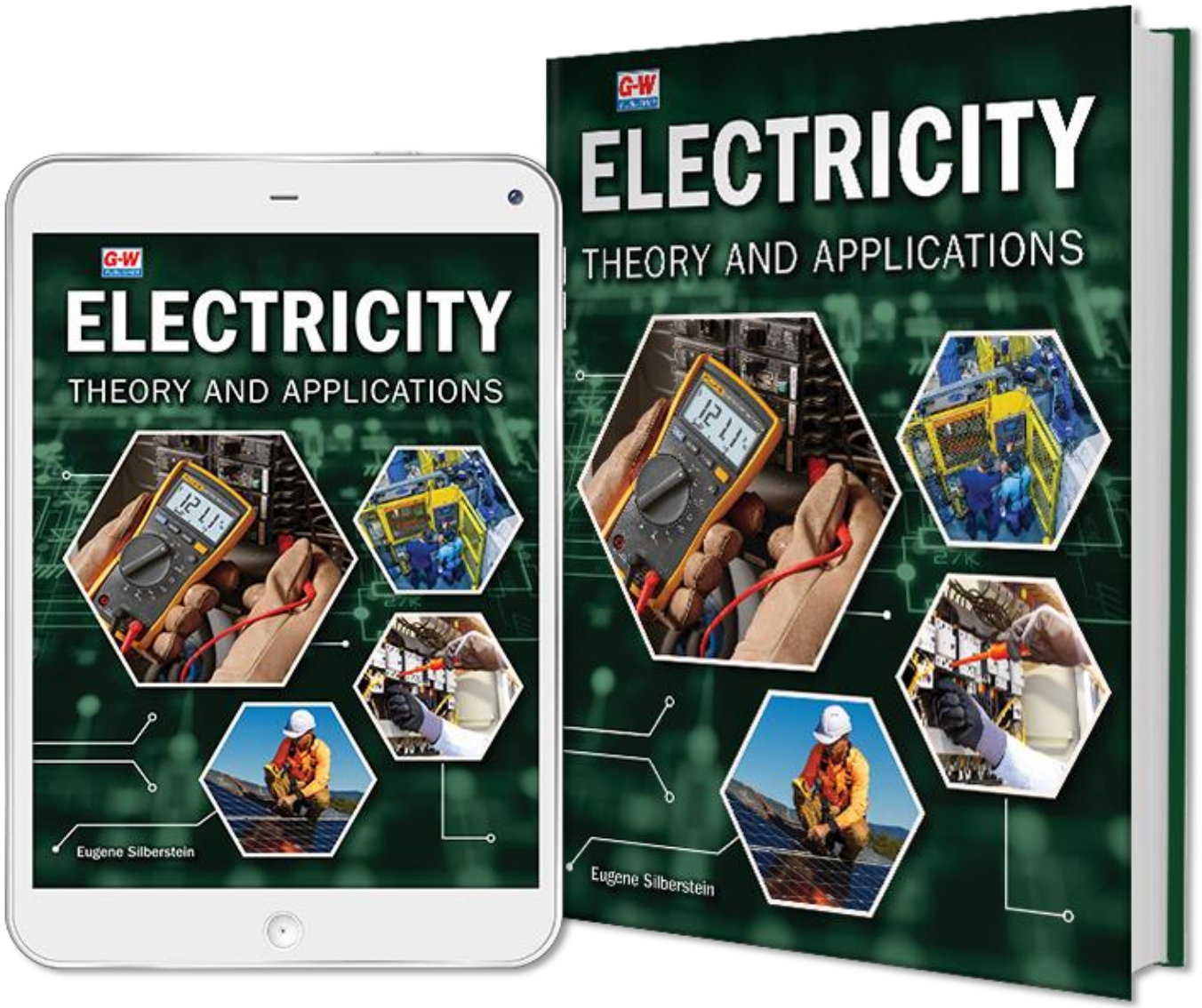

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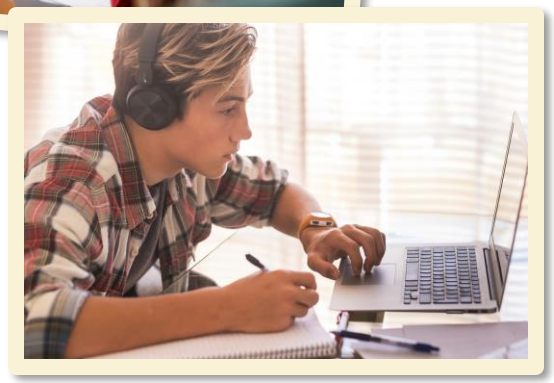

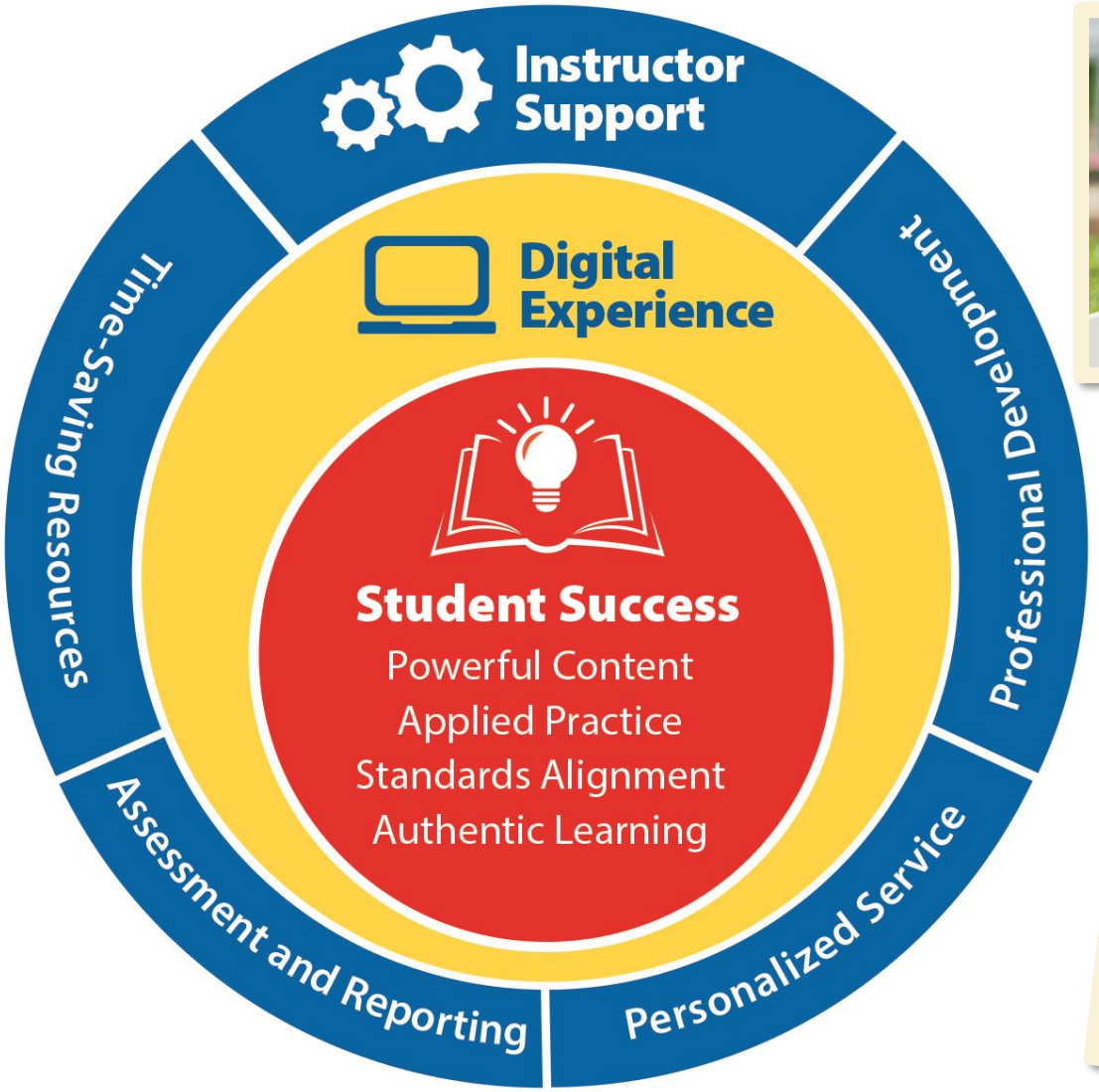

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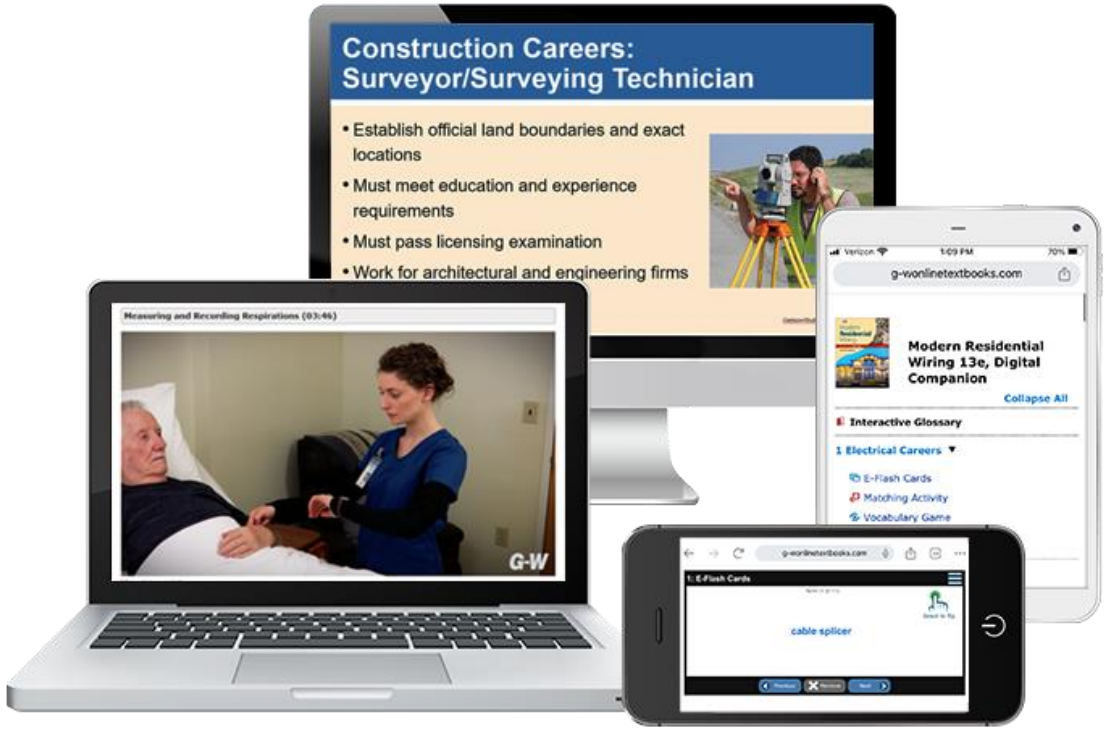

- ✓ Prepare for class
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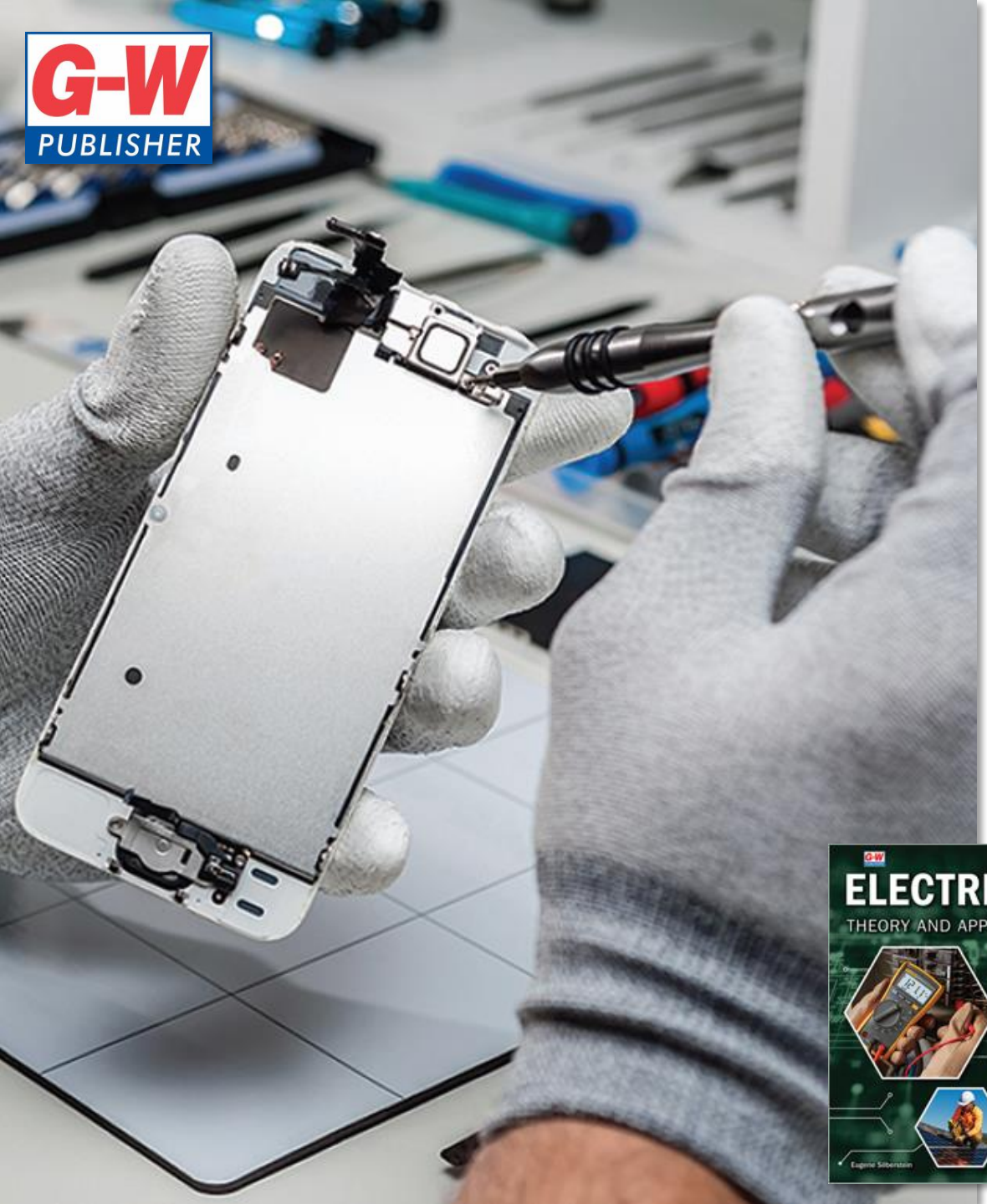

Electricity: Theory and Applications, 1e: Lesson Plan

Instructor: *Date:*
Course: *Unit:*

Chapter 12: Combination Circuits

Learning Outcomes

- 12.1 Define and identify a combination circuit.
- 12.2 Determine the order in which series and parallel circuit rules are applied to combination circuits.
- 12.3 Determine the power consumption of combination circuit components and total current and power.
- 12.4 Determine combination switch arrangements.

Sparking Discussion

- Would you consider the hotel key card shown here as part of a combination circuit? Why or why not?

Instructional Resources

- Textbook/eBook: Chapter 12
- Instructor Resources: Chapter 12 Instructor's Presentation for PowerPoint
- Instructor Resources: Chapter 12 Textbook Answer Key
- Instructor Resources: Chapter 12 Lab Workbook Answer Key
- Instructor Resources: Chapter 12 Animation Assessment Question Answer Key
- Other instructional resource:

Resources for Practice and Application

- Digital Companion: Interactive Activities
- Digital Companion: E-Flash Cards
- Textbook/eBook: Chapter 12 Review and Assessment, Measuring Your Potential
- Textbook/eBook: Chapter 12 Review and Assessment, Plug-In
- Textbook/eBook: Chapter 12 Review and Assessment, Making the Connection
- Lab Workbook: Chapter 12–Chapter Review
- Lab Workbook: Chapter 12–Lab Activity 12A: Building and Analyzing Combination Circuits
- Animation Library
  - Series-Parallel Circuit
  - Identifying Combination Circuits
  - Evaluating Combination Circuits
  - Calculating Current Flow and Power Consumption in a Combination Circuit
- Other resource:

Assessment

- Assessment Suite
  - Chapter 12 Pretest
  - Chapter 12 Posttest
  - Chapter 12 Exam
- Animation Assessment Handouts

Lesson Plans, Assessments, and Answer Keys

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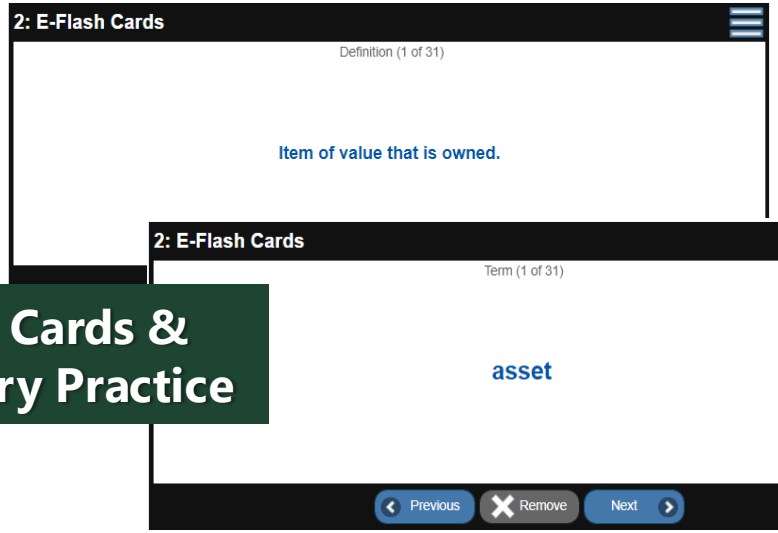
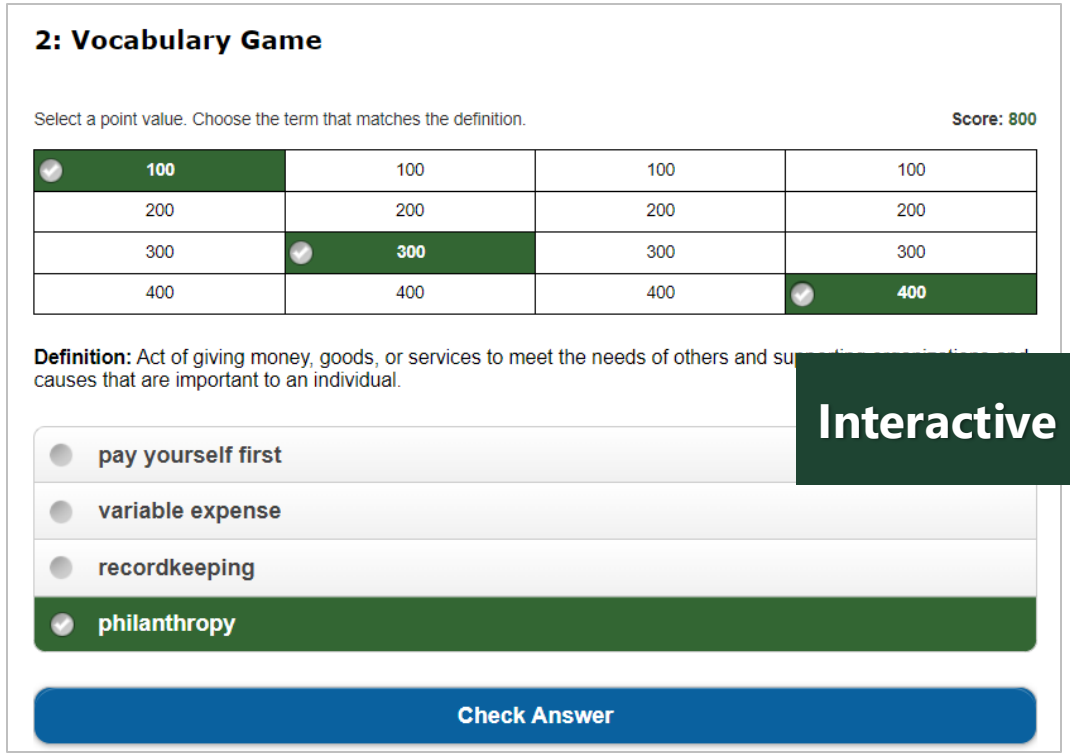
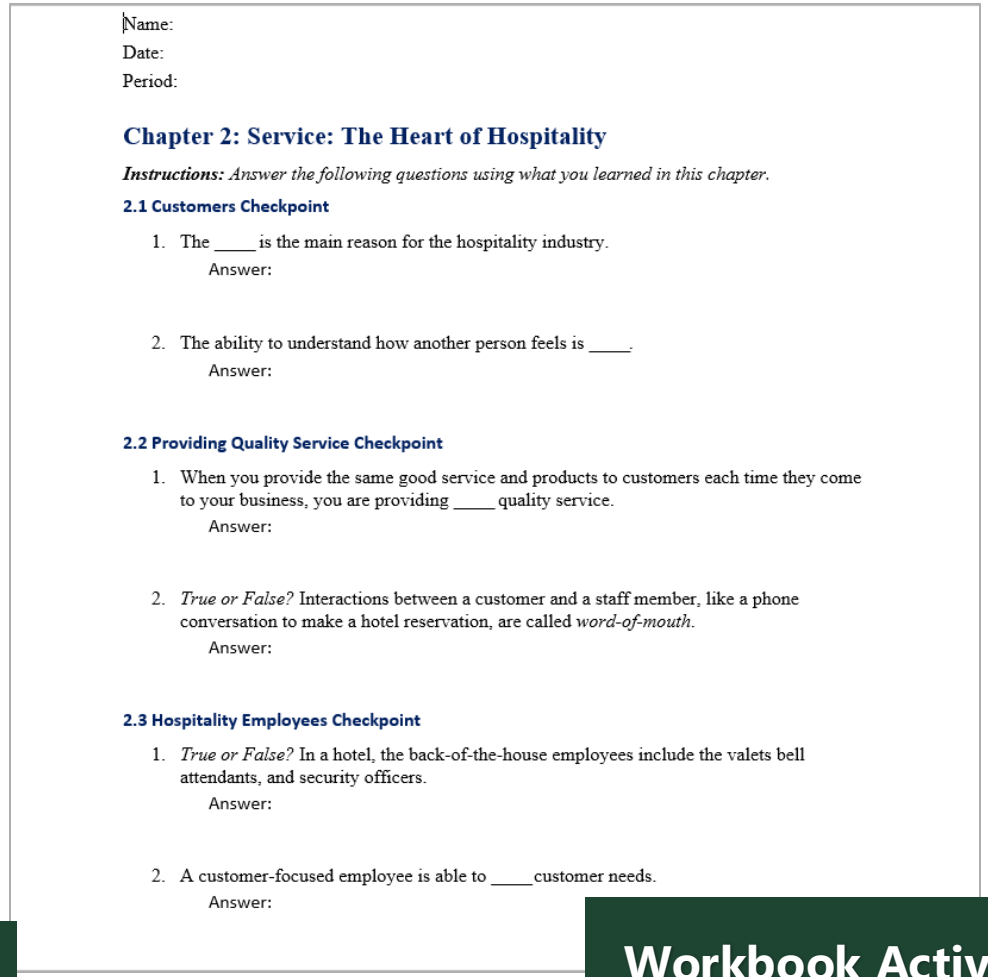


E-Flash Cards & Vocabulary Practice



Interactive Activities



Name:
Date:
Period:

Chapter 2: Service: The Heart of Hospitality

Instructions: *Answer the following questions using what you learned in this chapter.*

2.1 Customers Checkpoint

1. The ____ is the main reason for the hospitality industry.
   Answer:

2. The ability to understand how another person feels is ____.
   Answer:

2.2 Providing Quality Service Checkpoint

1. When you provide the same good service and products to customers each time they come to your business, you are providing ____ quality service.
   Answer:

2. *True or False?* Interactions between a customer and a staff member, like a phone conversation to make a hotel reservation, are called *word-of-mouth*.
   Answer:

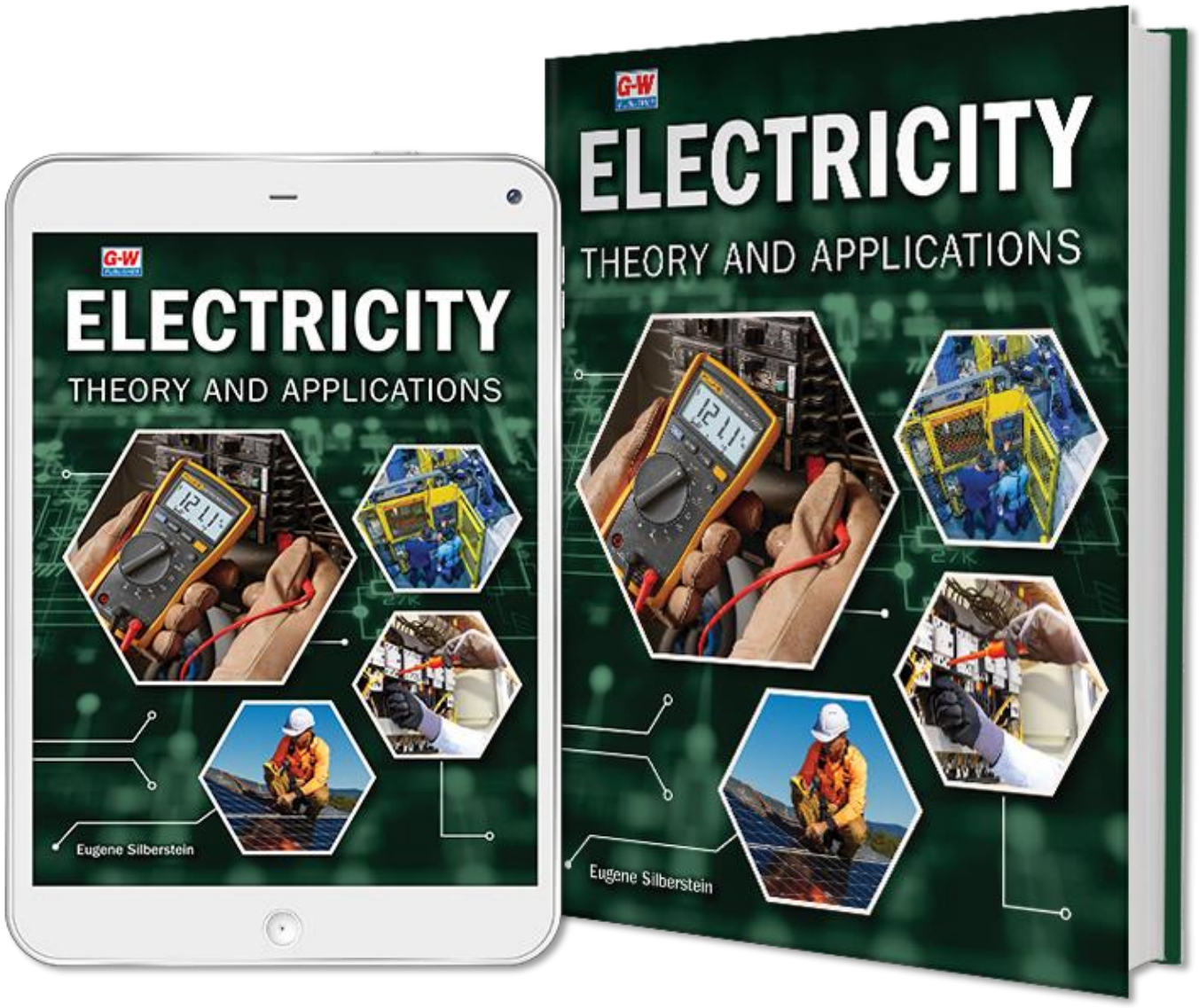
2.3 Hospitality Employees Checkpoint

1. *True or False?* In a hotel, the back-of-the-house employees include the valets bell attendants, and security officers.
   Answer:

2. A customer-focused employee is able to ____customer needs.
   Answer:

Workbook Activities

Integrate G-W Digital Resources



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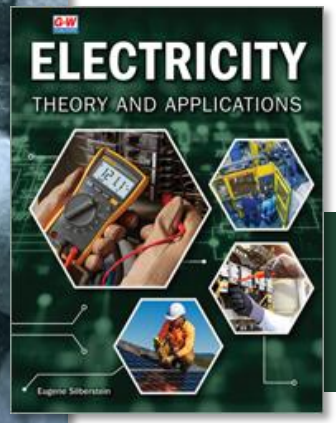
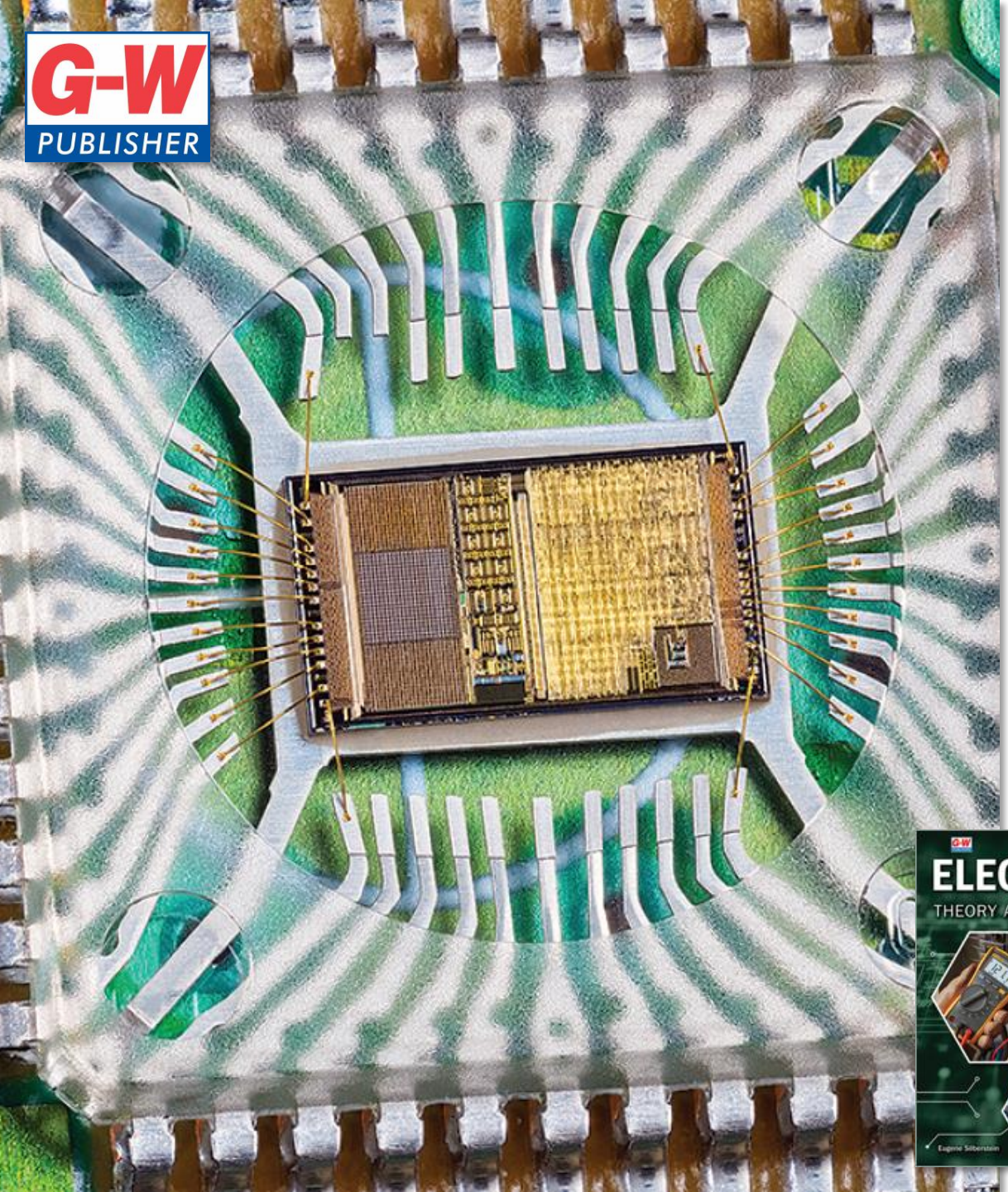
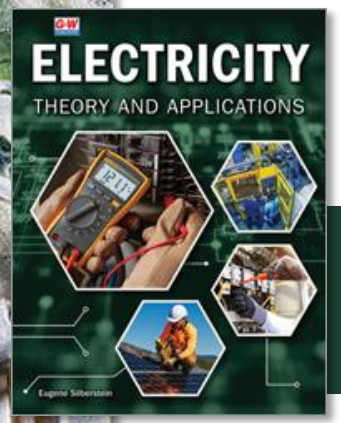


Student Textbook





CHAPTER

1 Introduction to Electricity

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SPARKING DISCUSSION

Considering all the possible technologies used to produce electricity, what is the best combination considering economics and sustainabilty?

LEARNING OUTCOMES

After completing this chapter, you will be able to:

1.1 Describe how earlier inventions and innovations helped to improve the predictability of electricity.

1.2 List factors that will affect the future of the electrical industry and explain the challenges related to each.

TECHNICAL TERMS

biofuel
efficiency
energy density
flow-limited
nonrenewable energy
renewable energy
sustainable energy

Chapter-Opening Materials

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Shedding Light

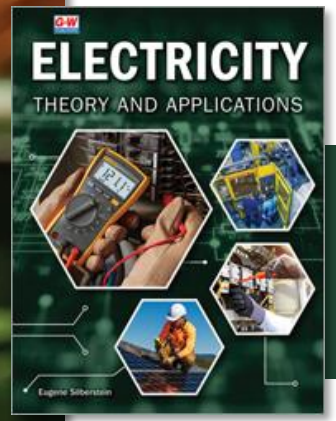
We can compare voltage, or potential difference in charges, with velocity. You and your family are driving in a car traveling at 60 miles per hour. The car and its passengers, moving at a relatively high velocity, can be thought of as a point of greater electrical charge. If you reach out your hand and pat the per
you, little energy is exchanged betw
passenger because you are both mo
velocity (comparable to having the s
charge). However, if a person is stan
of the road (comparable to a point o
charge) and you extend your hand o
to pat that stationary person, a large
will be exchanged due to the differe
(comparable to a difference in elect
Needless to say, the person standin
road will not be very happy.

Know the Code

In most instances, electrical services and systems (power supplies) are required by the *NEC* to be grounded. *NEC Sections 250.20*, *250.21*, and *250.22* list situations in which the grounding rules are modified to allow ungrounded installations. Some exceptions involve control transformers, cranes over combustible materials, circuits in parts of health care facilities, and larger ungrounded delta systems in industrial installations.

Safety Alert

Use only double-insulated two-prong or properly grounded three-prong power tools that are connected to properly grounded power supplies and circuits. Double-insulated power tools have no exposed metal parts that can present a shock hazard.



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Example 7-4

Calculate the value of the following expression.

$$2 \times (5 + 2)^2 + (2 + 1)^2 - 12 \div 3 = ?$$

✓ Solution

The first step is to solve the expressions appearing within the parentheses:

$$2 \times (5 + 2)^2 + (2 + 1)^2 - 12 \div 3 = ?$$

$$2 \times (7)^2 + (3)^2 - 12 \div 3 = ?$$

Next, the exponents are evaluated:

$$2 \times (7)^2 + (3)^2 - 12 \div 3 = ?$$

$$2 \times (49) + (9) - 12 \div 3 = ?$$

Then, perform the multiplication and division operations, in order, from left to right:

$$(2 \times 49) + 9 - (12 \div 3) = ?$$

$$(98) + 9 - (4) = ?$$

Finally, the addition and subtraction operations are performed from left to right:

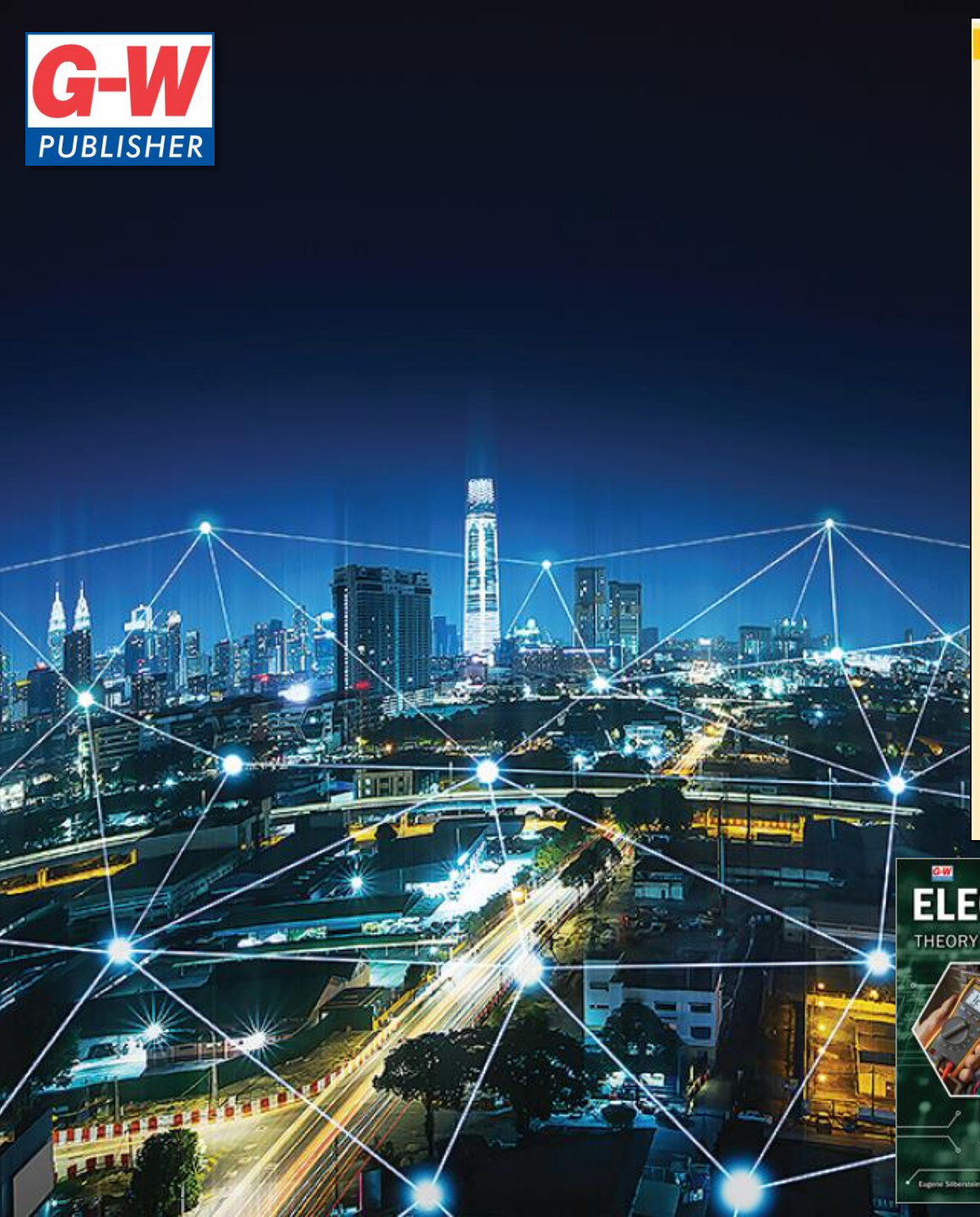
$$98 + 9 - 4 = 103$$

Now It's Your Turn 7-4

Calculate the following expression.

$$5 \times 6 - 4 + 9 - 6 \div 2 = ?$$

Special Features



Math Sidebar

When the denominator of a fraction is another fraction, the denominator of the fraction in the denominator becomes the numerator in the main fraction. Consider the expression 1 divided by 1/4. In this case, the 1/4 is the denominator of the fraction, and 4 is the denominator of this fraction. The 4 moves to the numerator, making the result 4.

$$\frac{1}{1/4} = \frac{1 \times 4}{1} = \frac{4}{1} = 4$$

Expressed verbally, the expression is asking how many times one-quarter goes into one or, for a more graphic example, how many quarters are there in a dollar? The answer to this question is four.

In another example, two divided by 1/5 becomes 10. The five moves up to the numerator so the expression becomes 2 × 5 divided by 1, which equals 10.

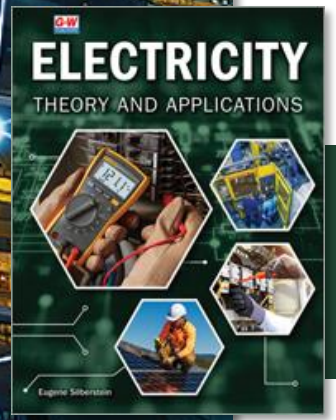
Another way to manipulate expressions such as these is to change the operation of division into a multiplication operation. When changing division to multiplication, the inverse of the expression in the denominator, the dividend, is used. The expression 2 ÷ (1/5) can, therefore, be written as 2 × (5/1), which is 10.

$$2 \div \frac{1}{5} = \frac{2}{1} \div \frac{1}{5}$$

$$\frac{2}{1} \times \frac{5}{1} = \frac{10}{1}$$

$$\frac{10}{1} = 10$$

Whenever possible, avoid multiple division operations, such as dividing a fraction by another fraction, in a single calculation. Dividing by a fraction is equal to multiplying by the reciprocal of the fraction. Dividing 1/2 by 1/8 is the same as multiplying 1/2 and 8/1 together.

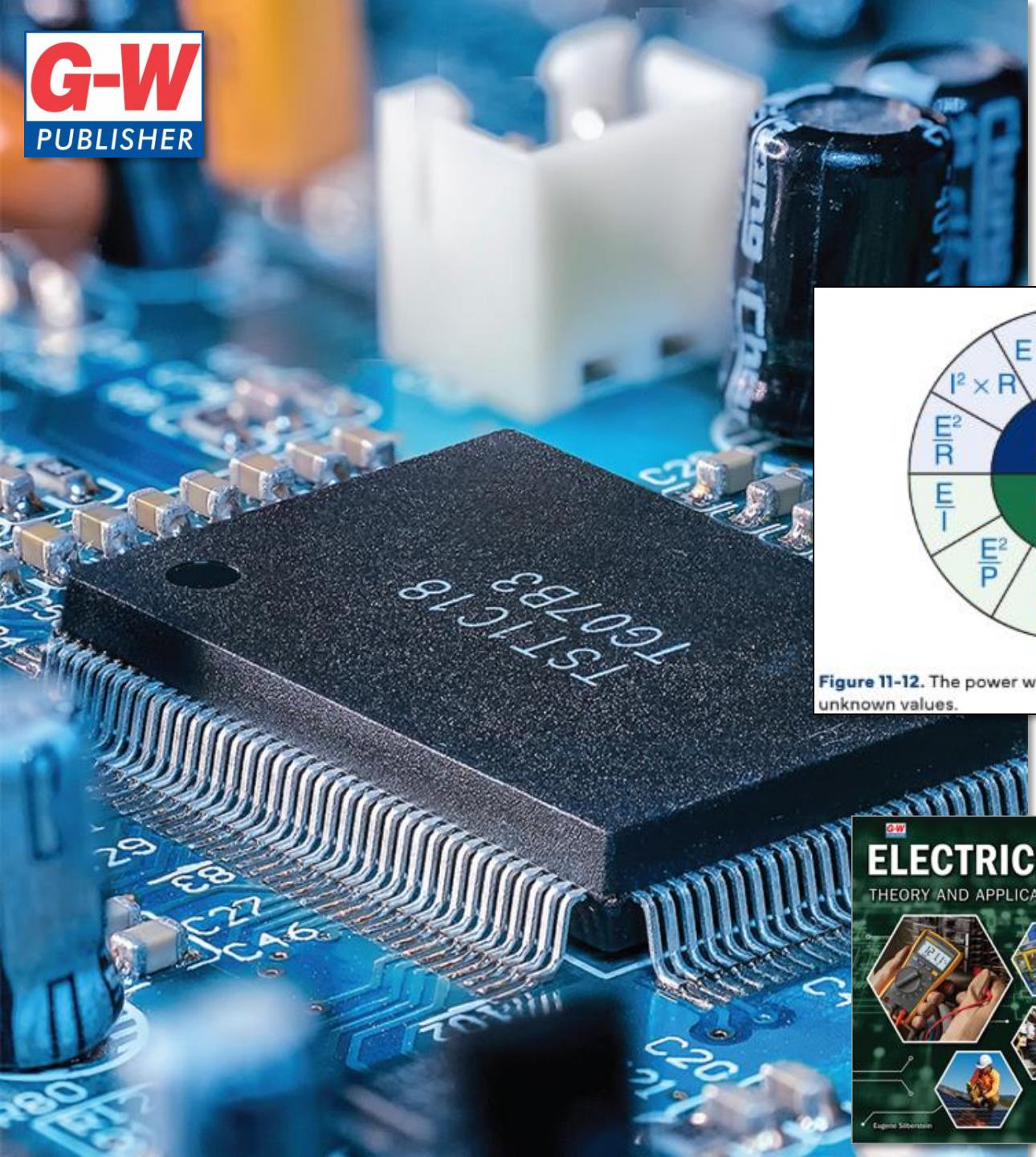


Procedure 21-1

Testing for Open Transformer Windings

1. Turn the digital multimeter on and set the instrument to measure ohms.
2. Check that the transformer being tested is de-energized, lockout/tagout procedures have been followed, and the connection leads are all disconnected. On a good transformer, there should be measurable resistance across both the primary and secondary winding, **Figure 21-34**. If the resistance reading across either the primary or secondary winding indicates OL on the meter's display, the winding is open, **Figure 21-35**.
3. Verify that any transformer-mounted overcurrent protective devices (OCPDs) are not tripped or open.
4. If an OCPD is open, determine the cause for the condition, remedy the problem, and then replace or reset the OCPD. Follow *NEC* requirements for sizing transformer OCPDs.
5. Once this has been done, retest the transformer.

Special Features



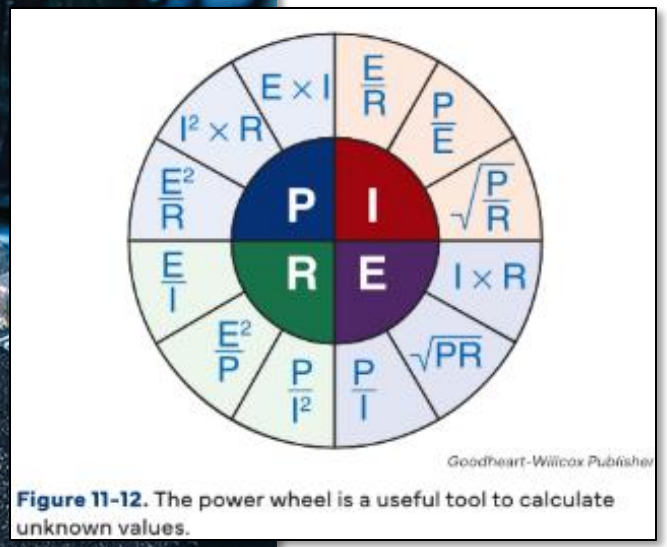


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Figure 11-12. The power wheel is a useful tool to calculate unknown values.

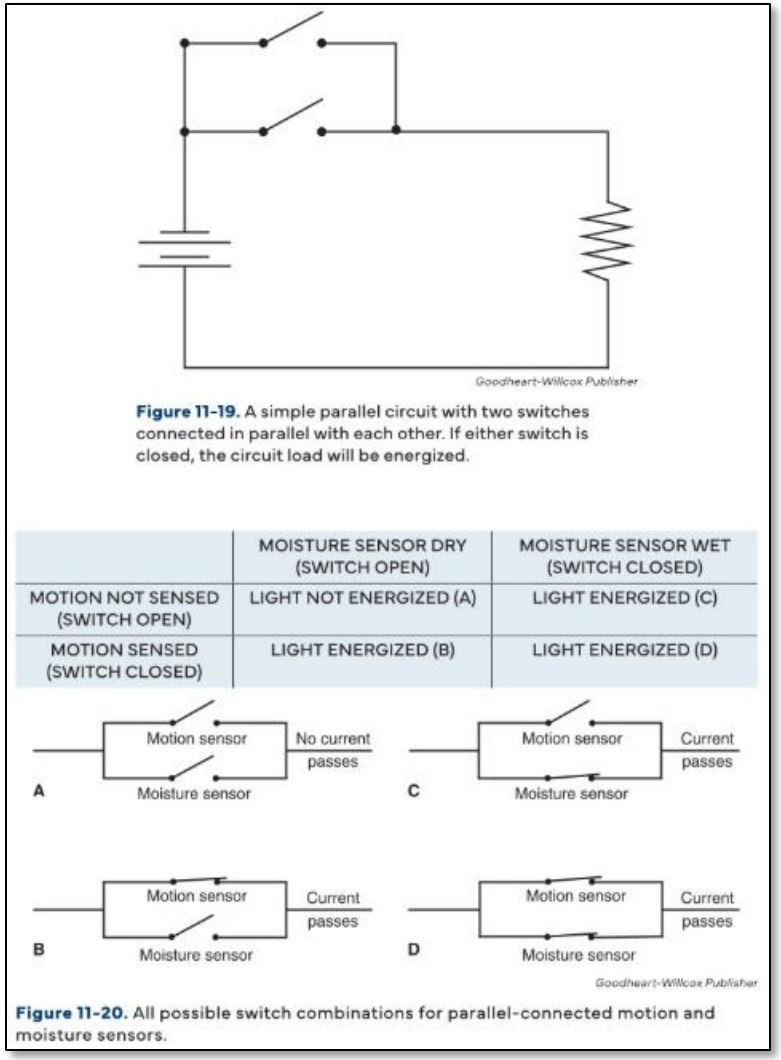

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Figure 11-19. A simple parallel circuit with two switches connected in parallel with each other. If either switch is closed, the circuit load will be energized.

	MOISTURE SENSOR DRY (SWITCH OPEN)	MOISTURE SENSOR WET (SWITCH CLOSED)
MOTION NOT SENSED (SWITCH OPEN)	LIGHT NOT ENERGIZED (A)	LIGHT ENERGIZED (C)
MOTION SENSED (SWITCH CLOSED)	LIGHT ENERGIZED (B)	LIGHT ENERGIZED (D)

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Figure 11-20. All possible switch combinations for parallel-connected motion and moisture sensors.

Illustrations and Photos

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CHAPTER 11 REVIEW

Summary

- In a parallel circuit there are multiple paths for electric current to follow. (11.1)
- Each path in a parallel circuit is called a branch. (11.1)
- A break in one branch of a parallel circuit will not affect current from flowing through the remainder of the circuit. (11.1)
- The total circuit current is the sum of the current flows through each individual branch. (11.2)
- The amount of current entering a node must equal the amount of current leaving the node. (11.2)
- The voltage supplied to a parallel circuit is the same voltage supplied to all branches in the circuit. (11.2)
- The total resistance in a parallel circuit is always lower than the lowest resistance in the circuit. (11.2)
- The power consumption of a parallel circuit increases as the circuit resistance decreases. (11.3)
- Multiple switches are sometimes connected in parallel with each other. (11.4)

Review Questions

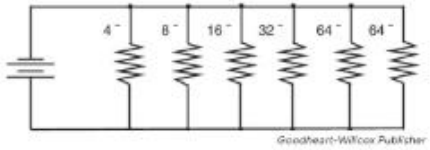
Use the information in the chapter to answer the following questions.

Measuring Your Potential

1. In a parallel circuit, the voltage measured across any branch will be _____. (11.1)
   A. equal to the voltage measured across the largest resistance
   B. equal to the voltage supplied across the entire circuit
   C. equal to the voltage measured across the lowest branch resistance
   D. always less than resistance value resistance
2. If four resistances with values of 5 Ω, 10 Ω, 20 Ω, and 20 Ω are wired in parallel with each other, the total resistance will be equal to _____. (11.2)
   A. 2.0 Ω
   B. 2.5 Ω
   C. 3.0 Ω
   D. 4.0 Ω
3. If four 20 Ω resistances are wired in parallel with each other, the total resistance will be equal to _____. (11.2)
   A. 5 Ω
   B. 10 Ω
   C. 15 Ω
   D. 20 Ω
4. Two 100 Ω resistances wired in parallel with each other will have the same resistance as two _____ with each other. (11.2)
   A. 10 Ω resistances wired in series
   B. 15 Ω resistances wired in parallel
   C. 25 Ω resistances wired in series
   D. 40 Ω resistances wired in parallel
5. A 60-V parallel circuit with one 20-Ω load and one 5-Ω load will operate with a total resistance of _____. (11.2)
   A. 15 Ω and a current of 4 A
   B. 15 Ω and a current of 15 A
   C. 4 Ω and a current of 4 A
   D. 4 Ω and a current of 15 A
6. What is the power consumption of a 50-V parallel circuit with one 20-Ω load and one 5-Ω load? (11.3)
   A. 200 W
   B. 475 W
   C. 625 W
   D. 850 W
7. In a parallel circuit with two switches wired in parallel with each other, power will not pass to the load when _____. (11.4)
   A. the switch closest to the power supply is closed
   B. the switch closest to the load is closed
   C. both switches are in the open position
   D. both switches are in the closed position

Plug-In

1. Determine the total resistance for the following circuit. (11.2)



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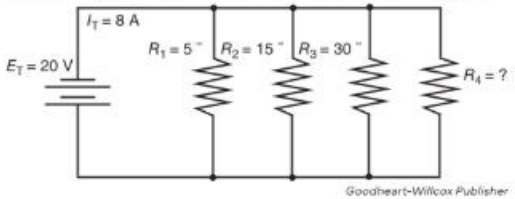
   A. 2 Ω
   B. 2.5 Ω
   C. 7 Ω
   D. 8.5 Ω
2. The power consumption of a 100-V parallel circuit with one 10-Ω load and one 40-Ω load is the same as the power consumption of a 50-V circuit with two _____ loads wired in parallel with each other. (11.3)
   A. 4-Ω
   B. 8-Ω
   C. 12-Ω
   D. 15-Ω

Refer to the following circuit to answer questions 3 through 5.



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3. The resistance of R_4 is _____. (11.2)
   A. 5 Ω
   B. 6 Ω
   C. 8 Ω
   D. 10 Ω
4. The I through R_1 equals _____. (11.2)
   A. 3 A
   B. 4 A
   C. 6 A
   D. 8 A
5. The total power of the circuit is _____. (11.3)
   A. 160 W
   B. 180 W
   C. 200 W
   D. 208 W

Making the Connection

1. Two lighting fixtures are wired in parallel with each other and each has its own switch. Both lights are illuminated. If one fixture is switched off the brightness of the other fixture will increase. Do you agree or disagree with this statement? Be able to provide support for your answer. (11.4)
2. As the diameter of a conductor increases, the resistance per unit foot of the conductor will decrease. Do you agree or disagree with this statement? Be able to provide support for your answer. (11.2)

End-of-Chapter Content

Name _____ Date _____ Class _____

CHAPTER 12 Combination Circuits

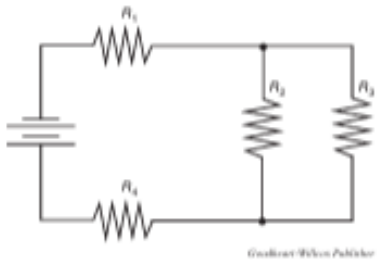
Chapter Review

Carefully study the chapter and then answer the following questions.

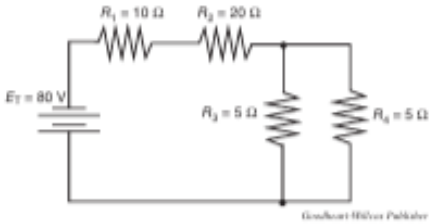
1. _____ Combination circuits are also referred to as _____ circuits. (12.1)
   A. series-parallel
   B. parallel
   C. series
   D. direct-current

2. _____ *True or False?* By asking yourself the question "Can power be supplied to any other circuit load without passing through this load?" will help determine whether a circuit is a combination circuit. (12.1)

3. _____ The following diagram is an example of a(n) _____ circuit. (12.1)
   A. series
   B. parallel
   C. combination
   D. alternating-current



Use the following circuit to answer questions 4 and 5.



4. _____ What is the total current flow for the circuit shown? (Round your answer to the nearest hundredth.) (12.2)
   A. 0.40 A
   B. 2.00 A
   C. 2.46 A
   D. 3.25 A

Name _____ Date _____ Class _____

Lab Activity 12A

Building and Analyzing Combination Circuits

Learning Outcomes

After completing this lab activity, you will be able to:

- Demonstrate the order in which series and parallel circuit rules are applied to combination circuits.
- Compute and analyze the power consumption of individual components in a combination circuit.

Introduction

In this lab activity, you will construct a combination circuit on a breadboard using a 9 V dc power supply, resistors, and LEDs. By applying series and parallel circuit rules in the correct order, you will calculate and verify the circuit parameters such as voltage, current, resistance, and power consumption. This exercise provides practical experience in analyzing more complex electrical circuits.

Text Reference

Chapter 12, *Combination Circuits*

Equipment

The following tools and equipment are needed to perform these activities:

- Breadboard
- 9 V dc power supply
- Digital multimeter (DMM)
- Resistors (values provided below)
- LEDs or small light bulbs as loads
- Jumper wires
- Safety glasses or safety goggles

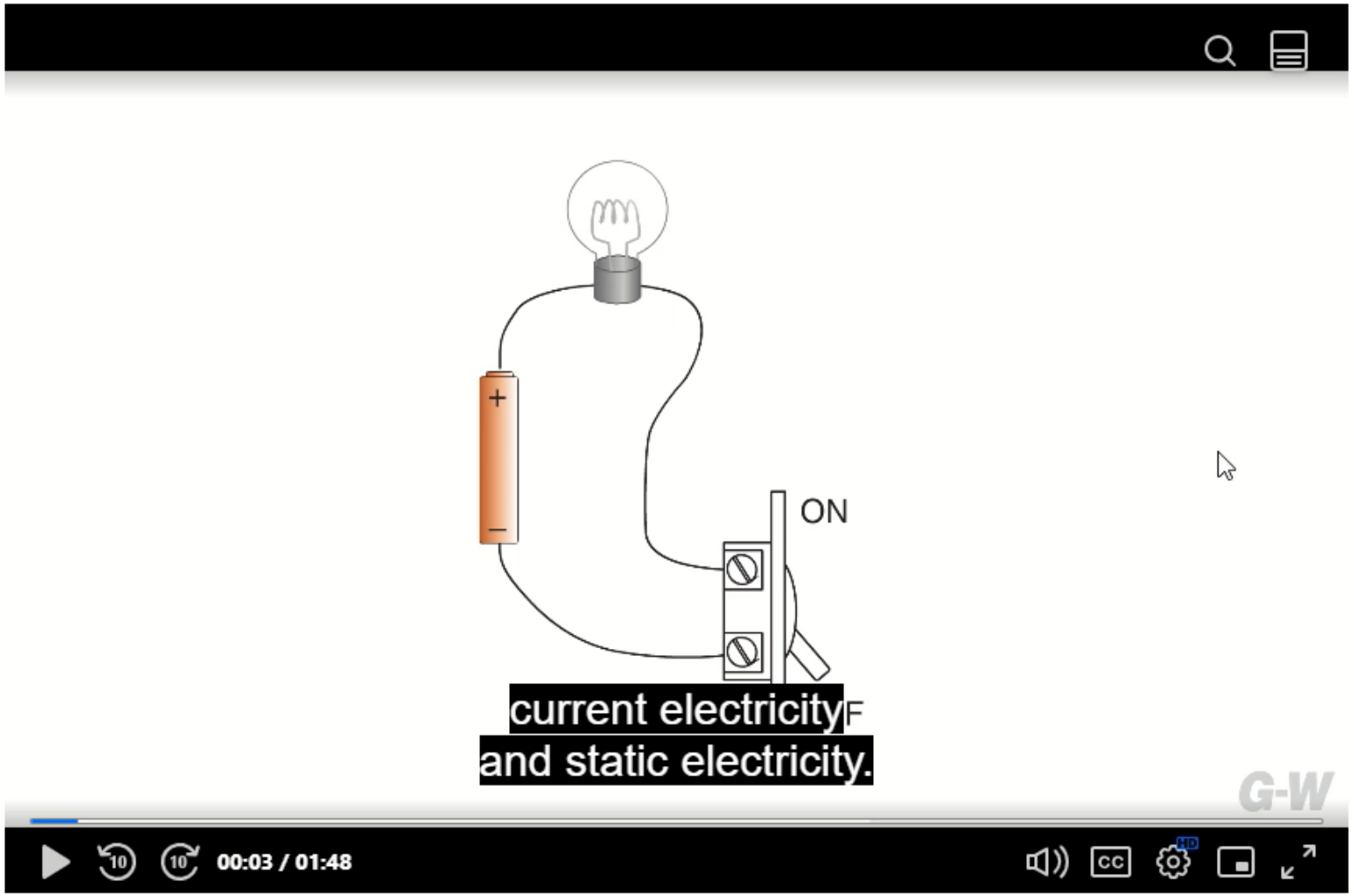
Safety Review

Follow all safety procedures outlined by your instructor and in the manufacturer's instructions. Additionally, keep these safety tips in mind:

- Wear personal protective equipment.
- Double-check your circuit connections.
- Before measuring, make sure the multimeter is set to the correct mode (current, voltage, or resistance).
- Avoid touching live components or wires while the circuit is powered on.
- Ensure that all wires and components are properly insulated.
- Always disconnect the power before adjusting the circuit or adding/removing components.
- Do not exceed the recommended power rating for resistors or other components.
- Keep your work area dry.
- Always turn off and disconnect the power supply after completing the lab activity.
- Always follow instructions and ask for help if you are unsure about any aspect of the lab.

Lab Workbook

Current, Electricity, and Static Electricity



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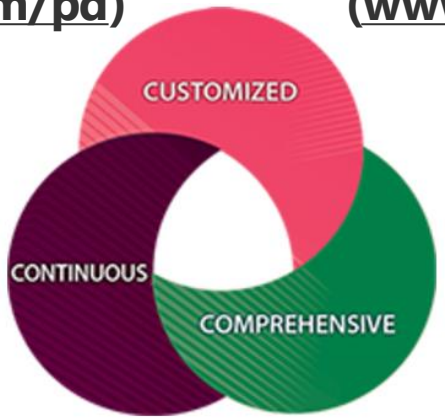

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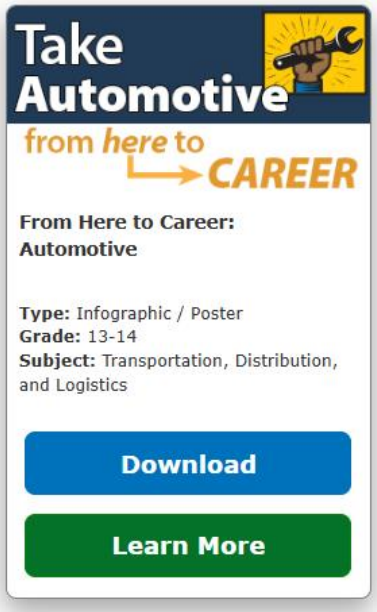

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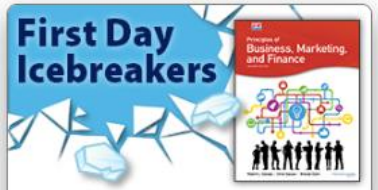

Snap, Clap, Pop: Business, Marketing, Finance

Type: Downloadable Activities
Grade: 9-12
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