Ohm in the Circuit part 9

1 Although Benjamin Franklin had his moment in the "spot light", there were many scientists in the 18th and 19th centuries who worked to discover the mystery of electricity. Franklin's creation of the lightning rod in 1752 sparked the interest of scientists throughout Europe and America. During the late 1700s and 1800s these scientists tried to figure out how to produce electrical energy and how to store large amounts of electricity. This whole "electricity era" started with hanging frog legs, but it ended with an important law for measuring the flow of electricity.

2 In 1786, an Italian scientist named Luigi Galvani tried to discover if lightning was truly the key to producing electricity. Prior to an approaching thunderstorm, he took the legs of a dead frog, attached them to a metal hook, and hung the hook from a metal railing. Galvani wanted to see if the lightning would produce an electrical current that would make the legs jump. However, before the lightning could arrive, the legs jumped. After Galvani observed this phenomena, he realized the frog's nerves had made a new type of electricity called **animal electricity**. People throughout Europe began to believe **animal electricity** was the secret to life. Now you know why Frankenstein had such a jolt when he woke up. Today the word galvanic stands for the direct current of electricity that is produced chemically. Galvanize means to shock with an electric current. I guess Galvani "galvanized" his frog's legs.

3 In the 1790s, another scientist named Alessandro Volta proved that Galvani's **animal electricity** was really a chemical reaction. A chemical reaction occurs when two or more substances are combined and a new substance is produced. The metal railing on Galvani's balcony reacted to the metal hook that held the frog's legs and the moisture in the air. The result was a mild electrical current that caused the legs to jump. Volta used this knowledge to produce the first battery in 1800. He built the battery by using alternate layers of copper and zinc in a jar of salt water. The chemical reaction that occurred between the two metals and the salt water caused a steady flow of electricity. Volta's work provided us today with the words **volt** and **voltage**. Volts are units of potential difference similar to the pressure in the circuit. Voltage is the type of pressure that pushes an electrical charge through a circuit. In addition to new science vocabulary words, Galvani and Volta's work helped other scientists as they learned about circuits and current electricity. Current electricity is the electrical energy that flows through an unbroken path or circuit.

4 During the 1820s, French scientist André Ampere proved that two parallel wires (side by side) carrying currents in the same direction would attract each other. Wires with electrical currents flowing in opposite directions would repel each other. Ampere continued to work on later experiments in electromagnetism. However, he left us with an important

word to add to our scientific vocabulary. An **ampere** or **amp** is a unit of electric current used to measure the rate or how fast electric current flows within a circuit.

5 As a result of the work of German scientist Georg Ohm in the mid 1800s, we have our most important scientific law about electricity. Ohm proved that the flow of electrical current through wire depended on the wire's resistance. The flow of electricity can be changed based on the length or the thickness of the wire. When you have a thick wire, the electrical energy has a wider pathway in which to travel. If the wire is thin, the passageway is narrow, and the electrical energy will be slowed down as it travels due to friction. An **ohm** is a unit used to measure a material's resistance to the flow of electricity. "Ohm's Law" states that the electromotive force or pressure in a circuit (measured in volts) equals the current (measured in amps) multiplied by the resistance (measured on ohms). An electrical circuit has three main parts: the source of the electricity (i.e., battery), a "load" or electronic device (i.e., lamp), and conductors to carry the electricity (i.e., wires).

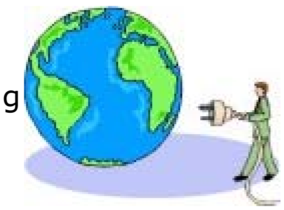
6 A simple way to demonstrate **Ohm's Law** is to imagine that you are using a plastic ketchup bottle to paint a huge ketchup picture. If you were to hold the bottle with both hands, this would be your "voltage" because you would use your hands to put pressure on the bottle. The nozzle or top on the bottle would be your "ohms" because the size of the bottle cap will affect the flow of the ketchup or provide resistance. Finally, the stream of ketchup is your "amps" or current. When you squeeze the bottle harder, the flow of ketchup will increase. So in a circuit, if you increase the voltage, the current in the circuit will increase; decrease the voltage, it will decrease. If you decide you want a bigger nozzle and make the hole larger, this will increase the flow of ketchup because you have lessened the resistance from the cap. In a circuit if you use a thicker wire, you will decrease the resistance the electrical current experiences, and therefore increase or speed up the flow of the current. When you use a thin wire, you increase the resistance and decrease or slow down the flow of electrical current.

7 As you can see, Franklin, Galvani, Volta, Ampere, and Ohm were important players in the game of learning about electricity. Without all of their hard work, we would be plugging in frog legs instead of electrical plugs.

Ohm in the Circuit

1. Voltage can be defined as ___________ (A) The chemical reaction between metals (B) The type of pressure that pushes an electrical current through a circuit (C) The resistance to electricity (D) The coating of steel or iron with rust-proof zinc	2. Name the three main parts of an electrical circuit. ____________________ ____________________
3. What is the relationship between voltage, current, and resistance? ____________________ ____________________	4. André Ampere discovered that (A) Parallel wires carrying the same current would repel each other (B) Parallel wires carrying the same current would attract each other (C) Perpendicular wires with the same current would attract each other (D) Wires carrying current in the same direction would repel each other
5. If a current of 4 amps flows through a circuit that has a resistance of 5 ohms, what is the voltage? ____________________ ____________________	6. If a circuit has a voltage of 30 volts and a resistance of 6 ohms, what are the amps for the current in the circuit? ____________________ ____________________
7. In 1786 Luigi Galvani developed the theory of (A) Animal electricity (B) Car electricity (C) Eel electricity (D) Frog electricity	8. Decreasing the resistance in a circuit will decrease the flow of electricity. (A) False (B) True

The Ohm 500 part 10



1 The movement of an electrical current is similar to the fast paced flow of race cars on the Indianapolis Speedway. Both move at a certain speed along an unbroken path trying to reach their desired destination. For the electricity, it is your video game in your XBOX, and for the race car driver, it is the checkered flag at the finish line. During the 18th and 19th centuries there were many scientists in Europe who worked to discover the mysteries of electrical energy. It is their discoveries that have helped modern men and women to harness and control the power of electricity.

2 Although Benjamin Franklin was the most famous "electricity explorer," there were certain European scientists who expanded on his scientific findings. Franklin's creation of the lightning rod in 1752 had sparked the interest of scientists in Italy, France, and Germany. During the late 1700s and 1800s these scientists tried to figure out how to produce and control large amounts of electrical energy. This whole "electricity era" began with the hanging of frog legs from a balcony, but it ended with an important scientific law for measuring the flow of electrical current in a circuit.

3 In 1786, Italian scientist Luigi Galvani tried to discover if lightning was truly the key or source for producing electricity. Prior to an approaching thunderstorm, Galvani took the legs of a dead frog, attached them to a metal hook, and suspended the hook from a metal railing of his balcony. He wanted to find out if lightning would produce electrical currents in the legs once the legs were struck by lightning bolts. However, before the storm could arrive, the legs jumped without assistance. After Galvani observed this phenomenon, he realized that the frog's nerves had caused the legs to move on their own. He theorized that a new type of electricity had been developed, and he called it **animal electricity**. People throughout Europe began to believe **animal electricity** was the secret to life. Scientists hurried to perform elaborate "electrical displays" to entertain the common masses. Now you know why Frankenstein had such a jolt when he woke up. Author Mary Shelley incorporated the scientific craze of the time into her famous novel. Today the word **galvanic** (after Galvani, of course) stands for the direct current of electricity that is produced chemically. Galvanize means to shock with an electric current and a galvanometer measures small electrical currents based on the mechanical effects that were produced by the current. I guess one could say that Galvani "galvanized" his frog's legs on the balcony.

4 In the 1790s, another scientist named Alessandro Volta proved that Galvani's **animal electricity** was really a chemical reaction. A chemical

reaction is a process where two or more substances are changed into other substances. The metal railing on Galvani's balcony reacted to the metal hook that held the frog's legs and the moisture in the air as a result of the impending storm. The result was a mild electrical current that caused the legs to jump. Volta used this knowledge to produce the first battery in 1800. He built the battery by using alternate layers of copper and zinc in a jar of salt water. The chemical reaction that occurred between the two metals and the salt water caused the first known steady flow of electricity. Volta's work has provided us today with the words **volt** and **voltage**. Volts are units of potential difference similar to the pressure in a circuit. An electrical circuit has three main parts: the source of the electricity (i.e., battery), a "load" or electronic device (i.e., lamp), and conductors to carry the electricity (i.e., wires). Voltage is the electromotive force, measured in volts, that pushes the electric current through the circuit. In addition to new science vocabulary words, Galvani and Volta's work helped other scientists as they learned about circuits and current electricity.

5 In France during the 1820s scientist André Ampere proved that two parallel wires (side by side) carrying currents in the same direction would attract each other. Wires with electrical currents flowing in opposite directions would repel each other. His observations were fundamentally different from what people knew about attraction and magnets (opposite poles attract and similar poles repel). As a result, his findings amazed everyone around Europe. Ampere continued to work on later experiments in electromagnetism. Like Galvani, Ampere left us with an important word to add to our scientific dictionary. An **ampere** or **amp** is a unit of electric current used to measure the rate at which current flows through a circuit. Another way to think of **amperage** is the number of electrons that pass a given point in a circuit at a given time.

6 Georg Ohm, a German scientist, combined the work of Galvani, Volta, and Ampere to develop our most important scientific law about electricity. Ohm proved that the flow of electrical current through wire depended on the wire's resistance. The flow of electricity can be changed based on the length or the thickness of the wire. When you have a thick wire, the electrical energy has a wider pathway in which to travel. If the wire is thin, the passageway is narrow therefore slowing down the current due to friction. The resistance in a circuit consumes the power within that circuit and converts that power to heat. The voltage in a circuit needs to be very strong to overcome that resistance. Ohm's work resulted in "Ohm's Law" which states that the electromotive force in a circuit (measured in volts) equals the current (measured in amps) multiplied by the resistance (measured on ohms). This law explains the relationship between current resistance, electromotive force, and rate of current flow.

7 A simple way to demonstrate **Ohm's Law** is to pretend that you are using a plastic ketchup bottle to paint a huge ketchup picture. If you were to hold the bottle with both hands, this would be your "voltage" because your

hands would apply the pressure on the bottle. The nozzle on the bottle would be your "ohms" because the size of the bottle cap will affect the flow of the ketchup and provide resistance. Finally, the stream of ketchup is your "amps" or current. When you squeeze the bottle harder, the flow of ketchup will increase; decrease the "squeeze" and the ketchup flow will decrease. So in a circuit, if you increase the voltage, the current in the circuit will increase; decrease the voltage, it will decrease. If you decide you want a bigger nozzle and make the hole larger, this will increase the flow of ketchup because you have lessened the resistance. In a circuit if you use a thicker wire, you will decrease the resistance the current experiences and therefore, increase the flow of electricity. When you use a thin wire, you increase the resistance in the form of friction and decrease the flow of electrical current.

8 As you can see, Franklin, Galvani, Volta, Ampere, and Ohm were important players in the race for electrical knowledge. Without all of their hard work, we would be plugging in frog legs instead of electrical plugs.

The Ohm 500

1. Voltage can be defined as ____________ (A) The theory of nerve impulses produced by animals (B) The type of resistance within a circuit (C) The electromotive force that pushes the current through a circuit (D) The coating of steel or iron with rust-proof zinc	2. Explain how the three main parts of an electrical circuit are related. ______________________________ ______________________________
3. Explain the relationship between voltage, current, and resistance in a circuit? ______________________________ ______________________________	4. André Ampere discovered that (A) Perpendicular wires with the same current would attract each other (B) Wires carrying current in the same direction would repel each other (C) Parallel wires carrying the same current would attract each other (D) Parallel wires carrying the same current would repel each other
5. If a current of 12 amps flows through a circuit that has a resistance of 9 ohms, what is the voltage? ______________________________ ______________________________	6. If a circuit has a voltage of 250 volts and a resistance of 25 ohms, what are the amps for the current in the circuit? ______________________________ ______________________________
7. In 1786 Luigi Galvani developed the theory of (A) Animal electricity (B) Static electricity (C) Reciprocal electricity (D) Battery electricity	8. The voltage in a circuit needs to be very weak to overcome the resistance in a circuit. (A) False (B) True