - an instrument used to detect electric charge

When a negatively charged object and a positively charged object are brought together, electrons move until both objects have _____

_____ -the loss of static electricity as electric charges transfer from one object to another

_____ -is a dramatic example of static discharge

ACTIVITY 1

MATERIALS: balloon, plastic ruler, wool cloth, rice krispies, aluminum foil pieces, paper pieces

PROCEDURE:

1. Rub balloon on piece of wool cloth

2. Discuss how the balloon and wool cloth react to each other

3. Hold the balloon close to the rice krispies. What happens?

4. Charge the ruler by rubbing it with wool cloth

5. Hold the ruler close to the rice krispies. What happens?

6. Repeat same procedure with the foil and paper pieces. Discuss results.

ALL MATTER HAS ELECTRICAL CHARGES

ACTIVITY 2

(Part One)

MATERIALS: 2 pieces of transparent tape in 8 inch lengths

PROCEDURE:

1. Attach 2 pieces of tape to a table - leave the one end up

2. Quickly pull both pieces of tape from the table at the same time

3. Hold the pieces close to each other - sticky side facing each other. What do you observe?

(Part Two)

MATERIALS: 1" by 8" strips of acetate (transparency)
2 strips of bread wrappers, paper towel

PROCEDURE:

1. Hold a strip of acetate by the end (2 people do this)
2. Rub the entire length of the strip with a paper towel (2-3 times)
3. Hold the two strips together to see what happens
4. Repeat procedure using bread wrappers
5. Compare the results

ACTIVITY 3

(Part One)

MATERIALS: 2 balloons, 2 feet of string

PROCEDURE:

1. Charge the balloons by rubbing each on the same fabric
2. Bring the two balloons together
3. Observe what happens

4. Repeat this again, but rub them on two different fabrics. Does anything different happen?

(Part Two)

MATERIALS: Newspaper strips, wooden pencils

PROCEDURE:

1. Lay the strips side by side on a table
2. Stroke vigorously (in one direction) throughout their length with the side of a pencil
3. Lift on end of a strip and release it. What happens?
4. Lift both strips into the air and bring together. What happens?

ACTIVITY 4

MATERIALS: Magnets, paper clips

PROCEDURE:

1. Bring like poles of two magnets together.
   Discuss what happens

2. Bring unlike poles of two magnets together.
   Discuss what happens

3. Lift a paper clip with the magnet by conduction
   See how many you can lift all together

4. Lift a paper clip with the magnet by induction
   See how many you can lift all together

STATIC ELECTRICITY EXPERIMENTS

ACTIVITY 1

3. What happens when you hold the charged balloon next to the rice krispies?

5. What happens when you hold the charged ruler next to the rice krispies?

6. What happens to the foil pieces?

   What happens to the paper pieces?

   Which material was more attracted to the balloon and ruler? Why do you think so?

ACTIVITY 2

Part One:

3. What happens to the tape pieces as you bring them together? Why?

Part Two:

5. What happens to the transparency strips as you bring them together? Why?

   What happens to the bread wrappers as you bring them together? Why?

ACTIVITY 3

Part One:

3. What happens to the balloons when brought together after being charged on the same fabric?

4. What happens to the balloons when brought together after being charged on different fabrics?

Part Two:

4. What happens to the charged newspaper strips after you bring them together?

ACTIVITY 4

1. What happens when you bring two like poles together?

2. What happens when you bring two unlike poles together?

3. How many paper clips were you able to lift by conduction?

4. How many paper clips were you able to lift by induction?

5. Choose objects around the room to test for magnetism - then conduct your experiment List the objects first then test.

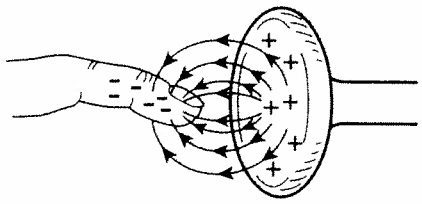
OBJECT	IS IT FERROMAGNETIC?
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Name _____ Date _____ Class _____

Electric Charge and Static Electricity

Understanding Main Ideas

The person whose finger is shown below has walked across a carpet and is about to touch the doorknob. Answer the following questions on a separate sheet of paper.



1. Are the charges in the finger attracted or repelled by the charges in the doorknob? How can you tell?
2. What do the lines around the finger and doorknob represent?
3. One kind of static electricity is a result of electrons moving onto an object from another object. What is another way static electricity can build up on an object?

Building Vocabulary

From the list below, choose the term that best completes each sentence.

conservation of charge	static discharge
static electricity	electric field
conduction	friction
induction	electric force

4. In electricity, _____ is the attraction or repulsion between electric charges.
5. The buildup of charges on an object is called _____.
6. The law of _____ states that charges are not created or destroyed. They are transferred.
7. The transfer of charge from one object to another by rubbing is called _____.
8. The loss of static electricity as electric charges transfer from one object to another is called _____.
9. A(n) _____ is a region around a charged object where the object's electric force is exerted on other charged objects.
10. The transfer of electrons from one part of an object to another part, caused by the electric field of another object, without the two objects touching is called _____.
11. The transfer of charge when electrons move from a charged object to another object by direct contact is called _____.

ELECTRICAL SAFETY
Chapter 2 Section 6: Pages 71-73
6.2.2d Investigate and understand the need for safety procedures when working with electricity

_____ - a connection that allows current to take the path of least resistance
For example, the electric charge can flow through a _____ rather than the wire

Electrical signals in the human body control _____, _____, and _____

_____ plays an important role in electrical safety

A circuit is electrically _____ when charges are able to flow directly from the circuit to Earth in the event of a short circuit

One method of grounding is to use a _____ on a plug. It is round, and connects any metal pieces of the appliance to the ground wire of the building. It protects people from shock, by taking the current directly to the earth in the event of a short circuit

If you use too many appliances at once, a circuit's current can become dangerously high and _____ the wires that carry it.

In order to prevent circuits from overheating, devices called _____ and _____ are added to circuits

_____ - a device that contains a thin strip of metal that will melt if too much current flows through it

_____ - a reusable safety switch that breaks the circuit when the current gets too high.

Name _____ Date _____ Class _____

Electrical Safety

Understanding Main Ideas

Complete the following table.

Device	Describe How It Works	How It Increases Safety
fuse	**1.**	**2.**
circuit breaker	**3.**	**4.**

Answer the following in the space provided.

5. Why is it important for people to avoid electric shocks?

_____

_____

_____

_____

Building Vocabulary

Fill the blank to complete each statement.

6. A circuit is electrically _____ when charges are able to flow directly from the circuit into Earth.

7. A(n) _____ is a device that contains a thin strip of metal that melts if there is too much current in it.

8. The _____ of an electrical plug connects any metal pieces of an appliance to the ground wire of a building.

9. A(n) _____ is a connection that allows current to take the path of least resistance.

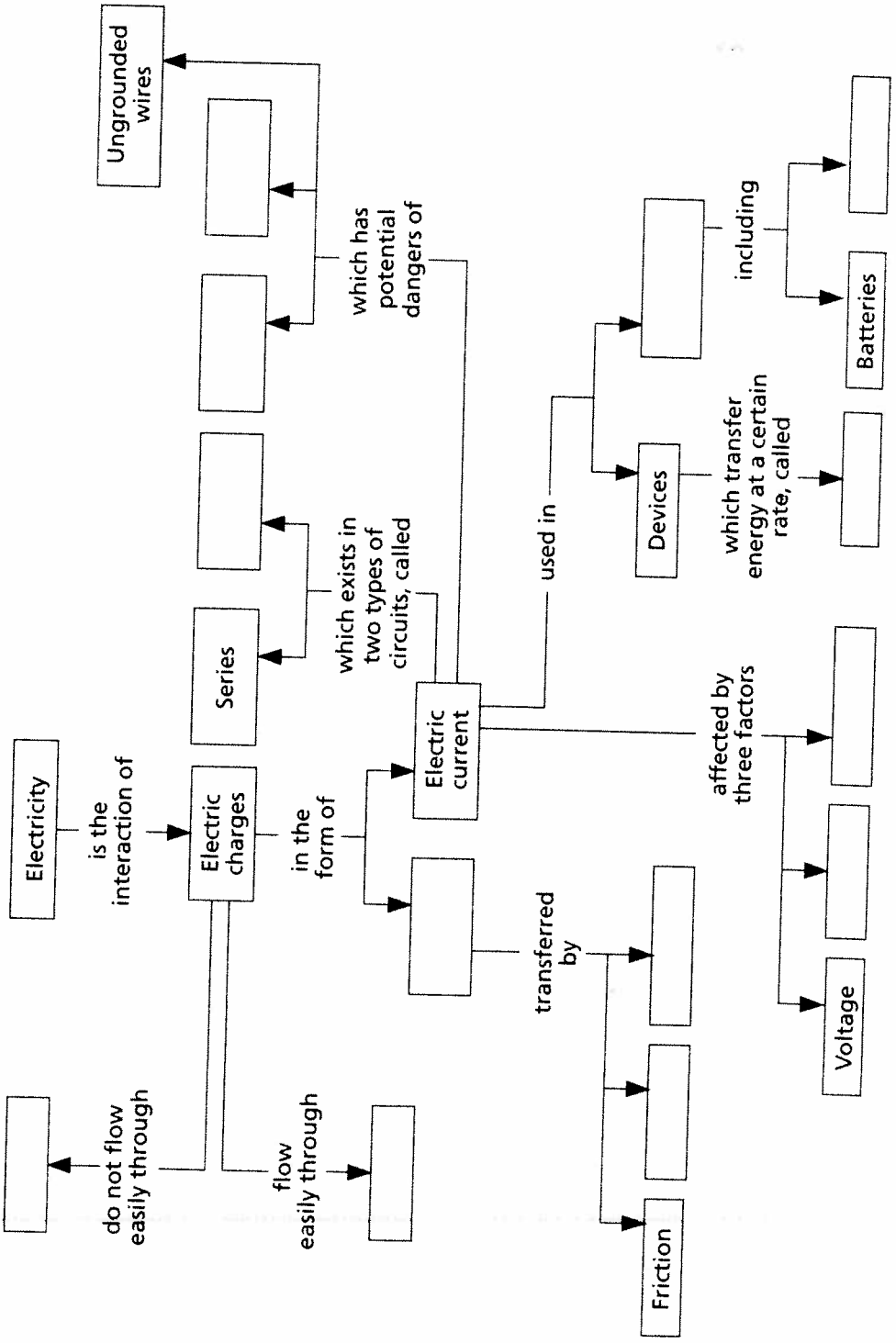
10. A(n) _____ is a reusable safety device that breaks the circuit when the current gets too high.

Name _____ Date _____ Class _____

Electricity • *Enrich*

Connecting Concepts

Develop a concept map that uses Key Concepts and Key Terms from this chapter. The concept map shown is one way to organize how the information in this chapter is related. You may use an extra sheet of paper.



ELECTRICITY, MAGNETISM & MOTION
Chapter 3 Section 1: Pages 80-84
Explain how electric current is related to a magnetic field

An electric current produces a _____

This relationship between electricity and magnetism is called _____

The magnetic field produced by a current has three distinct characteristics:

1. _____
2. _____
3. _____

By winding a wire with a current into many loops you _____ the magnetic field in the center of the coil.

_____ - a coil of wire with a current

_____ - a solenoid with a ferromagnetic core; a strong magnet that can be turned on and off

Electromagnets are used to record information onto

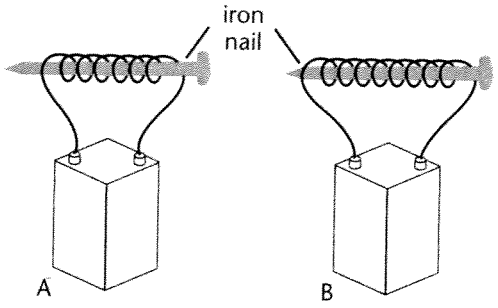
_____
_____
_____
_____

Other uses for electromagnets: _____
_____
_____

What Is Electromagnetism?

Understanding Main Ideas

Using the figure below, answer the following questions in the spaces provided.



1. What is a solenoid?

_____

_____

2. What kind of magnets are shown in the figure above?

_____

_____

3. Assuming the batteries are the same, which magnet do you think is stronger, A or B? Explain your answer.

_____

_____

4. List four factors that can be varied to change the strength of the magnets shown above.

_____

_____

_____

_____

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term in the left column.

____	5. electromagnetism	**a.**	A solenoid with a ferromagnetic core
____	6. solenoid	**b.**	The relationship between electricity and magnetism
____	7. electromagnet	**c.**	A coil of wire with a current

ELECTRICITY, MAGNETISM & MOTION
Chapter 3 Section 2: Pages 85-89
6.2.2e Explain how electrical energy can be converted to mechanical energy

_____ - the ability to move an object over a distance

_____ - the energy associated with electric currents

_____ - the energy an object has due to its movement or position

When a wire with a current is placed in a magnetic field, electrical energy is converted into _____

_____ - a device used to measure small currents.
An _____ is suspended between opposite poles of 2 permanent magnets.
The electromagnet's coil is attached to a _____
When current flows through the coil, the current produces a _____.
This field interacts with the field of the _____, causing the loops of wire and the pointer to _____.
Electric current is used to turn the pointer of the galvanometer.

_____ - a device that uses an electric current to turn an axle
transforms electrical energy into mechanical energy

Parts of a motor:

_____ - several loops of wire wrapped around a ferromagnetic core

_____ - repeatedly reverses the flow of current through the armature (a ring split in two)

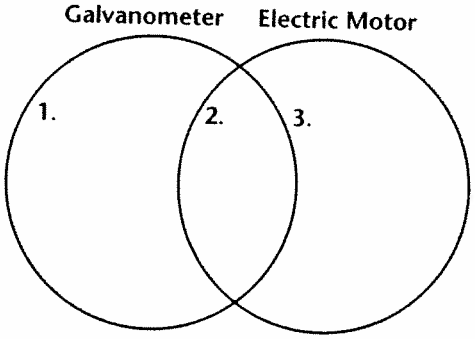
_____ - contact points, these are connected to the current source

Electricity, Magnetism, and Motion

Understanding Main Ideas

For items 1–3, write the letter of each characteristic in the correct area of the Venn diagram.

a. Transforms electrical energy to mechanical energy
b. Contains a loop of wire with a current in a magnetic field
c. Rotates only half a turn
d. Rotates continuously
e. Turns an axle
f. Turns a pointer on a scale
g. Current is reversed
h. Current is not reversed



Building Vocabulary

From the list below, choose the term that best completes each sentence.

energy
electrical energy
mechanical energy
galvanometer
electric motor

4. A device that uses electric current to turn the blades of a blender is an example of a(n) _____.
5. A moving fan blade has a type of energy called _____.
6. Electric current can be measured with a device called a(n) _____.
7. The ability to move an object some distance is called _____.
8. An electric motor turns an axle by transforming _____ into mechanical energy.

ELECTRICITY FROM MAGNETISM
Chapter 3 Section 3: Pages 94-101
6.2.2f Describe how electric current is induced and investigate generators and their energy sources

An _____ _____ is induced in a conductor when the conductor moves through a magnetic field.

_____ _____ - is the process of generating an electric current from the motion of a conductor through a magnetic field. Current that is generated in this way is called _____ _____

In an induced current, charges may _____, or they may _____ _____

_____ _____ (__ __) - a current consisting of charges that flow in one direction only

_____ _____ (__ __) - a current consisting of charges that move back and forth in a circuit

_____ _____ - a device that transforms mechanical energy into electrical energy

An electric motor uses an electric current to produce _____.

A generator uses motion to produce an _____

_____ - a device that increases or decreases voltage

A transformer that increases voltage is called a _____

A transformer that decreases voltage is called a _____

An important use of transformers is in the transmission of electrical energy from _____

Electricity From Magnetism

Understanding Main Ideas

Fill in the line to complete the statements about generators.

As the crank is turned, the **a.** _____ rotates in the magnetic field.

↓

The up-and-down motion of the armature induces a(n) **b.** _____ in the wire.

↓

After the armature turns halfway, each side of it **c.** _____ direction in the magnetic field.

↓

The result is that a(n) **d.** _____ current is induced.

Answer the following questions on a separate sheet of paper.

1. What is the difference between the primary coil and the secondary coil in a transformer?
2. What is the difference between an electric motor and a generator?

Building Vocabulary

Match each term with its definition by writing the letter of the correct description in the right column on the line beside the term in the left column.

___ 3. electromagnetic induction

___ 4. alternating current

___ 5. direct current

___ 6. electric generator

___ 7. transformer

___ 8. step-up transformer

___ 9. step-down transformer

a. device that decreases voltage

b. device that increases or decreases voltage

c. generating a current from the motion of a conductor through a magnetic field

d. device that increases voltage

e. type of current found in the circuits of homes

f. type of current produced by a battery

g. device that transforms mechanical energy into electrical energy