Electricity part 1

By Sharon Fabian

1 The ancient Greeks knew about static electricity back around 500 BC. They had discovered that a gold coloured material called amber could be made to attract small objects, like bits of a feather, when the amber had been rubbed with a piece of fur. Ben Franklin discovered the electricity in lightning in 1752, although nobody knows exactly how he did his experiment. Franklin was a careful scientist, and would have known that flying a kite in a thunderstorm could have deadly effects, so there must be a little more to the story that what we usually hear. Both the ancient Greeks and Ben Franklin had discovered examples of naturally occurring electricity. Their discoveries were amazing in their time, but not really useful yet. One of the first practical uses of electricity occurred in Dover, England in 1858, when electricity was first used to power the lamp in a lighthouse.

2 Later in the 1800s and into the early 1900s, electricity developed into a major industry. Homes in the cities usually received electric service first; by the 1930s about two-thirds of the households in the United States received electric power. Farms, on the other hand, were among the last to be served; only about 10 percent of farms had electric power in the 1930s. Today the United States produces and uses far more electric power than any other area of the world.

3 Americans use electricity in their homes, and also to power industry, and to provide communication and transportation. Home uses of electricity include heat and light, as well as power to run appliances and games. Factories use electricity to power the machines used to produce all kinds of goods. Communication systems that depend on electricity include telephone service, television and radio, and the Internet. There are streetcars and subways powered by electricity. Other types of transportation, such as planes and ships, depend on electricity for navigation equipment. A car's spark plugs use electricity.

4 Electricity for all of these uses does not come from lightning or from any other natural source. Most of our useful electricity is produced by huge generators in big power plants. These generators change mechanical energy into electrical energy. Power plants get their energy from a variety of sources. The most common source today is fossil fuels, such as gas and oil. Another source is

hydroelectric power (the prefix hydro- means water). This energy comes from water rushing over a dam. The mechanical energy from the rushing water is turned into electric energy by the generator in the power plant. Electricity like this cannot be stored for a long time, so the power plant must be constantly producing more electricity, and also constantly adjusting the amount that it produces to meet the changing demands for power.

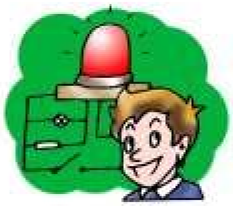
5 Electricity leaves the power plant over large transmission lines. It may pass through transformers that can either raise or lower the power as needed. When the electricity reaches its destination, maybe your house, it will be changed back to another kind of power. Maybe it will be changed into light to read by, or heat for a snowy day, or maybe it will be used to power your Game Boy or your washing machine.

6 Today electricity is used for everything from milking cows to sharpening pencils. Electronics, a fairly recent development in electricity, is used to produce electronic music, to scan groceries at the supermarket, and in the control centre for NASA's space program. What other uses of electricity can you think of? How many can you list in two minutes?

7 If you tried it, you probably came up with a long list, because electricity has become a big part of our lives in the twenty-first century. What would we do without it? That would probably be a long list too -- "Ways My Life Would Be Different Without Electricity."

Electricity

1. Static electricity has many practical uses. Ⓐ True Ⓑ False	2. Electricity from lightning can be stored for practical uses. Ⓐ True Ⓑ False
3. Generators produce most of the electricity that we use. Ⓐ True Ⓑ False	4. Power plants can store a large amount of electricity for about one month. Ⓐ True Ⓑ False
5. The word that means electricity produced from water power is Ⓐ Hydroelectric Ⓑ Generator Ⓒ Transmission Transformer	6. Power lines that carry electricity from the power station are called _______ lines. Ⓐ Generator Ⓑ Transmission Ⓒ Hydroelectric Ⓓ Transformer
7. This article is about Ⓐ Experiments with electricity Ⓑ Power stations Ⓒ The basics of electricity Ⓓ Electric motors	8. How do you think your life would be different if electricity hadn't been invented yet? ______________________________ ______________________________ ______________________________



Experimenting with Electricity

part 2

1 What do humans have in common with the electric eel and the lightning bug? Maybe not so much. While the electric eel and the lightning bug seem to be able to produce all of the electricity that they want, this is not true for people. People have to rely on power plants to generate most of their electricity. So far, power plants have mainly burned fossil fuels to produce our electricity, but fossil fuels will not last forever. Sooner or later, they will run out. That is one reason why electricity is such an interesting topic for scientists to investigate. As we learn more about electricity, maybe we will find new and better ways to produce all of the electricity that we want or need.

2 Experimenting always starts with a little research, and a little research into the subject of electricity leads us right to electrons. Electrons are one of the three microscopic particles that make up an atom -- protons, neutrons, and electrons. Electrons are the negatively charged ones that orbit around the centre of the atom. Usually an atom is balanced because it has the same amount of electrons, which have a negative charge, and protons, which have a positive charge. However, sometimes an atom can gain or lose some electrons. Then the whole atom becomes unbalanced, or charged (as in electric charge).

3 Static electricity is caused by charged atoms. When you touch a doorknob and get a shock, or run a comb through your hair and make it stand up on end -- that is static electricity.

4 There are lots of fun experiments that you can do to demonstrate static electricity. An old favourite is to blow up a balloon and then rub it with a woolly sweater. The balloon becomes charged. You can put it up against a wall, and it will stay there as if by magic. Of course it's not really magic; it's static charge. If you charge two balloons and hang each one by a string, you can show that like charges repel. Hold each balloon by its string and gradually bring the charged sides of each balloon closer together. As they get closer, the two balloons will begin to push each other away because both have the same type of charge, a negative one. Another static trick is to take a plastic spoon and rub it with a piece of wool to charge it. Then shake some pepper out on a table, and pass the spoon above it. The spoon will attract the pepper and make it jump up to the spoon.

5 Current electricity is also caused by charged atoms but, in this

case, the atoms are not just sitting there; they are constantly moving in a path called a circuit. Electricity from batteries and plug-in electricity are two kinds of current electricity.

6 When experimenting with current electricity, always use small batteries for the source of your electricity. Have an adult check out the materials that you plan to use before beginning your experiment.

7 A good place to start experimenting with current electricity is to see if you can build a circuit. Get a battery, two short pieces of electric wire, and a small light bulb. When the light bulb lights up, you will know that you have built the circuit right. Next you might want to try adding a switch. If you set it up right, the switch will stop and start the flow of electric current, and turn your light bulb off and on. If you research a little more, you should be able to find diagrams that show you how to hook up several light bulbs to one battery. There are two ways to do this, one is called a series circuit, and the other is called a parallel circuit. Can you build both of these?

8 Another fun experiment is to see if you can produce electric power without any batteries. Did you know that you can produce electricity from a lemon? It is also possible to build a clock that runs on a potato!

9 If you enjoy doing electricity experiments like these, maybe one day you will be working in the field of electricity. Scientists in this field are especially interested in finding new sources of electricity, such as solar, wind, or tide power. They also experiment to find better ways to use sources that we already have, including nuclear and hydroelectric power. Scientists are also looking into ways to be more efficient with the electricity that we produce, inventing machines that use less power to do their work. We may never have the instant electricity that the lightning bug and the electric eel have, but we do have the brainpower to experiment and find out new and better ways of doing things. This makes us pretty unique too.

Experimenting with Electricity

1. The negatively charged particles in an atom are called
   - (A) Protons
   - (B) Neutrons
   - (C) Atoms
   - (D) Electrons

2. An atom is usually
   - (A) Charged
   - (B) Negative
   - (C) Unbalanced
   - (D) Balanced

3. The two main types of electricity discussed in this article are
   - (A) Hydroelectric and nuclear
   - (B) Protons and neutrons
   - (C) Static and current
   - (D) Positive and negative

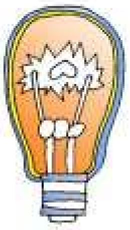
4. Students can do experiments with
   - (A) Both
   - (B) Neither
   - (C) Current electricity
   - (D) Static electricity

5. The experiment with the spoon and the pepper is about
   - (A) Current electricity
   - (B) Both
   - (C) Neither
   - (D) Static electricity

6. A circuit with a switch is an example of
   - (A) Neither
   - (B) Current electricity
   - (C) Both
   - (D) Static electricity

7. Students are the only people who still do electricity experiments today. Real scientists don't need to do them any more.
   - (A) True
   - (B) False

8. Scientists still want to find out about
   - (A) New sources of electric power
   - (B) Better ways to use the sources that we have
   - (C) More efficient uses of electricity
   - (D) All of the above



The Nuts & Bolts of Light Bulbs part 3

1 It's a convenience we use every day, usually several times a day. We walk into a room, flip on the switch, and presto - there is light!

2 The electric light bulb has been in use since 1879. Although other inventors had already developed the basic concept of the bulb, Thomas Edison was the man responsible for figuring out what kind of material would be best used for the filament (or wire) inside the bulb. The greatest challenge was to create a filament that would burn long enough so the bulb would provide light for an extended period of time.

3 Edison spent two intense years experimenting with such things as bamboo and silver before he finally stumbled upon the idea of using carbonized thread for the filament. This was ordinary cotton sewing thread burned to an ash. When an electric current was sent through the thread inside the bulb, it burned for an entire day providing a warm, bright glow. It would have burned longer; but Edison, being the curious inventor he was, increased the voltage of electricity to see how it would affect the bulb. Only then did it burn out. On December 21, 1879, news of Edison's invention of the electric *incandescent* light spread throughout the world.

4 The basic idea behind these bulbs is simple. Electricity passes through the thin filament. Because it's so thin, the filament offers quite a bit of resistance to the electricity, which turns the electrical energy into heat. The heat makes the filament white hot, and the white part is the light. The filament glows because of the heat-it "incandesces."

5 The basic function and performance of the incandescent bulb hasn't changed much over the years, but different shapes and sizes have been developed. You might see globe-shaped bulbs in a row around a bathroom mirror or tubular bulbs in indoor plant gardens, piano lights, or bankers' desk lamps.

6 The problem with incandescent light is that the heat wastes a lot of electricity. Heat is not light, and the purpose of the light bulb is light, so all of the energy spent creating heat is a waste.

7 Although incandescent bulbs are still widely used, another type-the *fluorescent* bulb, has grown in popularity, especially during the last decade. These long, thin glass tubes are coated on the inside with a white powder called *phosphor*. In order to turn them on, you must connect them to something called a *ballast*. Most ballasts are about

the size of a brick, and they're hidden inside the lighting, usually behind a piece of sheet metal. When you flip a switch to turn on the lights, what you are actually doing is turning on the ballast. The ballast "turns on" the fluorescent lamp by passing electricity through the tube. The electrical current causes the gas inside the lamp to give off ultraviolet energy. This energy hits the phosphor and gets converted to light.

8 Fluorescent bulbs last much longer than incandescent bulbs, use less electricity, and make 2-4 times more light. In other words, they're much more energy-efficient than incandescent bulbs! They are used most frequently for ceiling lighting in schools, offices, stores, and other large buildings.

9 You can now find small, compact fluorescent light bulbs (CFLs) that can be used in place of incandescent bulbs in table lamps at home. They have a very small ballast built into the bulb and screw into the socket of the table lamp. A CFL uses less electricity than an incandescent bulb that provides the same amount of light, so they cost less to operate and last up to 13 times longer.

10 Developing countries throughout the world are also reaping the benefits of fluorescent lighting technology. In 1995, China manufactured some 80-100 million fluorescent bulbs-more than any other country!

The Nuts & Bolts of Light Bulbs

1. What are the two types of light bulbs discussed in this article?
   - (A) Incandescent and fluorescent
   - (B) Round and tube-shaped
   - (C) White and yellow
   - (D) Electric and gas

2. The most difficult step in inventing the light bulb was developing a glass that wouldn't break.
   - (A) True
   - (B) False

3. The difference between an incandescent light bulb and a fluorescent light bulb is
   - (A) The incandescent light bulb has a filament, but the fluorescent does not
   - (B) The incandescent light is created by heat, but the fluorescent is not
   - (C) (a) and (b) are correct
   - (D) Only (a) is correct

4. "Incandesce" means
   - (A) To transfer heat
   - (B) To be powered by electricity
   - (C) A round bulb
   - (D) To glow from heat

5. What is the main problem with incandescent bulbs?
   - (A) They are too old-fashioned
   - (B) They are difficult to manufacture
   - (C) Electricity is wasted
   - (D) They cost too much

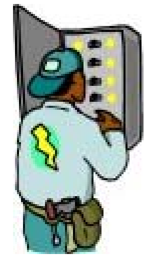
6. What is the main reason fluorescent bulbs are so popular?
   - (A) The stores have more fluorescents than incandescents
   - (B) They are more energy-efficient than incandescents
   - (C) They come in different shapes
   - (D) They look nicer than incandescents

7. Fluorescent bulbs are coated on the inside with
   - (A) Sheet metal
   - (B) Bricks
   - (C) Ballasts
   - (D) Phosphor

8. What country is a major manufacturer of fluorescent bulbs?
   - (A) Russia
   - (B) China
   - (C) Germany
   - (D) Mexico

To Flow Or Not To Flow?

part 4



1 Every time we turn on a switch in our houses, we expect our lights to shine, our toaster ovens to toast our bagels, or our radios to play music. However, did you know that there are certain conditions that can interrupt the flow of electricity? Did you also know that certain materials allow electricity to flow through them more easily than other materials?

2 The ability of electrical energy to flow through materials is called conduction. Materials that allow electricity to easily flow are called conductors. Think of a conductor on a train. He or she helps to direct passengers to their seats to help ease the traffic flow on the train. Well, some materials like metals work in the same way. Electricity passes through them very easily to the source that needs the electricity such as a light in your house. Electrical wires are made of metal because metal is one of the best conductors. One type of metal, copper, is most often used for electrical wires since it is very inexpensive to mine and to produce.

3 Materials that do not allow electricity to pass easily through them are called insulators. Rubber, glass, plastic, cloth, and non-metallic materials are poor conductors of electricity. This is why electrical wires are covered in rubber, plastic, or cloth. Electricians even wear rubber gloves when they are working with electrical wires. This does not mean that electricity cannot pass through insulators or any other material. If you give any object enough voltage (the force or push behind the flow of electricity), then that object will conduct electricity. Some insulators can become conductors when they are wet. You should turn off appliances when your hands are dry because human skin is a better conductor when wet. If you add dissolved minerals to pure or distilled water (a poor conductor), the water would be able to conduct electricity a little better than before the minerals were added.

4 Now that we have the "energy" flowing through your brain wires, let's talk about conditions that may interrupt the flow of electricity through electrical wires. Resistance slows down the flow of electricity as it travels through the wire to the appliance that you are trying to turn on. For example, when a wire is longer, there is a greater resistance to electricity because the electrical current has farther to travel. The width or diameter of a wire can also affect how electricity flows. Think about when you walk through a door on your way to lunch at school. What would happen if you and your classmates tried to get

through the door at the same time? Besides the chaos that would occur, you and your classmates would get stuck trying to pass through the door at the same time. As a result, very few of you would make it through the door because the passageway would become smaller, and your class would be late for lunch. This is similar to what happens with wires. When you have a thick wire, the electricity has a broad or wide passageway to travel through without being restricted. When the wire is narrow or thin, the flow of electricity is slowed down due to more friction. When there is more friction, heat is produced causing the wire to overheat.

5 Sometimes resistors are used to control the amount of electrical energy that flows through the wires. One type of resistor is a fuse. A fuse is a safety device that is placed in an electrical circuit. The fuse contains a metal strip. When the wire that is attached to the fuse overheats, the metal strip melts and opens the circuit which stops the flow of electricity. Modern cars also have fuses that are attached to electrical circuits that control power windows, air conditioners, lights, and radios.

6 There are occasions when electricity is prevented from flowing through a resistor. A short circuit is a path that allows most of the electricity in a circuit to flow around or away from the device in the circuit. An example of this would be placing an electrical cord for a lamp under a rug. If people walk on this rug everyday, the rubber insulation on the cord will eventually wear away. Once the rubber wears away, there will be only two bare wires in its place. When the bare wires touch, a huge amount of electricity will flow to this area, but it will not make it to the lamp. Without the rubber insulation, the heat from the electrical energy will escape into the air. Most of your current will be lost.

7 So when you turn on that switch at home or at school, just remember there are times when electricity does not "go with the flow".

To Flow Or Not To Flow?

1. The ability of electricity to flow easily through certain materials is called insulation. (A) False (B) True	2. A fuse is a safety device that stops the flow of electricity when a circuit overheats. (A) False (B) True
3. When a wire is narrow and thin, the flow of electricity ________ due to friction. (A) Changes direction (B) Stays the same (C) Is made slower (D) Is made faster	4. Another title for this article could be ___________. (A) Electricity at Home (B) Electricity and How It Flows (C) Electricity and Its Uses (D) Electricity at School
5. What can be added to pure or distilled water to make it a better conductor of electricity? (A) Ice (B) Dissolved minerals (C) Dissolved plants (D) Rocks and Dirt	6. What could cause a short circuit? (A) When wires are left on the floor (B) When two wires are connected to each other (C) When the rubber on a cord wears away and leaves two bare wires that touch (D) When two wires go past each other
7. Some materials which are poor conductors are: (A) Plastic, cloth, tin (B) Metal, cotton, glass (C) Rubber, plastic, glass (D) Copper, aluminum, cloth	8. Explain what would happen if you used a copper penny to replace a melted fuse. Why would this happen? ______________________________ ______________________________ ______________________________