Drexel-SDP GK-12 LESSON

Lesson: Electric Circuits

Subject Area(s) **Physical Science**

Associated Unit **Sea Perch, module 3**

Lesson Title **Lesson: Electric Circuits**

Grade Level 6 (5-12)

Lesson # 1 of 2

Lesson Dependency None.

Time Required 30 minutes

Heading

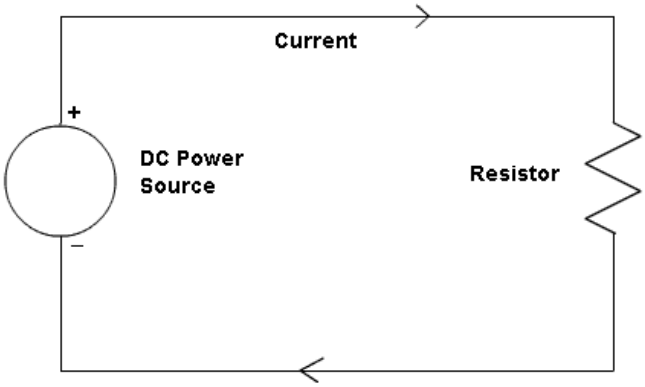

Image 1

ADA Description: Picture shows an electric circuit with a DC power source, the direction of current, and one resistor.

Caption: An electric circuit with a DC power source, the direction of current, and one resistor.

Image file name: elect_ohms_law-dc_circuit.gif

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Summary

How do we create an electric circuit by soldering two disjoint electrical paths together? In this lesson, students will learn concepts about what is electricity, designing electrical pathways, Kirchhoff's voltage law, Kirchhoff's current law, then follow with an activity to learn how to solder two disjoint pathways together to create an electrical circuit.

Engineering Connection

The engineering connection should jump right out – electrical and electronics engineering! This fruits (and follies) of this field of study are enjoyed by everyone – from computers to iPods to GPS systems – often with little thought given to the underlying circuitry of the device. In this lesson, we'll learn some of the fundamental terminology and concepts of electrical engineering, then follow up the lesson with an activity to learn to solder, and test the circuit with a V-I sensor.

Keywords

Circuits, current, electric circuits, electrical engineering, electronics, voltage

Educational Standards (PA)

- Science: Physical Science, Chemistry and Physics – Energy 3.4.B, Technology Education – Physical Technologies 3.6.C.
- Math: Computation and Estimation 2.2

Pre-Requisite Knowledge

Be familiar with the concept of electrical energy.

Learning Objectives

After this lesson, students should be able to:

- **Give three examples of electrical energy**
- **Identify the voltage source and resistors on a circuit diagram**

Introduction / Motivation

Ever wonder how electricity travels through your favorite electronic devices? Engineers love to play, too! By understanding how an electric circuit works, an engineer can design his or her ideal gaming environment. This lesson is intended to help you understand electrical energy. It is not necessary to memorize all the terminology, but you should be aware of some different examples of electrical energy. Also, you will be exposed to an electrical circuit diagram and be able to identify the voltage source and resistors on the diagram.

Lesson Background & Concepts for Teachers

This activity will be conducted after some discussion what is electricity, the symbols and relationships by which we describe electrical phenomena, the fundamental Kirchhoff laws of electrical phenomena, and designing electrical circuits. If you have the background knowledge, illustrate the concepts with a very simple example, otherwise, ask for the help of someone with knowledge of electrical engineering to help you teach this lesson.

Examples of electrical energy: The earth's atmosphere stores electrical energy within an electric field. During a thunderstorm, some of this energy is released in a lightening bolt releasing the potential. Power generation - heat energy of burning a fossil fuel is converted into electrical energy stored within the coils of an electric power generator, which is then released over wires to the consumer. Potential energy is stored within the chemical cells of a battery, which is then converted into electrical energy by forming a circuit around the positive and negative terminals.

Electricity: The term electricity, derived from the word 'electron', is used for the variety of phenomena resulting from the presence and flow of electric charge.

Electric charge: Measured in coulombs, a fundamental property of subatomic particles. Electrically charged particles produce and are influenced by electromagnetic fields.

Electric potential: Measured in volts, the capacity of an electric field to do work.

Electric current: Measured in amperes, the rate of movement of electrically charged particles.

Electric energy: Measured in joules, the energy made available by the flow of electrically charged particles through an electrical conductor.

Electric power: Measured in watts, the rate at which electrical energy is converted to or from another energy form such as light, heat or mechanical energy.

Electrical circuit: A network of electrical elements (such as resistors, inductors, capacitors, transmission lines, voltage sources, current sources, and switches) that has a closed loop, providing a return path for the current.

Ohm's law: The voltage across a resistor is the product of its resistance and the current flowing through it. V=IR.

Kirchhoff's current law: Also called Kirchhoff's first law or Kirchhoff's point rule. Applies the principle of the conservation of electric charge. The sum of currents flowing towards that point is equal to the sum of currents flowing away from that point. However, a charge build up can occur in a capacitor. In this case, the sum of the currents flowing into one plate of the capacitor is equal to the rate of charge accumulation.

Kirchhoff's voltage law: Also called Kirchhoff's second law or Kirchhoff's loop rule. Applies the principles of the conservation of energy. The directed sum of the electrical potential differences around a circuit must be zero.

Solder: (n.) a fusible metal alloy (often containing tin (Sn) and lead (Pb)), melted to join two metal surfaces. In our case, we will be using flux solder with a melting point below 375 degrees Fahrenheit. Flux is a compound combined with the solder to reduce the impurities in the points of contact. Solder can splash when melted, which is why we will be wearing safety goggles. Solder vapor is also corrosive and you should not lean directly over the vapors. Many plumbing applications used to use a higher concentration of lead until it was found the element could leach

into the water supply, having deleterious effects on human health. (v.) The act of using solder to join two metal surfaces.

Soldering iron: The electric or gas heated device used to heat solder and the points of contact.

Vocabulary / Definitions

Word	Definition
Electricity	Energy that is transmitted in the form of rays
Electric current	A flow of electrons
Electric power	The amount of work done by an electric current
Electric potential	Measurement of the distance from the equator
Solder (v.)	Fasten together pieces of metal
Solder (n.)	The metal compound used to fasten together two pieces of metal
Resistor	A device used to oppose the flow of electric current.
Voltage source	Device that supplies electric potential

Associated Activities

Activity: Learn to Solder

Lesson Closure

Follow with the Activity: Learn to Solder

Assessment

Lesson Summary Assessment

Ask to see the students' notebooks to ensure they have recorded the vocabulary words – design a short quiz of 5-6 questions to see if the students were listening. In addition, you may use the rubric below for scoring.

Students will be evaluated on a scale from 0 to 4 on:

_____	_____	_____
Note completeness	Attentiveness	Vocabulary quiz

Lesson Extension Activities

Activity: Learn to Solder

References

Paul, Clayton R., Fundamentals of Electric Circuit Analysis, 2001.

Serway, Raymond A. and Jewett, John W., Physics for Scientists and Engineers, 2004.

Tipler, Paul, Physics for Scientists and Engineers: Electricity, Magnetism, Light, and Elementary Modern Physics, 2004.

Contributors

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