

Adult Basic Education
Level II Science

**Science 2014
Electricity**

Study Guide

Suggested Resources: *Discovering Science 9*

Level II Science Courses

Science 2011 Life Science

Science 2012 Physical Science

Science 2013 Chemical Science

Science 2014 Electricity

Science 2015 Earth Science



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To the Student

Introduction to Science 2014

This course is intended to help you acquire the basic knowledge of electricity that will prepare you for study in one of the Level III profiles (Degree and Technical, Business-Related College and General College).

You may/may not have to complete all ABE Level II Science courses. You are only required to complete sufficient Level II Science courses to ensure success in one of the Level III graduation profiles. For example, if you intend to complete the Degree-Technical Profile (Academic) in Level III, you may need to complete more Level II Science courses than if you intend to complete the General College Profile (General) in Level III.

Science 2014 Electricity is divided into two units. The outcomes for this course are given below. By completing the **Required Work** in this Study Guide, you will fulfill the outcomes for this course.

The first unit, ***Static Electricity and Electric Circuits***, will cover the following course outcomes:

- 1.01 Define the term “static electricity”.
- 1.02 Describe the types of charges on objects. Include: positive charge, negative charge, neutral charge.
- 1.03 Define the Laws of Electric Charges. Include: like charges repel, unlike charges attract, and charged objects attract some neutral ones.
- 1.04 Define the term “electric circuit”.
- 1.05 Describe the flow of charge in an electric circuit.
- 1.06 Describe the parts of an electric circuit.
- 1.07 Create a circuit diagram using appropriate circuit symbols. Include symbols for: lamp, cell, battery, wires, resistors, ammeter, and voltmeter.
- 1.08 Define the term “electrical resistance”.

The second unit, ***Parallel and Series Connections and Uses of Electricity***, will cover the following course outcomes:

- 2.01 Distinguish between series and parallel circuits.
- 2.02 Give examples of situations where parallel and series circuits are used.
- 2.03 Define the term “electrical energy”.
- 2.04 Define the term “electrical power”.
- 2.05 Given power rating and time, determine electrical energy used.
- 2.06 Given electrical energy used and cost of electrical energy, determine cost to consumer.
- 2.07 Recognize that electrical energy is converted to many forms.
- 2.08 Recognize that Energuide labels are used to aid consumers.
- 2.09 Describe the transfer and conversion of energy from a generating station to the home.
- 2.10 Describe different types of electrical generating stations. Include:
hydroelectric, thermal and nuclear.

To the Student

Use of Science Study Guides

Before beginning this course, ensure you have the text(s) and any other resources needed.

Your Study Guide is organized as follows:

Required Work	Suggested Resources/Notes
<p>The left-hand column guides you through the material you must complete in order to successfully complete the course. You will see three headings in this left-hand column:</p> <p>Writing: This section comprises your notes for the unit. Here you will find either written questions or references to specific questions or problems from your text. You may want to write out each question followed by the answer. This material should be checked by your instructor before moving on to the next unit.</p> <p>Laboratory: This section indicates if there is a Core Lab that should be completed for the unit. Let the instructor know in advance that you will be ready for the lab. A lab report should be submitted for each Core Lab. Your instructor will provide guidelines as to how s/he wants the report written.</p> <p>Assignment: This section indicates if there is an assignment that should be completed for the Unit. The information in the “Suggested Resources/Notes” column will indicate any additional information you need to complete the assignment. These assignments frequently relate the science content to a practical application.</p>	<p>This right-hand column provides you with information on the resources needed for the course. It also draws your attention to assignments and core labs that will be evaluated as part of your final course mark. Other notes may be included here such as helpful suggestions, safety precautions, etc.</p>

To the Student

Recommended Evaluation

Written Notes	20%
Labs/Assignments/Test(s)	30%
Final Exam (entire course)	<u>50%</u>
	100%

The overall pass mark for the course is 50%.

Note: The evaluation scheme recommended above is presented as a suggestion. Institutions may choose an alternate evaluation scheme in order to meet the individual needs of adult learners.

Unit 1: Static Electricity and Electric Circuits

Required Work	Suggested Resources/Notes
<p>Writing:</p> <p>1. Read pages 228-231 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none"> a) Define the term “static electricity”. b) The atom consists of three smaller particles. <ul style="list-style-type: none"> • Give the name and charge of each of these particles. • State where in the atom each of these particles is found. c) What is the overall charge when an atom has more protons than electrons? d) What happens to the charge on an atom when it gains electrons? e) What can happen to electrons during friction? <p>2. Read page 239 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none"> a) Using a diagram, describe the Laws of Electric Charges. b) A positively charged object is brought near another object. If the two objects repel, what is the charge on the second object? 	<p>Note: The atom and its three parts are included in Science 2013. If you have already done Science 2013, this will serve as a review.</p> <p>The Glossary on pages 502-509 may be helpful in defining terms.</p> <p>The Laws of Static Charge and The Laws of Electric Charges are the same thing.</p>

Unit 1: Static Electricity and Electric Circuits

Required Work	Suggested Resources/Notes
<p>3. Read pages 260-262 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ol style="list-style-type: none"> <li data-bbox="283 566 1046 671">a) What is meant by the term “electric circuit”? Give an example of where you would expect to find an electric circuit. <li data-bbox="283 713 1046 745">b) Describe the four basic parts of an electric circuit. <li data-bbox="283 787 1046 819">c) What is the purpose of a circuit diagram? <li data-bbox="283 861 1046 1210">d) Draw and label each of the following circuit symbols: <ul style="list-style-type: none"> <li data-bbox="381 903 638 935">• conducting wire <li data-bbox="381 946 638 977">• cell <li data-bbox="381 988 638 1020">• battery <li data-bbox="381 1030 638 1062">• light bulb <li data-bbox="381 1072 638 1104">• open switch <li data-bbox="381 1115 638 1146">• closed switch <li data-bbox="381 1157 638 1189">• voltmeter <li data-bbox="381 1199 638 1231">• ammeter 	<p>A voltmeter is a device that measures the voltage in an electrical circuit.</p> <p>An ammeter is a device that measures the current in an electric circuit.</p>
<p>4. Read page 270 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ol style="list-style-type: none"> <li data-bbox="283 1400 1046 1431">a) Define the term “electrical resistance”. <li data-bbox="283 1474 1046 1537">b) How can electrical resistance be compared to the flow of cars on a busy highway? 	<p>The Glossary on pages 502-509 may be helpful in defining terms.</p>

Unit 1: Static Electricity and Electric Circuits

Required Work	Suggested Resources/Notes
<p>Laboratory 1</p> <p>Read <u>7-1A: Detecting Static Charge</u> on page 229 of <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none">a) Record all observations required in the “What to Do” section.b) How did touching a charged electroscope with your finger affect the leaves?c) Explain what you think might have happened to this charge.	If your college laboratory does not have an electroscope, your instructor can help you make one.

Unit 2: Parallel and Series Connections and Uses of Electricity

Required Work	Suggested Resources/Notes
<p>Writing:</p>	
<p>1. Read pages 286-290 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ol style="list-style-type: none"> <li data-bbox="290 671 1041 705">a) Briefly explain a series circuit using a simple diagram. <li data-bbox="290 745 1041 819">b) Give an example of a situation where a series circuit is commonly used in everyday life. 	<p>See Figure 9.4 on page 288 of the text.</p>
<p>2. Read pages 290-293 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ol style="list-style-type: none"> <li data-bbox="290 994 1041 1068">a) Briefly explain a parallel circuit using a simple diagram. <li data-bbox="290 1108 1041 1182">b) Give an example of a situation where a parallel circuit is commonly used in everyday life. 	<p>See Figure 9.7 on page 290 of the text.</p>
<p>3. Read page 306 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ol style="list-style-type: none"> <li data-bbox="290 1366 1041 1400">a) Define the term “electrical power”. <li data-bbox="290 1440 1041 1474">b) What unit is used to measure electrical power? 	<p>The Glossary on pages 502-509 may be helpful in defining terms.</p>
<p>4. Read pages 314-317 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ol style="list-style-type: none"> <li data-bbox="290 1628 1041 1702">a) List three forms of energy that can be produced from the conversion of electrical energy. <li data-bbox="290 1742 1041 1795">b) Include an example of a device that uses each form of energy listed in item a) above. 	

Unit 2: Parallel and Series Connections and Uses of Electricity

Required Work	Suggested Resources/Notes
<p>Assignment 1</p> <p>Read <u>9-2B: The Cost of Electricity</u> on page 310 of <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none"> a) Copy the data table into your notebook or on loose-leaf paper. Be sure to give your data table a title. b) Calculate the energy consumed, in kilowatt-hours, by each of the appliances. Be sure to change the power in watts to kilowatts. c) Using the cost of electricity as 9.6 cents per kilowatt-hour, calculate the daily cost of each appliance in cents and in dollars. d) Which appliance had the greatest daily cost? e) Considering all the electrical devices in your home, state which ones you think would have the greatest daily cost. <p>4. Read page 320 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none"> a) What are the two costs associated with electrical devices in your home? b) What is an EnerGuide label, and what information does it tell consumers? c) Page 323 contains a visual of an EnerGuide label on a stove. Describe how its energy efficiency compares to other stoves. 	<p>This assignment is to be submitted to your instructor to be evaluated as part of your final mark for this course.</p> <p>The following will help you do your calculations:</p> <p>There are 1000W in 1 kW. To change watts to kilowatts, you divide the number of watts by 1000. For example, $14,000\text{W}/1000 = 14\text{kW}$.</p> <p>To calculate kW-h, multiply the kW by number of hours. For example, $0.5\text{kW} \times 2\text{h} = 1\text{kW-h}$.</p> <p>Energy efficiency is the percentage of energy input that is converted to a useful form. See page 316 for a more detailed explanation if required.</p>

Unit 2: Parallel and Series Connections and Uses of Electricity

Required Work	Suggested Resources/Notes
<p>5. Read pages 324-328 in <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none">a) What is a generator?b) List and briefly explain three types of generating stations.c) Describe the steps involved in the generation and transfer of electrical energy from a generating station to the home.	Note: it is unnecessary to go into great detail for c). You can create a diagram such as an illustration or flowchart including the steps.
<p>Laboratory 2</p> <p>Read <u>9-4A: Generating an Electric Current</u> on page 325 of <i>Discovering Science 9</i>, and then complete the following items:</p> <ul style="list-style-type: none">a) Follow the procedure as outlined in the “What to Do” section. Record all required observations.b) Describe how electricity and magnetism are related.c) How does the magnet’s speed affect the electric current produced?d) How does the position of the coil or magnet affect the electric current produced?e) What combination of conditions generates the largest current?	