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“Changes In Lifestyle Due To Electricity”

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INTRODUCTION

To wait for the sun to rise before you are able to see would be a terrible thing today. The people who discovered fire found out it could light rooms at night. Those who could afford it used candles. Later, a fuel kerosene was used in special lamps. As time passed an illuminating gas provided light in the homes and on the streets. Finally, electricity came along and now practically all have artificial light.

Since the invention of electricity, man has not been able to get along without it. Electricity is a form of energy. Energy has the capacity to do work.

Today there seems to be a never ending stream of machines that do a myriad of jobs for man to make his lifestyle less taxing and in many instances very comfortable. It is through electrical technology that this has all been made possible. Man’s lifestyle has been enhanced socioeconomically, in transportation, jobs, and leisure time.

This unit is a basic unit on electricity. This unit will be used in the seventh grade Life Science class, and can also be used in grades six through nine. This unit deals with a hands on approach to understanding electricity. This unit is directed toward:

1. Personalities responsible for the discovery and enhancement of electricity such as Alessandro Volta, Michael Faraday, Benjamin Franklin, Joseph Latimer.
2. Electricity as a source of energy may be converted from gas and coal through the mechanism of an engine.
3. Energy conservation guidelines.
4. Safety rules. Included also are vocabulary list, lesson plans, footnotes. teacher reading list, student reading list, hands on activities. bibliography. Recommended also is a suggested field trip, film strip, and resource presentations.

What Is Electricity?

Electricity is the separation of positive and negative charges at a power plant. The electrons pass through a circuit or wire. The wire permits these charges to travel from the power plant through the various homes and businesses. The negative charges comes back to the power plant to find the positive charges and out again in a continuous pattern, which is the creation of electrical work.

Electricity is energy produced by the flow of electrons through a conductor, such as copper wire today, which can be transformed into forms of energy, including light, heat, and sound.

Electricity is a form of energy and is sometimes called electrical energy.

Electricity has enhanced man's lifestyle to the point whereas today it is possible to fly planes, operate automobiles, and sail ships. Electricity also makes it possible to enjoy radio, television, and the phone.

Benjamin Franklin flew a kite with a brass key attached to the string in a thunderstorm to prove that lightning and electricity is the same. Electric current has energy and lightning is a large electric current.

Electric current flowing through a wire also has energy.

Static Electricity

Electrical charges that stand still are called static electricity. "Electrons either leave or flow back into the material and the ions will turn into neutral atoms again. Usually this happens when some object is around to receive or give up electrons." [1] An example of this, is when the electrical charges on the shoe spreads over the body after moving your feet and scuffing electrons from the rug atoms. The charges then jump to a better conductor; a metal door knob. The charges then spread over the house and eventually it goes back to the rug atoms.

It is possible for a charged material to lose extra electrons or gain lost electrons. The earth has both positive and negative ions within it. Once a charged object touches the earth, it immediately loses its charges, Again, once this happens the object is said to be grounded because electrons either flow from the charged object into the ground or vice versa.

"In a thunderstorm there are strong winds and air currents. The moving air cause an electric charge to build up on the clouds. The charges jump between the cloud and the ground. There is a flash of lightening as the moving charge heats the air." [2] It is like the spark from your hand after you walk across a rug and touch a metal door knob but is much more powerful.

Current Electricity

Current electricity occurs when static electricity forms a spark, it is no longer at rest. The electricity is moving electricity. The electrons are flowing from atom to atom. It is this type of electricity that does the most work for man.

As the electricity flows it can pass better through some materials better than others. These are called conductors. Such materials are copper, silver, iron, and aluminum, all of which are good conductors.

Electricians often wear rubber gloves when they work. The tools they use may have rubber or plastic handles. These are all good insulators, but there is no perfect insulator. High voltage electric current can go through

insulators. Lightening is a high-voltage electric current.

Voltage/Amperes

The unit in which electrical pressure is measured is called volts. The greater the electrical pressure upon the electron the more electric current will flow.

The flow of electricity is measured in amperes or sometimes commonly known as amps.

In the case of poor conductors, electrons do not pass easily from one atom to another atom. These poor conductors of electricity are called insulators.

There are many uses for poor conductors. There are many appliances which may have them, such as the iron, the toaster, the heating pad, coffee maker, waffle iron, electric heaters, electric frypan, and the list goes on.

Some examples of good insulators are rubber, cloth, glass, paper, and some plastics. Insulators prevent electricity from where it is not wanted.

Electricity is put to work by sending it through a conductor such as copper wire. Electricity must be able to flow around and around in a path called a circuit.

Electricity flowing through a wire can do work. Some kinds of wire do not permit electricity to flow through them very well. When electric currents flow through these wires they get very hot. Such appliances as the clothes dryer and heating stoves operate on this principle.

Electricity can go through very thin wires, the wire becomes so hot that it glows and gives off light that we can use. The electric light bulb has a tiny wire called a filament inside that gives off light. If one of the wires should happen to break, it will give no more light. (See lesson plan 6)

Pioneers and Inventors

Until Alessandro Volta, discovered the electric battery all electricity hardly moved and was therefore called static electricity. Volta concluded that “whenever you have series of similar objects you can call them a battery of objects.” [3] Volta’s battery produced electricity that ran through a wire at a steady rate for a long period of time. He built the first electric circuit.

Michael Faraday, has been called the father of electricity. The highest award given by the Institution of Electrical Engineers is the Faraday Medal.

Faraday invented the induction ring. The discovery was electromagnet induction, the induction of electricity in a wire by means of the electromagnetic effect of a current in another wire. This invention formed the basis of modern electrical technology. The reason is that it made electricity economical. It directly changed mechanical energy to electrical energy. As a result the cost of electrical energy decreased. The induction ring was the first electric transformer. The electricity supply to industry is totally dependent on transformers.

To send electrical energy over many miles requires high pressure to be done economically. The pressure has to be changed many times between generator and consumer and it is done by transformers.

Later Faraday built the first generator.

Benjamin Franklin is sometimes called the father of American science. Franklin had an idea that lightening and electricity was the same and set out to prove it during a thunderstorm. He used a kite with a brass key attached to the string. His experiment proved him correct.

Joseph Henry reversed Faraday's discovery by making electric current turn a wheel. He invented the electric motor. The electric motor could be started and stopped at will. With a small electric motor small objects could be kept moving. A gigantic electric motor could keep enormous objects moving. The electric motor made it possible to do most of the work that human and animal muscles have been doing in the past.

Samuel F. B. Morse, built the first electric telegraph in 1844. The current in the wire could be started and stopped at will to send short (dots) and long (dashes) signals. The dots and dashes were arranged in different ways to represent each letter in the alphabet, which became the Morse Code. The Morse Code made it possible to send messages for long distances at a speed of electricity which is 186,000 miles per second. (See lesson plan 4)

Thomas A. Edison in his invention found a way to run an electric current through a carbon thread in a closed glass container that held no air. The results were the electric current heated the thread until it glowed white hot. Since there was no air it could not burn but just glow. Consequently, Edison invented the electric light.

Lewis Latimer was a member of the Thomas Edison research team. He made outstanding contributions toward the development and commercialization of the electric light. Latimer patented a process for making carbon filaments for light bulbs. He also invented the threaded socket. He helped install the carbon filament lighting system in New York, Philadelphia, Montreal, and London.

Today electric current is wide spread and readily accessible to operate the many machines we use in our homes and industry.

Electrical Sources

Oil is a liquid formed underground by prehistoric decomposed microscopic plants and animals and is considered to be a form of fossil fuel. Coal is a solid black mineral that when burned gives off heat. Coal was formed many years ago from decayed vegetation under great pressure inside the earth. Coal is a form of fossil fuel.

Natural gas is formed underground by decomposed prehistoric microscopic plants and animals and is also a form of fossil fuel.

Energy is the result of converting another form of energy into electricity. The conversion can be done via fossil fuels, nuclear reaction, geothermal energy, hydroelectric power, solar power, and the wind. All of which can generate electricity to power a turbine.

"Fossil fuels (oil, natural gas, and coal) are burned to produce steam from water and the steam powers the turbine. Uranium atoms are split in a nuclear reactor; this process creates heat, which produces the necessary steam. To make use of the geothermal energy, the heat in the earth's interior, naturally heated ground water is tapped to provide steam or water is sent deep into the ground to be heated and pumped bach to the turbine. Hydroelectric power depends on the force of falling water to spin the turbine and wind supplies energy for the generator by turning wind turbines. Once the turbine has been set into motion electricity is produced." [4] In addition, when the turbine connected to the shaft which is connected to a dynamo which is to

make electric energy by separation of positive and negative charges in a magnetic field, electrical energy is produced.

The energy produced will effect homes, schools, hospitals, businesses and transportation.

Energy Conservation

We should conserve energy because our coal, natural gas, and oil supply is running low. It took hundreds of years to produce them. If the generations of tomorrow are to enjoy some of the products we take for granted today, such as plastics, garden hoses, soaps and insulations we must be conservative. In addition you save money by conserving and use the saved money to do something you enjoy.

As you watch around your home and take note on how you use energy you can become conservative minded.

The total amount of electrical energy consumed in (kw) kilowatts can be found by multiplying the current in amperes by the voltage in volts by the time in hours and dividing by a thousand. (See diagram 2)

Some activities that will assist you in the consumption and conservation of energy are:

1. Make a study of how much electricity you use in your home in one month.
2. Invite someone in from the illuminating company and learn how to read the electric meter. Make a classroom project on the number of kilowatt hours consumed and graph your findings. Invite other classes to join you and give a prize to the class that conserves the most energy.
3. Invite someone from the gas company to explain how to read a gas meter.
4. As a class project do a study on how much gas is used in a month and graph your results.
5. Conduct a survey for one hour in the summer of the number of cars suspected of using their air conditioner and specify if they were justified or not.
6. Have your class do a skit or a debate on the pros and cons of energy conservation.
7. Join the city in the collection of cans, glass, and paper for recycling.
8. Design a poster on energy conservation.
9. Write a letter to the school news paper on the concerns of the class regarding energy conservation.
10. Interview grandparents on the changes they have witnessed over the years in electricity.
11. Design an energy conservation bumper sticker with the aide of the art teacher.
12. (See diagram 3)

Check List For Efficient Lighting

To light a house your family probably consumes about 2,000 kw hours in a year. The local power plant burns about 150 gallons of oil to generate that electricity.

Below is a check list to see how efficient the lights are in your home.

1. Are light bulbs and lampshades kept free from dust and dirt so that they do not block the transmission of light?
2. Are the lampshades translucent so that the light can pass through?
3. Do the ceilings and walls reflect light?
4. Have you made sure that the more critical lighting levels are kept as low as possible? The adequate amount is one watt of lighting per square foot.
5. Are the lights turned off when they are unnecessary even for a few seconds? The neglect of doing so is a waste of electricity.

Safety Rules

Electricity when used improperly can be very dangerous or worse, it could kill. Listed below are some safety rules that should be observed at all times when ever electricity is involved.

1. Never touch a switch with wet hands.
2. Never overload a connector.
3. Never put electrical wires under a carpet or rug.
4. Never put a penny in a fuse box.
5. Never pull the chain of a light bulb if you are standing in water.
6. Never fiddle around a radio or television when the switch is on.
7. Avoid standing under a tree in a thunderstorm or an electrical storm.
8. Never go swimming in an open lake during a thunderstorm.
9. Refrain from operating any electrical appliance when you are wet.
10. Never, never touch a broken cable at any time. Call a policeman or a fireman.

Electricity can be your friend or your enemy if you treat it with respect it will serve you loyally.

Conclusion

Man has a tendency to take electricity for granted. Electricity has been around for such a long time and the only time we miss it is when we flip a switch and nothing happens.

Some experts believe that we waste a quarter of the energy that we use. If we stop and consider the vast amount of oil, coal, and natural gas, we consume in any given day, maybe we will realize that we cannot afford it. However, there is no end to the many uses of electricity. Every year people are using more and more of electricity to do great things. This makes our lives completely different from that of our ancestors. We contribute this to the curiosity of great men who over the many centuries kept wondering why things behaved as they did. Their innate drive triggered many discoveries in electrical technology and superconductivity causing many changes in lifestyle over the years and in the years to come.

Vocabulary List

1. electricity: energy produced by the flow of electrons through a conductor
2. energy: the ability to do work
3. insulator: a material that electricity cannot get through
4. ampere: a unit for measuring electricity
5. conductor: a material that allows electric current to flow through it
6. switch: something used to turn electric current on and off
7. ammeter: an instrument for measuring electric current
8. electron: a tiny particle with a negative charge
9. positive charge: opposite to negative charge, the kind of charge on a proton
10. magnet: any object that can exert force on another magnet
11. proton: a positive charged atomic particle
12. ion: an atom that is electrically charged because it has lost or gained electrons
13. negative charge: opposite to positive charge, the kind of charge on an electron
14. volt: a unit that measured electrical current pressure
15. circuit: a path that electric current flows
16. static electricity: positive or negative charges on an object
17. turbine: a device that spins when wind, water or steam hits its blades

Pre Test/Post Test

1. What is electricity?
2. What is static electricity?
3. What causes the lights in your home to work?
4. How do you measure electrical energy?
5. How does the electricity get to your house? (essay)
6. List four safety rules of electricity.
7. Who invented the light bulb?
8. Who invented the Morse Code?
9. Why is conservation important? (essay)
10. What did people use to light with before electricity? (essay)
11. Who was Michael Faraday?

Lesson Plans

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1. What is electricity?

Objective The students will be formally introduced to what electricity

is.

a.) pre-test
b.) static electricity
c.) current electricity
d.) vocabulary list
e.) volts/amperes
f.) Activities: Static electricity
effect of electrons upon water, paper and a balloon

Materials Rubber comb, wool strip, running water and small pieces of paper

Procedure Rub the comb across a wool sweater several times and hold the charged comb over small pieces of paper. Bring the charged comb near a slow stream of running water from the faucet.
Record your observations and explain what happened and why. Explanation: Some of the electrons are rubbed off the atoms of the wool and join some of the atoms of the comb.

Electrons move when electricity is produced while the protons remain where they are in the nucleus.

The comb becomes negative charged because it has more negative electrons than positive. The sweater has become positive charged because it has lost some of its negative electrons.

An atom that has either more or less electrons than protons is called an ion.

The water will bend in the directions of the comb and the balloon after rubbing against a sweater will stick to the wall.

(figure available in print form)

Homework Review an energy conservation contract.

2. Media Research.

Objective The students will use the media center to do research on one of the following personalities in regards to electricity.

a.) Alessandro Volta
b.) Michael Faraday
c.) Lewis Latimer
d.) Benjamin Franklin
e.) Samuel Morse
f.) Thomas Edison

Homework Prepare a 3 minute talk on the person to be given in class.

3. Source of Energy.

Objective The students will listen to a lecture on the sources of energy.
a.) 3 minutes oral class presentations

b.) oil

c.) natural gas

d.) coal

*for the next 2 weeks be responsible for taking your family bottles, cans and newspaper to the drop off spots.

4. Construct a model for sending the morse code.

Objective To use model in learning the morse code.
a.) a telegraph set

Materials Dry cell battery, wire, switch, 2 nails, screw, piece of metal, block of wood and glue.

Procedure Bend the piece of metal into the z-shape shown in the diagram. Glue it to a block of wood. Hammer 2 nails under the free end of the metal. Be sure the underside of the metal is not painted. Connect a long piece of wire to one terminal of the dry cell battery. Wind the wire several times around the nail. Begin at the top of the nail and work downward. Bring the wire across to the other nail. Wind it around as many times as before working upward. Connect a second wire between the free terminal of the dry cell and the switch. Close the switch. The sounder (the z-shaped metal) will be attracted to the 2 nails underneath it. Explanation: Electricity flowing through the coils of wire around the nails made the nails magnets.

(figure available in print form)
(figure available in print form)

5. Presentation from United Illuminating.

Objective The students will listen to a guest lecturer from the United Illuminating Company and learn how to read the electric meter.

6. Film on electricity.

Objective The students will view a film on electricity by Eye Gate.

a.) write a critique on the film
b.) observe the filament of a light bulb that the teacher will provide. Critique your observation (turn on a good bulb with head cut away, repeat with a bad light bulb).

7. Construct a spinning turbine wheel.

Objective The students will construct a spinning turbine wheel.

Materials knitting needle, clay, pins, cardboard.
Trace this figure onto card board and cut out carefully

(figure available in print form)

A. Make a spinning turbine wheel.
B. Place a knitting needle in the center and clay to hold it in place.
C. Stick on a small piece of cardboard.
D. After inserting the knitting needles into the cardboard wheel bend the blades slightly. This will make the turbine spin when you blow on it.
E. Place the blocks on the table. Place the needle on the crossed-pins bearings. Use your breath and blow the blades just like the steam in a power station.

(figure available in print form)
Write up the outcome of the activity and tell why such an apparatus can be useful today.
(figure available in print form)

8. Conservation and Safety.

Objective The students will debate on the pros and cons of energy conservation and safety in relation to electricity. The class will be divided into groups of fours.

Homework Observe 30 minutes a day for 5 days the number of cars with their windows up using air conditioning and tell whether they were justified.

9. Energy Posters.

Objective The students will bring in pictures to make posters on energy conservation. The class will take apart a flashlight to see how it works.

Materials Flashlight and a piece of wire.

Procedure Make sure that the flashlight works . Strip the insulation from both ends of a piece of wire about 6 inches long. Wrap one end around the base of the bulb that was removed from the flashlight. Then touch the bottom of the bulb to the center terminal of the cell. Touch the end of the wire to the bottom of the cell closing the switch of the flashlight, hence, completing a circuit and light goes on.

(figure available in print form)
Write the outcome.

10. Optional Activities and Post Test.

Objective The students will be tested again to measure growth from the unit.

Optional Activities

a.) construct a switch
b.) connection of 2 dry cell circuits

Notes

1. How Did We Find Out About Electricity p. 10
2. Concepts and Challenges in Physical Science p. 164
3. How Did We Find Out About Electricity p. 51
4. Science and Children p. 32

Reading List For Teachers

1. Asmov, Isaac; How Did We Find Out About Electricity"; Walker and Company, Inc., New york, 1973.
2. Branly, Franklin M.; "The Electromagnetic Spectrum"; Thomas Y. Crowell, New York, 1979.
3. Epstein, Sam and Beryl,; "Michael Faraday"; Carrard Publishing Company, Champaign, Illinois, 1971
4. Bowers, Brain; "Pioneers of Science and Discovery Michael Faraday and Electricity"; Wayland publishers Ltd., 49 Landowne Place, Hove, East Sussex BN3, HF, 1974.

Reading List For Students

1. Bernstein, Leonard, Schachter, Martin, Winkler, Alan and Wolfe, Stanley; “Concepts and Challenges In Physical Science”; Cebco, Allyn and Bacon , Inc., Rockleig, N.J., 1989.
2. Victor, Edward; “Electricity”; Follett Publishing Company, N.J., 1967.
3. “Energy Conservation”; Thomas Alva Edison Foundation, Southfield, MI. 1974.

Diagram 2
(figure available in print form)
Diagram 3
(figure available in print form)

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