

Important Concepts . . .

Preview Review



Science

Grade 9 TEACHER KEY

W1 - Lesson 1: Electrical Principles

Important Concepts of Grade 9 Science

W1 - Lesson 1	Electrical Principles
W1 - Lesson 2	Electrical Circuits
W1 - Lesson 3A	Energy Consumption
W1 - Lesson 3B	The Distribution of Matter in Space
W1 - Lesson 4	Objects in Space
W1 - Lesson 5	Optical and Radio Telescopes
W1 - Quiz	
W2 - Lesson 1	Physical and Chemical Properties of Materials
W2 - Lesson 2	Chemical Reactions
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W2 - Lesson 4	Naming Chemical Compounds
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W2 - Quiz	
W3 - Lesson 1	Variation
W3 - Lesson 2	Reproduction and Patterns of Inheritance
W3 - Lesson 3A	Genes and Cell Division
W3 - Lesson 3B	Organisms and Matter in their Environment
W3 - Lesson 4	Biological and Chemical Monitoring/Acids and Bases
W3 - Lesson 5	Transfer of Materials through the Air, Ground, and Water/Biological Impacts of Hazardous Chemicals
W3 - Quiz	

Materials Required

Textbook:
Science in Action 9

Science Grade 9

Version 5

Preview/Review W1 - Lesson 1 TEACHER KEY

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Preview/Review Concepts for Grade Nine Science

TEACHER KEY



***W1 - Lesson 1:
Electrical Principles***

OBJECTIVES

By the end of this lesson, you should

- identify the different types of energy and energy transformations
- investigate and evaluate the use of different chemicals, chemical concentrations, and designs for electrical storage cells
- distinguish between static and current electricity, give examples of each, and identify how current electricity is measured

GLOSSARY

battery - set of electrical cells connected together

cellular respiration - chemical reaction that occurs in cells; food (sugar) reacts with oxygen to produce energy, water, and carbon dioxide

conductor - a material through which electric charge can move easily

electrochemical cell - package of chemicals designed to produce small amounts of electricity; produces electricity from chemical reactions

ion - atom that has become electrically charged because it has lost or gained electrons

voltage - a measure of how much electrical energy a charged particle carries

Introductory Information for Teachers

Preview/Review courses are aimed mainly at students who have complete the regular course but who need to review before beginning the next grade. Other students may find Preview/Review courses useful in preparing for the new materials they will study in their next grade. No Preview/Review course is intended to replace the regular course because all cover only some important concepts from the Program of Studies for each grade.

Preview/Review materials are intended for use by teachers in one-subject and one-grade classrooms.

This Preview/Review course contains fifteen lessons in three sections. Each section has five lessons with homework. A short quiz is provided at the end of each section to test students' knowledge of the material studied. In a classroom, the course will likely be completed in three weeks.

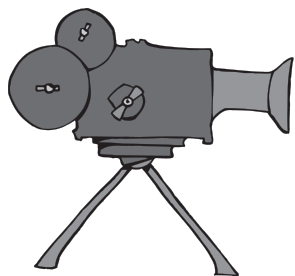
Students may attend one, two, or all three sections. Because Science has five units per grade and does not divide into three sections, Sections 1 and 2 cover two units each and Section 3 covers the final unit.

In Science, textbooks are central to Preview/Review. That is, the textbook must be read and used to complete the activities proficiently.

Textbooks required:

- Grade 7: *Science in Action 7*
- Grade 8: *Science in Action 8*
- Grade 9: *Science in Action 9*

W1 - Lesson 1: Electrical Principles



Pop, hot buttered popcorn, chocolate-covered raisins, comfortable high back seats, and the newest release on the big screen. Mmm, paradise! Could you imagine a world without movies? If energy transformations did not occur we would not have these things. Portable walkmans would not be around if batteries did not exist. This lesson will teach the science behind these devices.

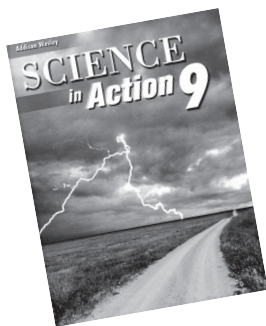


Energy Transformations

Electricity is a form of energy we use to survive and be comfortable. It allows us to watch TV, clean clothes, listen to music, and even be warm. **Energy** is the ability to do work. The most important source of energy on the earth is the sun. The sun is connected to nearly all the energy transformations on the Earth. You must know two important points about energy. Energy can only be transformed from one form to another; it can not be created or destroyed. Several different types of energy are available to do work. You will investigate other sources of energy and give examples of how the energy is converted from one form to another.

Chemical energy is stored, potential energy found in chemical bonds. One example of how chemical energy is transformed from one type of energy to another is through the breakdown of glucose, a simple sugar ($C_6H_{12}O_6$). Most living things use glucose at the cellular level to obtain energy. This process occurs in the mitochondria of the cells and is called **cellular respiration**. Chemical energy in glucose is converted to heat, mechanical energy, etc. Read pages 320 and 321 of *Science in Action 9*.

1. Identify another example of chemical energy transformed to another form such as mechanical energy.



Explosives rapidly release their chemical energy

***to provide the mechanical energy that demolishes
a building.***

Thermal energy is the total kinetic energy of particles in a substance. The warmer a substance is, the faster its particles move. Thermal energy can be converted into electrical energy through a **thermocouple**. A thermocouple uses two different metals to conduct heat. The transfer of heat between the two metals causes electricity to flow. The amount of electricity produced depends on the temperature. Read page 323 of *Science in Action 9*.

2. Identify and explain a practical application of a thermocouple.

Thermocouple cables can be hung in grain bins to help determine whether the grain is getting too hot (from too much moisture). Thermocouples are used in furnaces to regulate flow of gas.

Electrical energy is the energy of charged particles and consists of negative electrons flowing from one location to another. Household appliances and motors run on different types of electrical energy. You have probably heard of the terms AC and DC. Read the bottom of page 328 of *Science in Action 9* for more details.

3. Distinguish between AC and DC power.

Alternating current flows back and forth 60 times per second. Direct current flows in only one direction.

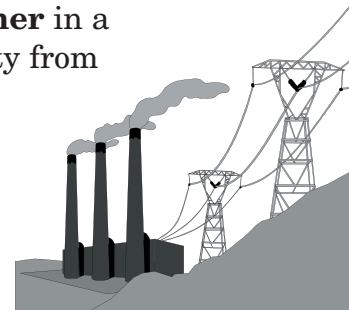
4. Give examples of devices that operate under each type of power.

A.C. – microwave oven (or any household appliance)



D.C. – computers, cell phones, calculators

Electrical energy flows through a **transformer** in a power grid. A transformer changes electricity from a high voltage power line into a low voltage current that can be used for household appliances. A very small energy loss occurs when the voltage is reduced. A sample diagram of a power grid is on page 280 of your textbook. Read page 329 of *Science in Action 9*.



5. Explain how a transformer works to reduce voltage.

An electrical wire is wrapped around in coils on two sides of an iron core. If the primary coil has more coils than the secondary coil, voltage is reduced.

6. Give an example of the voltage that a high power transmission line carries and the voltage that comes into your house.

high-power transmission line – 500 000 volts

household plug-in – 120 volts

Mechanical energy is the energy possessed by an object because of its motion or potential to move (due to gravity). People who like to golf understand the energy transformation that takes place when they lift their drivers and hit the balls. Mechanical energy of the raised club causes the ball to fly through the air and land perfectly down the middle of the fairway.

7. One activity people enjoy in the summertime is sitting around a fire pit. Make a word diagram outlining the energy transformations that take place when a person starts and enjoys a summer camp fire.



Heat energy is applied to the wood which releases chemical energy (burning) and produces heat, light, and sound energy.

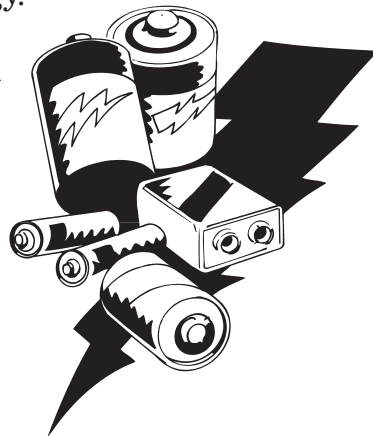
Chemical Cells



It is a beautiful sunny day and your mother asks you to walk to the corner store to buy a carton of milk. You decide to listen to some music to make the trip more enjoyable. What three things do you need to accomplish this task? A CD player, a CD, and **batteries**!

A **battery** is made up of electrochemical cells joined together. An **electrochemical cell** produces a tiny chemical reaction which converts chemical energy to electrical energy. You will study three different types of electrochemical cell; dry cells, wet cells, and rechargeable cells.

The basic parts of a cell are two electrodes of different metals and an electrolyte. An electrolyte is a liquid or paste substance that is capable of conducting electricity because it contains chemicals that form ions. A salt solution is an example of a substance that makes a good electrolyte because sodium and chloride ions form when mixed with water. A substance that makes a poor electrolyte is sugar dissolved in water. Sugar, a molecular compound, does not break apart into ions when mixed in solution.



Dry and wet cells are referred to as primary cells because the chemical reactions that occur in them cannot be reversed. Therefore, they are not reusable.

Read pages 288 and 289 of *Science in Action 9*.

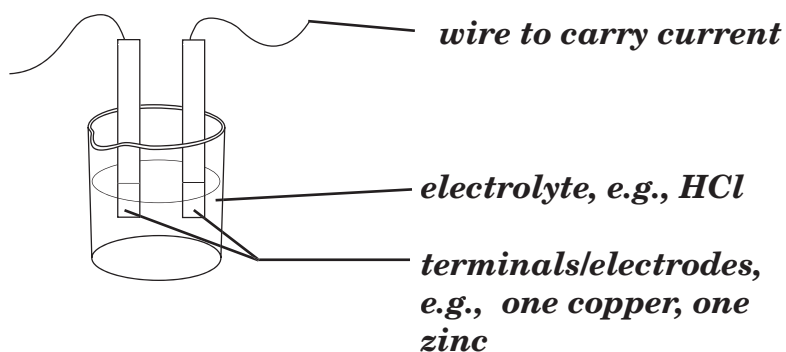
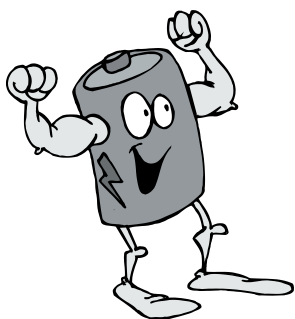
8. Electrodes can be made of many different metals. Identify two metals that could be used in this way.

Zinc, manganese, copper, silver, magnesium, etc.

9. What is the basic difference between a *wet* and a *dry* cell? Where are they most commonly used?

A wet cell uses a liquid electrolyte such as sulfuric acid and is commonly found in car batteries. A dry cell contains a paste electrolyte and is found in flashlight.

10. If you had to make a wet cell, what specific materials would you use? Draw a simple diagram of a wet cell. Be sure to label each part clearly.

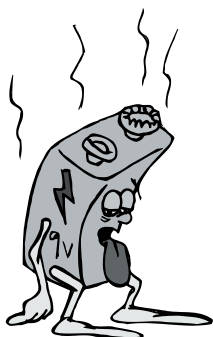


A **rechargeable cell** can be used over and over again. An external source of energy is used to build up the chemicals inside the cell that undergo the reaction to produce electricity. An example of material in this type of cell is nickel oxide and cadmium.

11. Where might you use a rechargeable battery? Why?

Rechargeable batteries may be used in a CD walkman.

To use this kind of battery is cheaper if one listens to a lot of music.

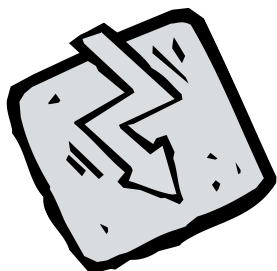


12. Can these batteries be “recharged” forever? Explain.

No. Eventually the electrodes are not reformed perfectly each time and are depleted.

Static vs. Current Electricity and its Measurement

The energy required for you to watch your favorite television show or listen to your favorite song is electricity—the energy of charged particles. Electricity can be divided into two categories: **static electricity** and **current electricity**.



The word *static* means stationary. **Static electricity** does not have a charge that flows. The charge, however, can be built up and released from time to time. Every time lightning strikes, static electricity is released. This type of electricity cannot be used to make Toaster Strudel or other breakfast goodies. For that task we need electrical current.

Electrical current is the steady flow of charged particles. This requires a source of energy and a complete path for the charged particles to follow – a **circuit**. A circuit consists of an energy source, a conductor, and a load. A **load** converts electrical energy into another form of energy. An example of a load is a light bulb that converts electricity into light and heat.

You must know several terms when dealing with electrical current. The **rate** that electrical current flows is measured in **amperes (A)**. A refrigerator runs with approximately 15 amps of electricity. Electrical current can also be measured by using a **voltmeter** that measures **voltage**. A unit of voltage is called a **volt (V)**. A wall socket that you use to plug in your microwave oven supplies 120 volts of electricity to the appliance.

Read pages 280 and 281 of *Science in Action 9*.

13. What is the rate of current flow in a 60-watt light bulb?

0.5 amps

14. Define voltage. Also identify another name for voltage.

Voltage is a measure of how much electrical energy each
charged particle carries. It is also called potential
difference.

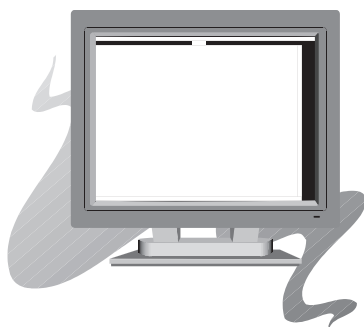
15. Explain how to connect properly a voltmeter to test a battery.

Connect the red lead to the positive terminal and the black lead to the negative terminal.

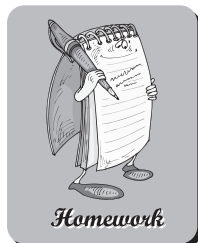
Internet Websites

The address for the website below was accurate at the time of printing.

www.gomilpitas.com/homeschooling/explore/electricity.htm



You should now have a better understanding of different types of energy and its transformations, static and current electricity, and electrical cells. To explore the topics more fully, do the following homework assignment.



Homework

16. When you go home, think about and make a list of all the items in and around your household that use batteries.

A list of items could include: watches, computers, clock radios, remote controls, toys, etc.

17. Look at various types of batteries, (such as AAA, AA, C, or D.

- a. Identify the voltage found in each.

They each have 1.5V

- b. Calculate how much voltage is necessary for you to use your television remote and your CD walkman.

Walkman - usually 2AA = 3.0V

Remote - the same

18. Perhaps you carry a portable walkman for your listening pleasure. How many energy conversions take place for you to be able to hear the music?

This answer concentrates on the sound - not all components.

Chemical → electrical → light (laser) → electrical → sound

