Name _____

MEASURING AND USING ELECTRICITY
from the series *Electricity and Magnetism*

PRE-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.

A	B
1. complete circuit _____	a. Something that lets electrons flow easily through it.
2. alternating current _____	b. A source of electrons, a path for the electrons, and a device to use the electrons.
3. direct current _____	c. Used by the electric company to keep track of the amount of energy used at a home or business.
4. amperage _____	d. The push behind electricity.
5. conductor _____	e. The kind of current we get from batteries.
6. resistor _____	f. The unit of measurement for current.
7. wattage _____	g. The kind of electricity from the power plant.
8. voltage _____	h. A material that slows the movement of electrons.
9. circuit breaker _____	i. A safety device that will shut off the flow of electricity if the amperage gets too high.
10. electric meter _____	j. The amount of electrical energy used in a certain amount of time.

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

1. What causes a circuit breaker to switch off?

2. Some people consider it a real bother when a circuit breaker switches off, but actually, it is a good thing. Why?

3. How does a hair dryer work?

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PROGRAM QUIZ

Part A Directions: At the end of the program, there is a short quiz. Record your answers on this sheet.

1. Current is measured in _____.
   a. volts
   b. amperes
   c. electrons
   d. protons

2. The push behind current is called _____.
   a. voltage
   b. amperes
   c. electrons
   d. wattage

3. The amount of electrical energy used in a certain amount of time is called _____.
   a. voltage
   b. amperes
   c. electrons
   d. wattage

4. Materials that allow the flow of electricity are called _____.
   a. insulators
   b. conductors
   c. wattage
   d. voltage

5. A complete circuit is made up what three things?
   a. Voltage, wattage, and amperes.
   b. Conductors, insulators, circuits.
   c. A source of electrons, a path, something to use the electrons.
   d. Electrons, protons, and neutrons.

6. A thousand watts is called one _____.
   a. circuit
   b. hundred twenty volts
   c. sixty cycles
   d. kilowatt

Part B Directions: The next four questions are short answer.

1. How do circuit breakers protect our homes?

2. If a household appliance has a wattage of 720 and it uses standard 120 volts, what would the amperage be for this device?

3. Why is copper such a good conductor of electricity?

4. What does it mean when the circuit is open?

Name _____

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MEASURING AND USING ELECTRICITY
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RHEOSTATS

You may have seen lights in a theater dim just before a performance or movie begins. Or maybe you have a dimmer switch in your home that allows you to decide how bright or how dim lights will be in a room. You can make a rheostat that shows this dimming effect. The word *rheostat* comes from a Greek word that means "slowing down the stream."

Purpose: To show how a dimmer switch works.

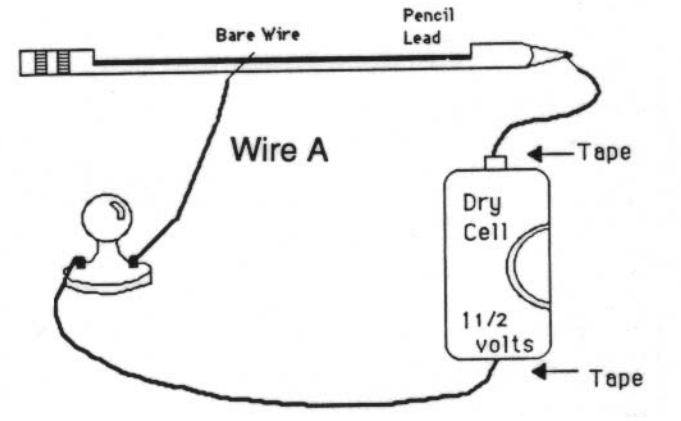
Materials: number 2 pencil
light bulb and socket
wire
dry cell
pliers
tape

Procedures:1. Use the pliers to split away some of the wood of the pencil to expose the pencil lead. (Actually it isn't pencil lead, it is carbon.)

2. Cut the wire into three pieces as shown in the diagram.

3. Use the diagram to help you put together the rheostat.

4. Slide wire A along the pencil lead and make observations.



Observations: 1. What happens to the brightness of the bulb as you slide wire A along the lead?

2. When is the light brightest?

Conclusions: How does a rheostat work?

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ELECTRIC POWER

Electric power is the amount of electric energy that flows through a circuit in a given amount of time. Electric power is measured in units called watts. The amount of wattage used by an electrical device is determined by multiplying the voltage of the circuit times the current. The current is measured in amperes. Here is a formula for calculating electric power.

Power = voltage x current (amps)

EXAMPLE: A hair dryer needs 10 amperes of current in a 120-volt circuit. How much power does it use?

SOLUTION: Power = voltage x current
120 volts x 10 amps = 1,200 watts
The hair dryer uses 1,200 watts of power every hour.

A kilowatt is used to measure large amounts of electrical power. A kilowatt is equal to 1,000 watts, so the hair dryer uses 1,200 watts or 1.2 kilowatts of power.

Directions: Try these problems using the information and formula from the top part of this sheet. (Give your answers in watts or kilowatts.)

1. A washing machine uses six amperes of current in a 120-volt circuit. How much power does it use?

2. A color television needs to be plugged into a 120-volt circuit. It uses 2.5 amperes. What is the television's wattage?

3. The wattage of a vacuum cleaner is calculated to be 1,080 watts. If it is in a 120-volt circuit, how many amperes of current does the vacuum cleaner draw?

4. A clothes dryer has a wattage of 2.4 kilowatts. If it is in a 120-volt circuit, what is the amperes it needs to run?

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ELECTRIC METER

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Electric companies keep track of how much energy people use by reading the electric meter, which is usually located outside the home. The electric meter has a glass covering and is hooked into the main electric line used by the house. There are five dials that record the amount of electrical energy used in the house. Electrical energy is measured in kilowatt-hours. One kilowatt hour is equal to 1,000 watt-hours. For instance, if a 1,000-watt hair dryer is left on for one hour, it has used 1 kilowatt-hour of energy. If 10 100-watt light bulbs are left on for one hour, they have also used 1 kilowatt-hour of energy.

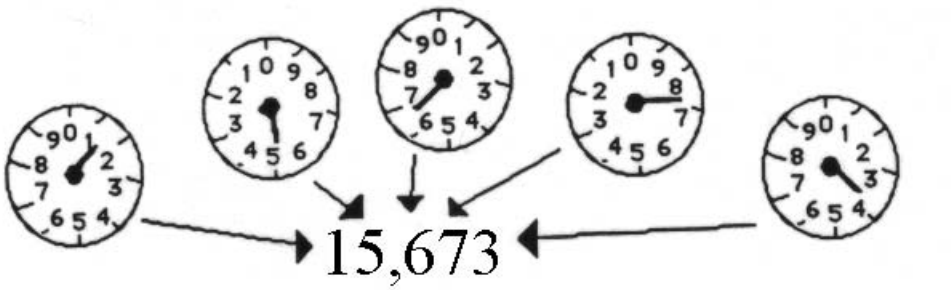
To calculate the amount of electrical energy used by an appliance, multiply the power times the time that the appliance is turned on. Here is a formula:

Electrical energy = power x time

The electric company sends a person around to homes to read the meter so they can calculate how much energy each home in a community uses. You can find out how much electrical energy your family uses by doing the following activity.

DIRECTIONS: Follow these steps to determine the amount of electrical power your family uses in one twenty-four hour time period.

1. Locate the electric meter.
2. Read the five dials from right to left and record the number. The dial on the far right represents the ones place. The dial to the first dial's left is the tens place and so on until you get to the ten thousands place. Read the dials carefully; they don't all turn the same direction. IF THE ARROW IS BETWEEN TWO NUMBERS RECORD THE SMALLEST NUMBER. Here is an example:



3. When you record the number, also mark down the exact time that the recording was made.

4. Now on the next day at exactly the same time, go to the electric meter and record the new reading.

5. Subtract the first day's reading from the second day's reading and the result is the amount of electrical energy used by your household in one 24-hour time period.

6. Compare your results with others in the class.

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MEASURING AND USING ELECTRICITY
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WATTS COOKING?

"Watts Cooking?" Well, hopefully not your home. This sheet will give you information about how to avoid overloading an electrical circuit.

The rate of flow of electricity, or current, is measured in amperes. It is a measurement of the number of electrons moving past a point in a given time.

Voltage is a measure of the amount of push behind the electrons.

Wattage is a measurement of the amount of work that electricity can do.

It is important to know the amperage, for the higher the rate of flow, the greater the risk of fire. Circuits are designed to handle only so much amperage. In many homes, a typical circuit is designed for 25 amps of electricity. That means if many appliances are plugged into and used in that circuit at the same time and the total amperage exceeds, or is greater than, 25 amps, the circuit breaker will switch off. The flow of electrons would be stopped. Otherwise, the circuit would heat up and possibly start a fire.

Most appliances have information listed on them to help you determine amperage. These formulas can help:

- WATTS = VOLTS X AMPERAGE
- VOLTS = WATTAGE/AMPERAGE
- AMPERAGE = WATTS/VOLTS

If you have a hair dryer that is labeled 1,200 watts, you can calculate the amperage in the following way:

Homes use 120 volts, so using the formula AMPS = WATTS/VOLTS
AMPS = 1,200/120
AMPS = 10

Directions:
Use the formulas above to calculate the amperage of other appliances around the home. You can find wattage on a label on the appliance. Use Blackline Master 7, "Watts Cooking?, Part 2," to record your findings.

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MEASURING AND USING ELECTRICITY
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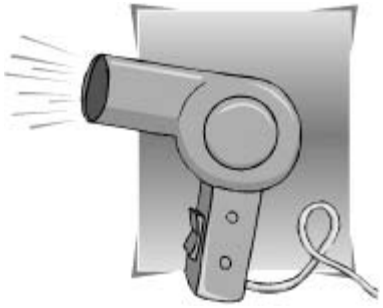
WATTS COOKING? PART 2

Find various appliances around your home and determine the amperage for each item. These formulas will help, depending on the information supplied on the appliance information plate.

- WATTS = VOLTS X AMPERAGE
- VOLTS = WATTAGE/AMPERAGE
- AMPERAGE = WATTS/VOLTS



Name of appliance	Volts	Wattage	Amperage

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Name _____

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POST-TEST

I. Directions: Circle the correct word to complete the statements.

1. Electricity is the flow of _____ .
   - water
   - electrons
   - protons
2. The unit that measures the amount of work done by electricity is the _____ .
   - ampere
   - watt
   - volt
3. The rate of flow of electricity is measured in _____ .
   - amperes
   - watts
   - volts
4. The strength of an electric current is measured in _____ .
   - amperes
   - watts
   - volts
5. Current that flows in one direction continuously is called _____ .
   - alternating current
   - direct current
   - amps

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

1. What are some ways a material's electrical resistance is used to accomplish a certain job?

2. How does an electric company determine how much electrical power a home or business has used in a given amount of time?

3. What is the difference between direct current and alternating current?

4. Why does a generator produce alternating current?

5. Calculate the amperage for the following electrical devices:
   - a. hair dryer - 1,200 watts, 120 volts _____
   - b. light bulb - 120 watts, 120 volts _____
   - c. toaster - 960 watts, 120 volts _____
   - d. electric iron - 1,560 watts, 120 volts _____

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

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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