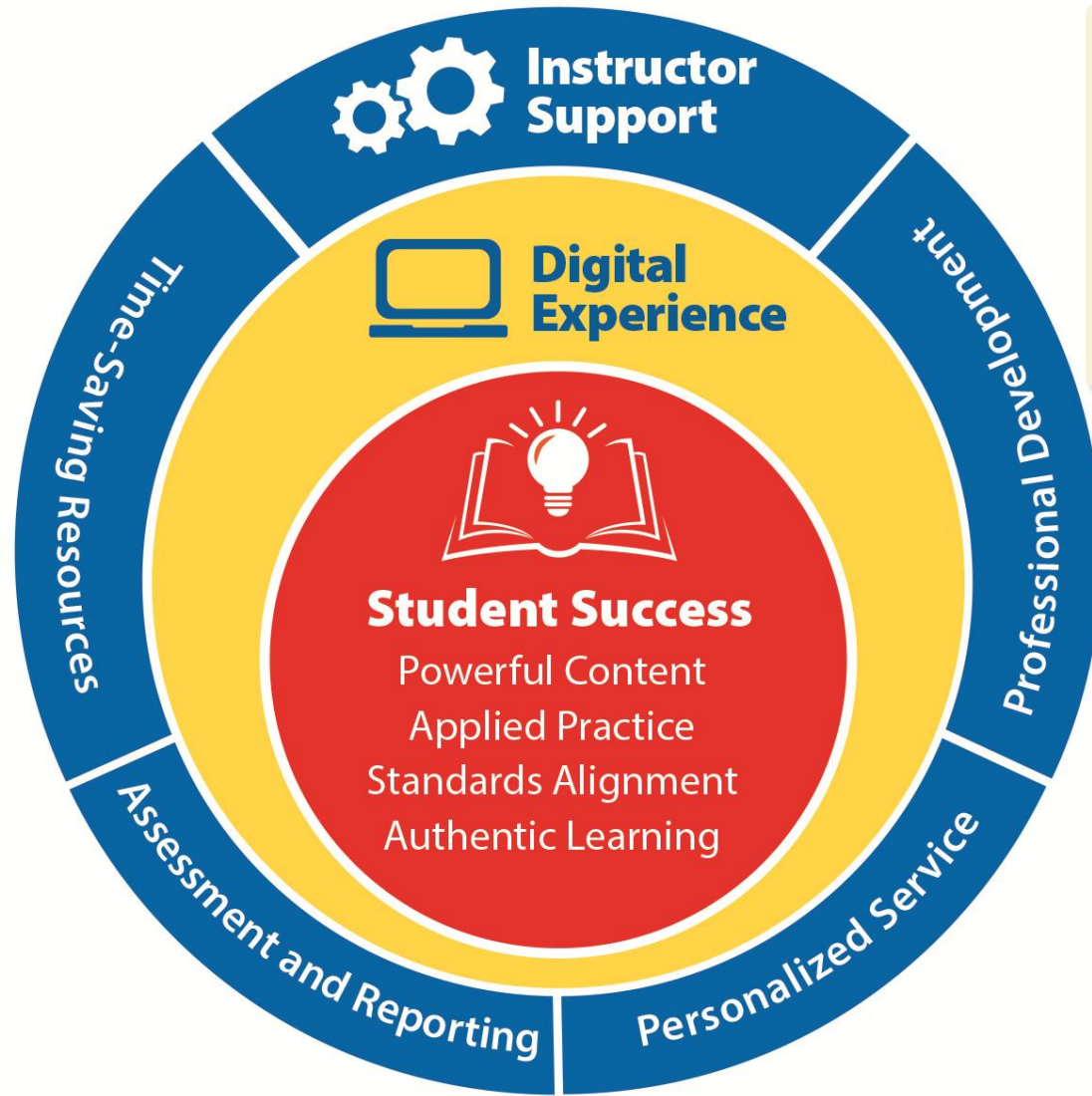


Principles of Residential Construction: Essential Skills and Practices



Designed by Educators, Built for Educators



Aligned to Standards: Student Success Is At the Heart of What We Do



- ✓ Prepare for class
- ✓ Reinforce new concepts
- ✓ Assess learning

**Ready-to-Implement
Online Instructor Resources**



G-W Assessment

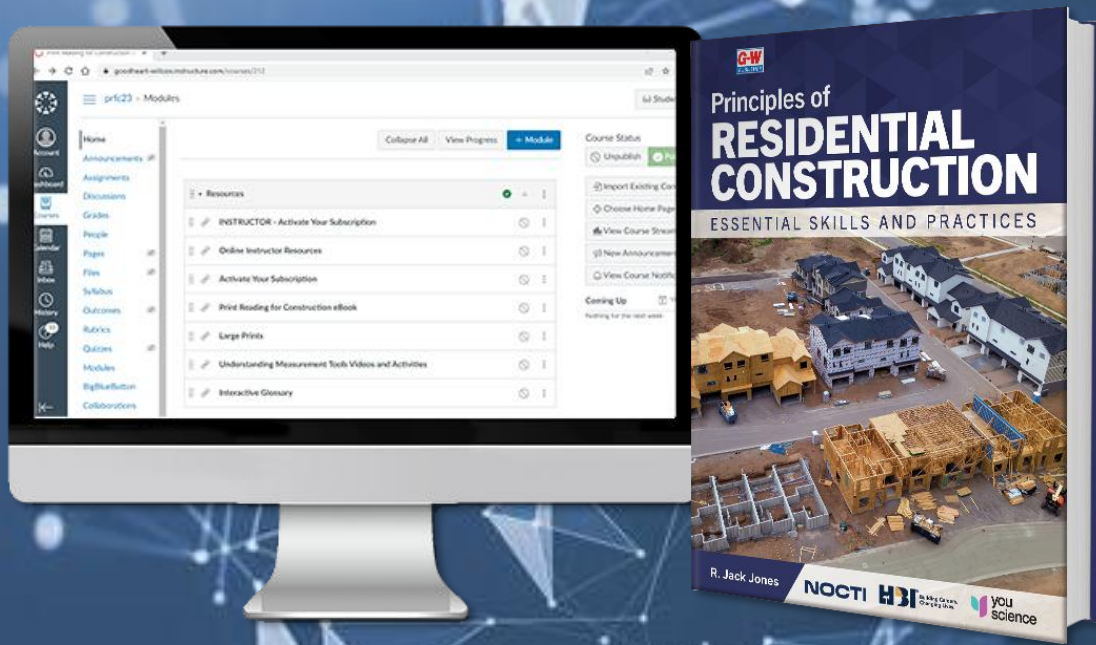
Assess learning • Gain insights • Build skills

- **Utilize a cloud-based assessment platform** that can seamlessly integrate with your LMS and Google Classroom
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- **Access G-W Assessment with one quick click** from any device

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Platforms

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ClassLink


1EDTECH
CERTIFIED


Google Classroom

LMS and CMS Integration Easy Navigation

2: E-Flash Cards

Definition (1 of 31)

Item of value that is owned.

2: E-Flash Cards

Term (1 of 31)

asset

Select to flip

Previous Remove Next

E-Flash Cards & Vocabulary Practice

2: Vocabulary Game

Select a point value. Choose the term that matches the definition.

Score: 800

<input checked="" type="radio"/> 100	100	100	100
200	200	200	200
300	<input checked="" type="radio"/> 300	300	300
400	400	400	<input checked="" type="radio"/> 400

Definition: Act of giving money, goods, or services to meet the needs of others and support causes that are important to an individual.

- pay yourself first
- variable expense
- recordkeeping
- philanthropy

Check Answer

Interactive Activities

Chapter 1: Preparing for Construction

Activity 1-1: Chapter 1 Review

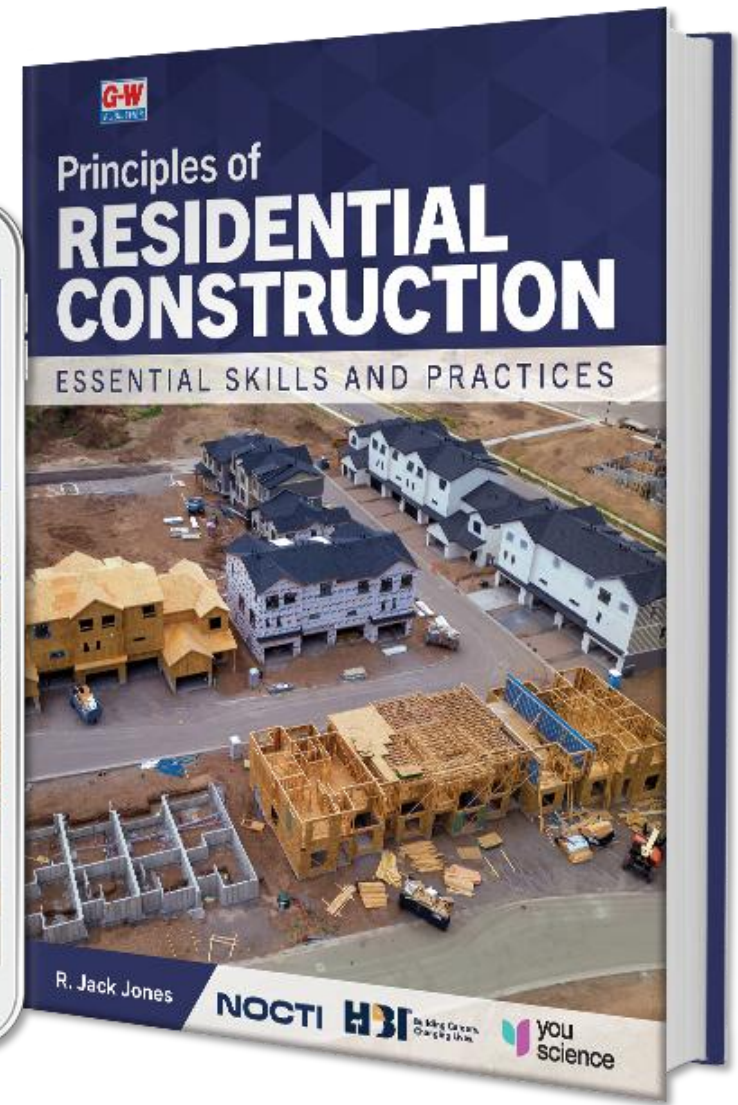
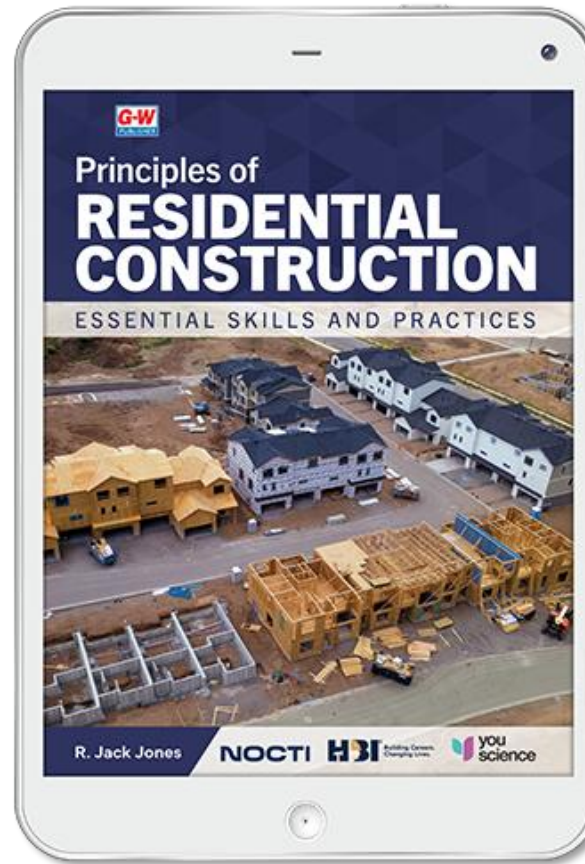
Answer the following questions after studying the chapter.

Lesson 1.1

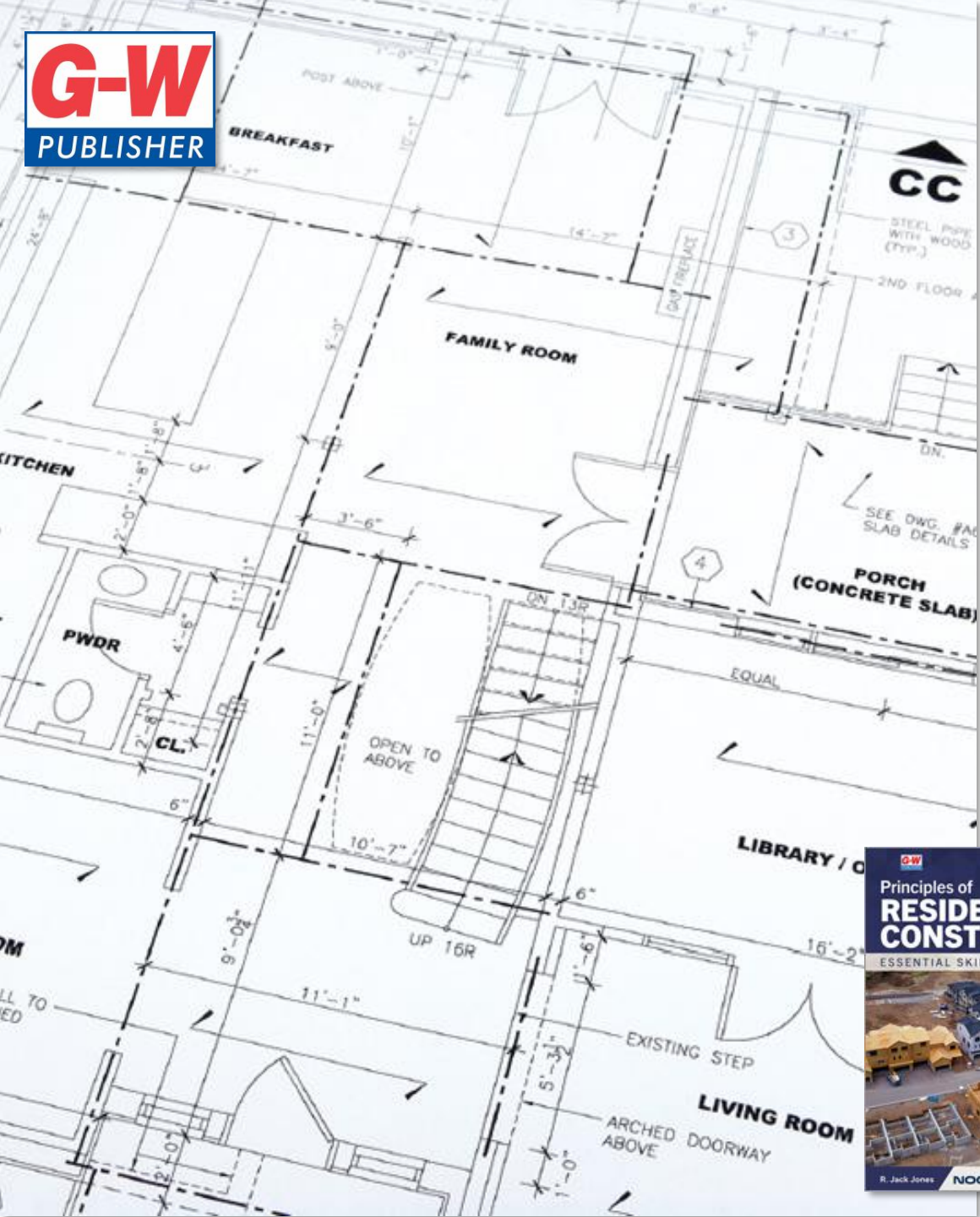
1. *True or False?* Renovating a home is a form of residential construction. (1.1-1)
Answer:
2. *True or False?* Wages in the construction industry have increased at a slower rate than most other industries. (1.1-2)
Answer:
3. Much of the oldest known evidence of construction in the world consists of structures made of which building material? (1.1-3)
 - A. Grass
 - B. Mud
 - C. Sticks
 - D. Stone
 Answer:
4. Some of the earliest evidence of large-scale construction comes from _____. (1.1-3)
 - A. Australia
 - B. Iceland
 - C. Mesopotamia
 - D. North America
 Answer:

Workbook Activities

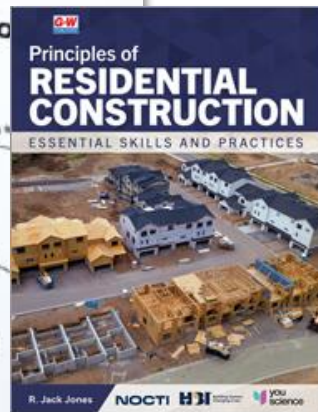
Integrate G-W Digital Resources



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by R. Jack Jones



- CHAPTER 1
Preparing for Construction
- CHAPTER 2
Excavation and Foundations
- CHAPTER 3
Framing Systems
- CHAPTER 4
Drying In
- CHAPTER 5
Exterior Finishes
- CHAPTER 6
MEP Systems Rough-In
- CHAPTER 7
Interior Insulation and Surfaces
- CHAPTER 8
Interior Finishes
- CHAPTER 9
Finish MEP Systems and Punch List



Student Textbook



Chapter 6 Outline

Lesson 6.1—Industry and Careers

Trade Organizations

Lesson 6.2—Construction Fundamentals

Trade Credentials and Certifications

Lesson 6.3—The Construction Path

MEP Rough-In

Electrical Wiring

Plumbing

Heating, Ventilation, and Air Conditioning

Lesson 6.4—Materials and Fasteners

MEP Rough-In Components and Materials

Fasteners, Adhesives, and Sealants

Lesson 6.5—Tools

Tools Used for MEP Rough-In

Lesson 6.6—Safety

Electrical Hazards

Avoiding Electrical Hazards

Lesson 6.7—Math

Estimating Materials Used

Lesson 6.8—Print Reading

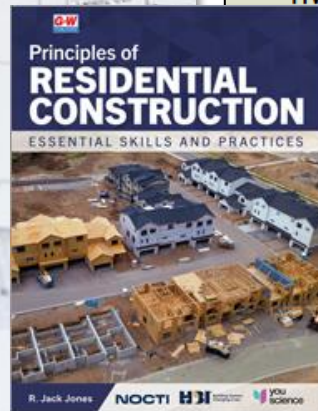
Electrical Plans

Plumbing Plans

HVAC Plans

Lesson 6.9—Green Building

Improving Efficiency of MEP



LESSON 6.1

Industry and Careers



LEARNING OUTCOMES

After completing this lesson, you will be able to:

- 6.1-1** Explain the role of trade organizations in the residential construction industry.

TECHNICAL TERMS

- standards organization
- trade organization
- trade union

Chapter-Opening Material



Green Note

The local climate, design of a home, and type of heating system can drastically impact a home's energy use. Homes built in climates that are colder for more of the year will have an increased benefit through the use of energy-focused design principles and higher efficiency systems.



Safety Note

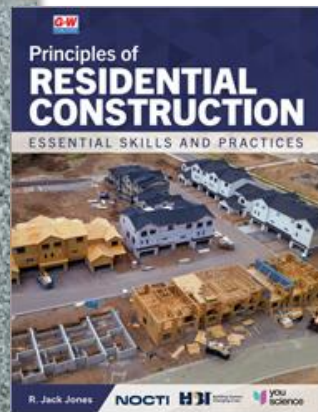
Electrical current can be extremely dangerous if a grounded person accidentally touches bare conductors or other energized parts of a circuit. Always follow these safety rules when you work around electricity:

- Make certain that a circuit is de-energized before working on it; turn off the circuit breaker or remove the fuse.
- Remove all jewelry, watches, rings, and any other metal objects before beginning work.
- Keep work areas dry and clean.
- Wear boots with insulated soles.
- Use only wood or fiberglass ladders, never metal.

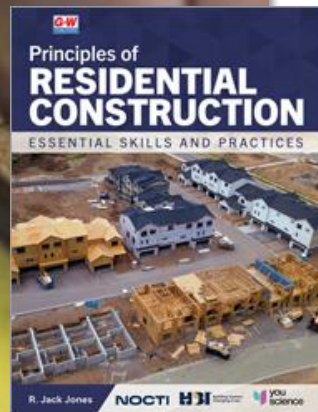


Code Note

Electrical outlets must be placed according to local building codes, typically specifying distances from corners, doors, and other features. For example, outlets are usually required to be spaced no more than 12 feet apart along walls in living spaces.



Special Features



Pro Tip

Many contractors benefit from professional networking through their local trade organizations. These organizations act as a place for general contractors and subcontractors to connect, share training and ideas, and collaborate on job opportunities.

Practice 6-2

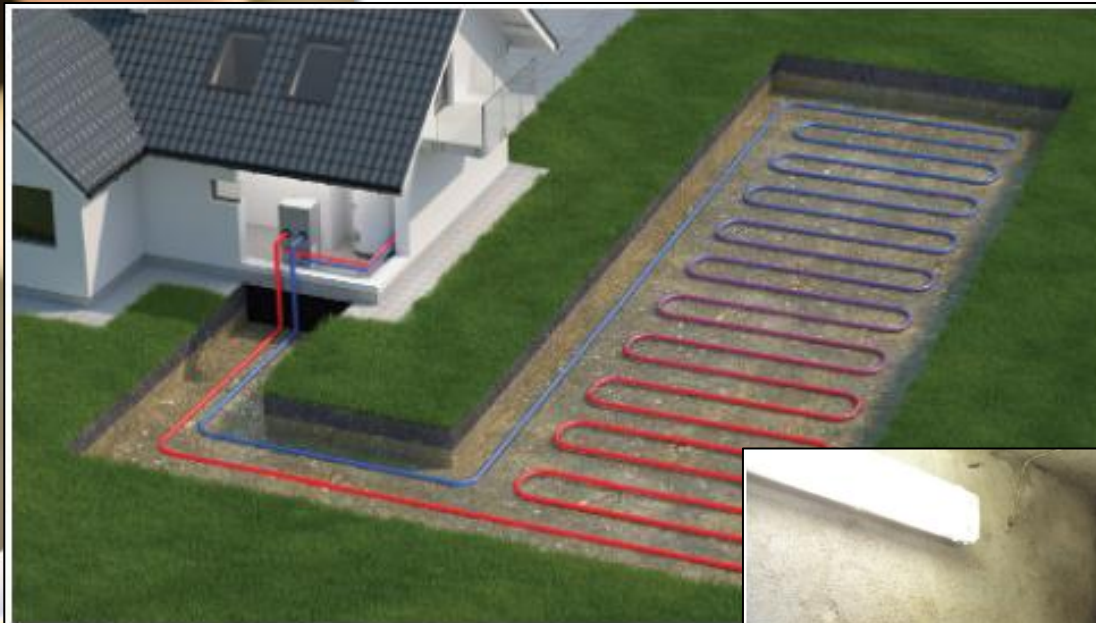
To find the area of a wall in a room with a vaulted ceiling like the one in **Figure 6.7-1**, break the wall into a rectangle and a triangle. Calculate the area of the rectangle and the triangle and then add the areas together.



pics721/Shutterstock.com

Figure 6.7-1. Complex shapes can be broken into simpler shapes to make calculations easier.

Special Features



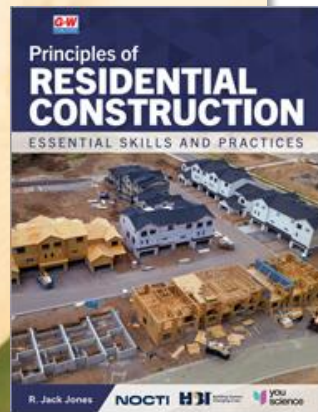
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Figure 6.9-3. Geothermal fields or wells are used to make use of heat for efficient operation of the heat pump.



caifas/Shutterstock.com

Figure 6.9-1. The compact design of this condensing boiler allows it to be mounted to the wall.



Illustrations and Photos

LESSON 6.7 Review

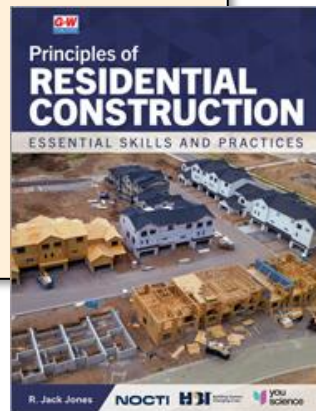
Answer the following questions based on information in this lesson.

1. *True or False?* Area is a measure of total surface. (6.7-1)
2. One square foot is a unit of measurement that represents an area equal to _____. (6.7-1)
 - A. $1'' \times 1''$
 - B. $10'' \times 10''$
 - C. $1' \times 1'$
 - D. $10' \times 10'$
3. *True or False?* $5^2 = 10$. (6.7-1)
4. What is the area of a rectangle that measures 12' long and 8' wide? (6.7-1)
 - A. 6 sq ft
 - B. 12 sq ft
 - C. 48 sq ft
 - D. 96 sq ft
5. What is the area of a triangle with a base of 10' and a height of 14'? (6.7-1)
 - A. 24 sq ft
 - B. 70 sq ft
 - C. 140 sq ft
 - D. 280 sq ft
6. *True or False?* The value of π varies depending on the size of the circle. (6.7-1)
7. *True or False?* The circumference of a circle is the distance from the circle's center point to its outer edge. (6.7-1)
8. What is the approximate circumference of a circle with a diameter of 9'? (6.7-1)
 - A. $14'-2''$
 - B. $28'-3''$
 - C. $44'-4''$
 - D. $56'-6''$
9. What is the area of a circle with a radius of 7"? (6.7-1)
 - A. 21.98 sq in
 - B. 34.51 sq in
 - C. 69.02 sq in
 - D. 153.86 sq in

LESSON 6.9 Review

Answer the following questions based on information in this lesson.

1. *True or False?* When a traditional boiler is used, heat is lost through the exhaust created from the combustion process. (6.9-1)
2. Condensing units achieve efficiency ratings of _____. (6.9-1)
 - A. 48% or lower
 - B. 62% to 73%
 - C. 78% to 84%
 - D. 90% or higher
3. *True or False?* Ductless mini-split systems allow for individual room control. (6.9-1)
4. Which statement about smart thermostats is false? (6.9-1)
 - A. They can integrate with home automation platforms.
 - B. They enable homeowners to track their energy usage.
 - C. They are a significant source of phantom power consumption.
 - D. They can learn users' preferences to optimize energy usage.



Chapter 6 Review

Summary

Lesson 6.1

- Trade organizations play an important role in residential construction by providing a platform for collaboration, advocacy, education, and networking, strengthening the collective influence of their members and promoting the development, growth, and sustainability of the industry. (6.1-1)

Lesson 6.2

- Trade credentials and certifications can be a big benefit to career progression, as well as staying current with industry changes and fulfilling specific task requirements within your field of expertise. (6.2-1)

Lesson 6.3

- Mechanical, electrical, and plumbing systems, known as MEP systems, all have components that must be installed before a home is insulated and interior surfaces are applied. This is referred to as the rough-in phase of construction. (6.3-1)
- Major HVAC rough-in components include ducting for forced-air and make-up air systems, primary piping for hydronic systems, and heating appliances with support equipment. (6.3-2)

Lesson 6.4

- MEP systems rough-in requires a wide variety of materials and components: service entrance components, switch and receptacle boxes, conductors, and conduit for the electrical system; pipes, valves, fasteners, and some fixtures for the plumbing system; and ductwork and tubing for HVAC systems. (6.4-1)
- The MEP rough-in uses a variety of fasteners from electrical cable staples to sheet metal screws and concrete and masonry anchors. Different sealants are used to maintain proper connections between pipes and fittings. (6.4-2)

Critical Thinking

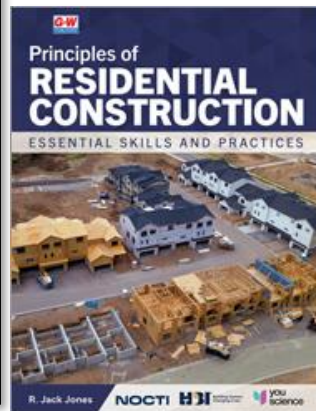
- Repairing plumbing can be a messy business. What precautionary measures would you take if you had to repair a water supply system? What about a drainage, waste, and venting (DWV) system? (6.3-1)
- What are the implications of owning and living in a home with an HVAC system that performs poorly? (6.3-1)
- List three safety and health issues that an electrician might face. What precautionary measures should they take to protect themselves from each? (6.6-1)

Communicating about Construction

- Reading.** With a partner, create flash cards for the key terms in the chapter. On the front of the card, write the term. On the back of the card, write the phonetic spelling text. (You may use a dictionary for this.) Practice reading aloud the terms, clarifying pronunciations where needed. (6.3-1)
- Speaking.** Make a series of safety posters that provide information about the dangers of electric shock. Explain your posters to the class. (6.6-1)
- Listening, Writing, and Speaking.** Search online for local unions that may have workshops, guest speakers, or presentations on HVAC installation and new materials. Look online for instructional videos. Also, your local library may have multiple presentations on construction efficiency.

Apply and Analyze

- Should you join a trade organization when you start working in the residential construction industry? Why or why not? (6.1-1)
- Is it a good idea for people just getting started in the residential construction industry to pursue credentials? Why or why not? (6.2-1)



Chapter 1: Preparing for Construction

Activity 1-1: Chapter 1 Review

Answer the following questions after studying the chapter.

Lesson 1.1

1. *True or False?* Renovating a home is a form of residential construction. (1.1-1)

Answer:

2. *True or False?* Wages in the construction industry have increased at a slower rate than most other industries. (1.1-2)

Answer:

3. Much of the oldest known evidence of construction in the world consists of structures made of which building material? (1.1-3)

- A. Grass
- B. Mud
- C. Sticks
- D. Stone

Answer:

4. Some of the earliest evidence of large-scale construction comes from _____. (1.1-3)

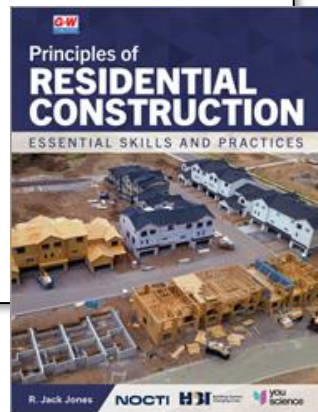
- A. Australia
- B. Iceland
- C. Mesopotamia
- D. North America

Answer:

Lesson 1.2

1. Which of these is an example of a hard skill? (1.2-1)

- A. Communicating effectively



Chapter 1: Preparing for Construction

Activity 1-5: Project—Building a Sawhorse

Learning Outcomes

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

- Read construction drawings to build a sawhorse.
- Transfer angles using layout tools.
- Use the proper tools needed to construct a sawhorse.

Introduction

A sawhorse is a tool used by the carpenter to support material being worked on and to keep the work off the ground. Sawhorses are generally used in pairs especially when working with long material. They are designed to be portable and stackable. In this activity, you will use a variety of hand and power tools to build a sawhorse. A good rule to remember on any building project is to “measure twice, cut once.”

Text Reference

Chapter 1, *Preparing for Construction*

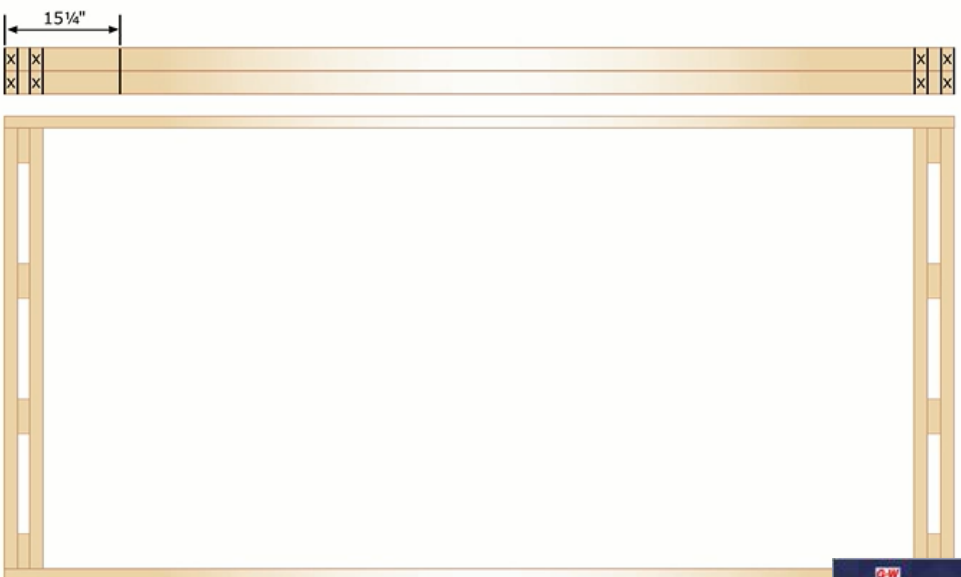
Equipment

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

- 1/2" plywood or equivalent, 12" × 30"
- 1×4 lumber, 6' long
- 2×4 lumber, 10' long
- 2×6 lumber, 36" long
- Block plane
- Builder's level, 24" or larger
- Carpenter's pencil
- C-clamps or F-clamps
- Circular saw
- Combination square or speed square
- Construction screws (12), 3"

Marking Stud Locations for Wall Framing

Marking Stud Locations for Wall Framing



15 1/4"

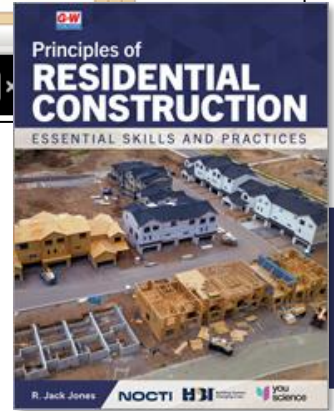
Play 00:27 / 01:14

Installing Subfloor



Installing Subfloor

00:01 / 02:04











Video and Animation Library

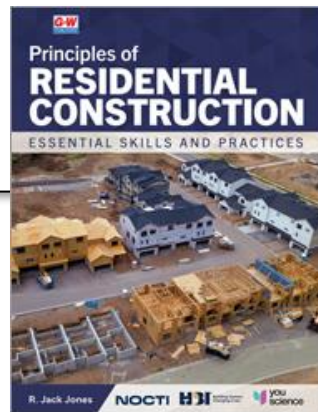
Principles of Residential Construction Virtual Toolbox



Toolbox E-Flash Cards

Toolbox E-flash cards make learning tool names easy! Pick a category from the list below and use the E-flash cards to become an expert. Each E-flash card includes an image of a tool on one side and the tool's name on the other. Click on the E-flash card to "flip it over" and see the other side. Some E-flash cards also include information about a tool, such as a short description or examples of what the tool is used for. Keep practicing with the E-flash cards in a category until you know all the tool names by heart; then move on to the next category!

-  [Blueprints](#)
-  [Fasteners](#)
-  [Measuring and Marking Tools](#)
-  [Leveling and Layout Tools](#)
-  [Hand Tools](#)
-  [Power Tools](#)
-  [Fastening Hand and Power Tools](#)
-  [Specialty Tools](#)
-  [Safety](#)



Virtual Toolbox: Power Tools Activities

Activity 1: Cutting Tools 1

Match the name of the tool with its description.

- A. Combination blade
- B. Abrasive blade
- C. Masonry blade
- D. Fiber cement blade
- E. Finish blade

1. A cutting tool used with a circular saw that is textured to cut metal materials.

Answer:

2. The cutting tool that is the most used attachment for a circular saw. It is ideal for rough framing and can be used to cut both along and against the grain of a piece of wood.

Answer:

3. A cutting tool used with a circular saw to cut through hard masonry materials like concrete.

Answer:

4. A cutting tool used with a circular saw with fine teeth to make smooth, fine cuts.

Answer:

5. A cutting tool used with a circular saw to cut through soft masonry materials like brick and block.

Answer:

Virtual Toolbox

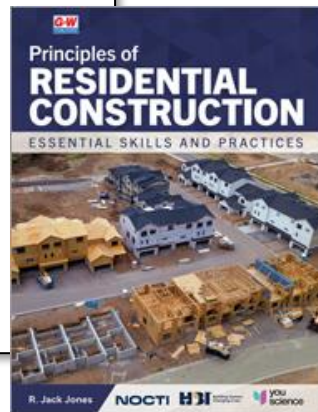


Activity Worksheets

Are you ready for a challenge? After you watch the videos, it's time to show what you know. Select a category from the list below to complete the activity worksheets. If you get stuck, you can go back to the videos for a refresher.

PDFs that do not meet ADA or Section 508 requirements are accompanied by an accessible DOCX file equivalent that meets ADA and Section 508 requirements.

- [Rulers and Tape Measures \(DOCX\)](#)
- [Rulers and Tape Measures \(PDF\)](#)
- [Reading Fractions \(DOCX\)](#)
- [Reading Fractions \(PDF\)](#)
- [Decimal Equivalents \(DOCX\)](#)
- [Decimal Equivalents \(PDF\)](#)
- [Adding Fractions \(DOCX\)](#)
- [Adding Fractions \(PDF\)](#)
- [Tape Measure Tips \(DOCX\)](#)
- [Tape Measure Tips \(PDF\)](#)
- [Making Your Mark \(DOCX\)](#)
- [Making Your Mark \(PDF\)](#)



Understanding Measurement Tools Videos and Activities



Resource Materials

Instructor's Materials

- 🔗 [Release Notes \(Updated 11/12/2023\)](#)
- 📄 [HBI Basic Principles of Construction](#)
- 📄 [HBI PACT Core Examination](#)
- 📄 [HBI PACT Green Core Examination](#)
- 📄 [NOCTI Fundamentals of Construction](#)
- 📄 [YouScience - Construction Trade](#)
- 📄 [Virtual Toolbox Activity Answer Key](#)

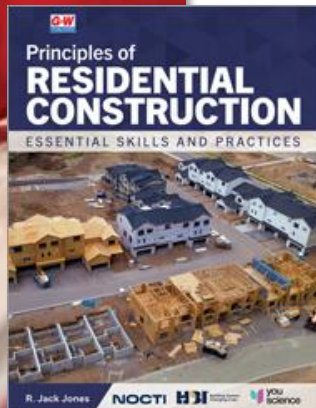
2 Excavation and Foundations

2 Resources

- 📄 [Textbook Answer Key](#)
- 📄 [Lesson Plan](#)

2 Presentations

- 📄 [Lesson 2.1 Instructor's Presentation](#)
- 📄 [Lesson 2.1 Instructor's Presentation for PowerPoint](#)
- 📄 [Lesson 2.2 Instructor's Presentation](#)
- 📄 [Lesson 2.2 Instructor's Presentation for PowerPoint](#)
- 📄 [Lesson 2.3 Instructor's Presentation](#)
- 📄 [Lesson 2.3 Instructor's Presentation for PowerPoint](#)
- 📄 [Lesson 2.4 Instructor's Presentation](#)
- 📄 [Lesson 2.4 Instructor's Presentation for PowerPoint](#)
- 📄 [Lesson 2.5 Instructor's Presentation](#)
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- 📄 [Lesson 2.9 Instructor's Presentation](#)
- 📄 [Lesson 2.9 Instructor's Presentation for PowerPoint](#)



**Lesson Plans, Assessments,
and Answer Keys**



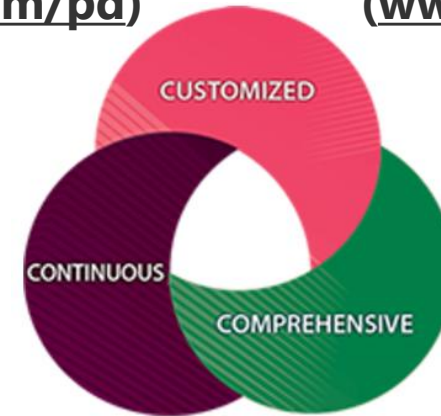
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from here to **CAREER**

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From Here to Career: Early Childhood Education

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From Here to Career: Automotive

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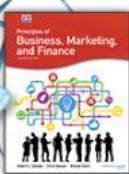
First Day Icebreakers 

Snap, Clap, Pop: Construction

Type: Downloadable Activities
Grade: 9-12
Subject: Architecture and Construction

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Grade: 9-12
Subject: Business, Marketing, and Finance


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Snap, Clap, Pop: Health Science

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Grade: 9-12
Subject: Health and Physical Education


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Snap, Clap, Pop: Health Skills for High School

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Subject: Health and Physical Education

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First Day Icebreakers 

Snap, Clap, Pop: Animal Science

Type: Downloadable Activities
Grade: 9-12
Subject: Animal Science

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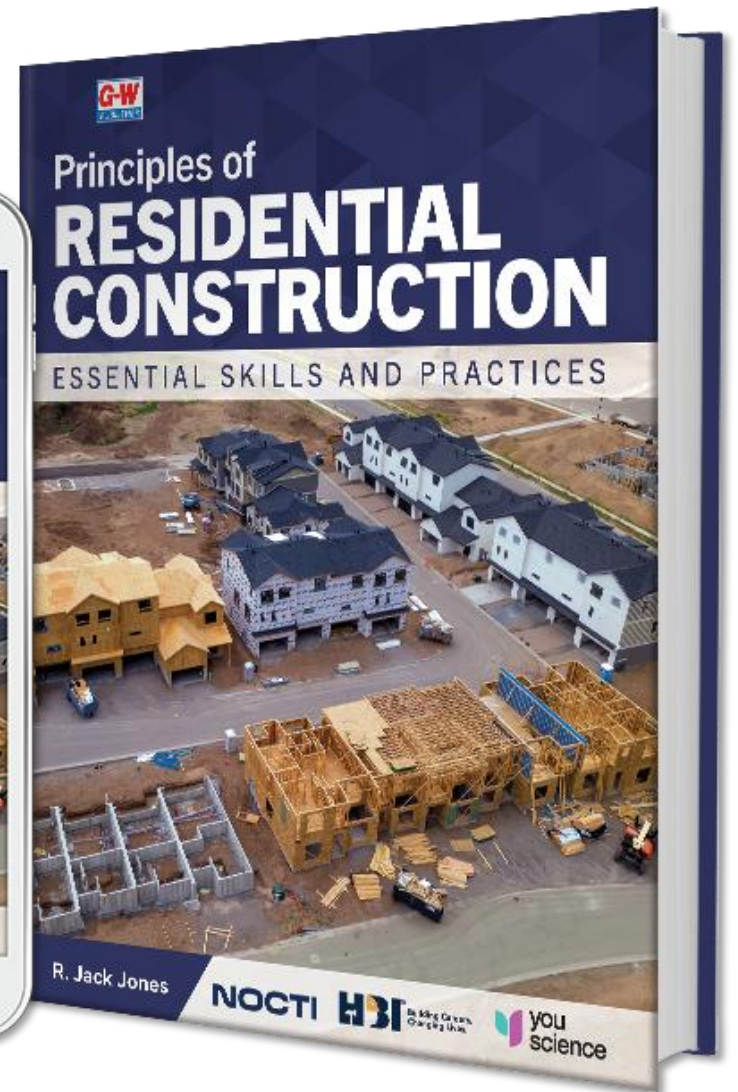
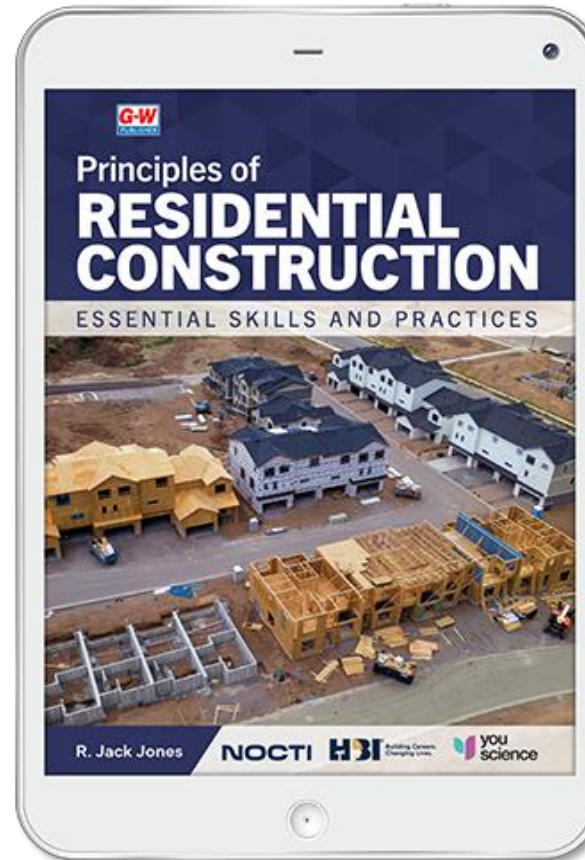
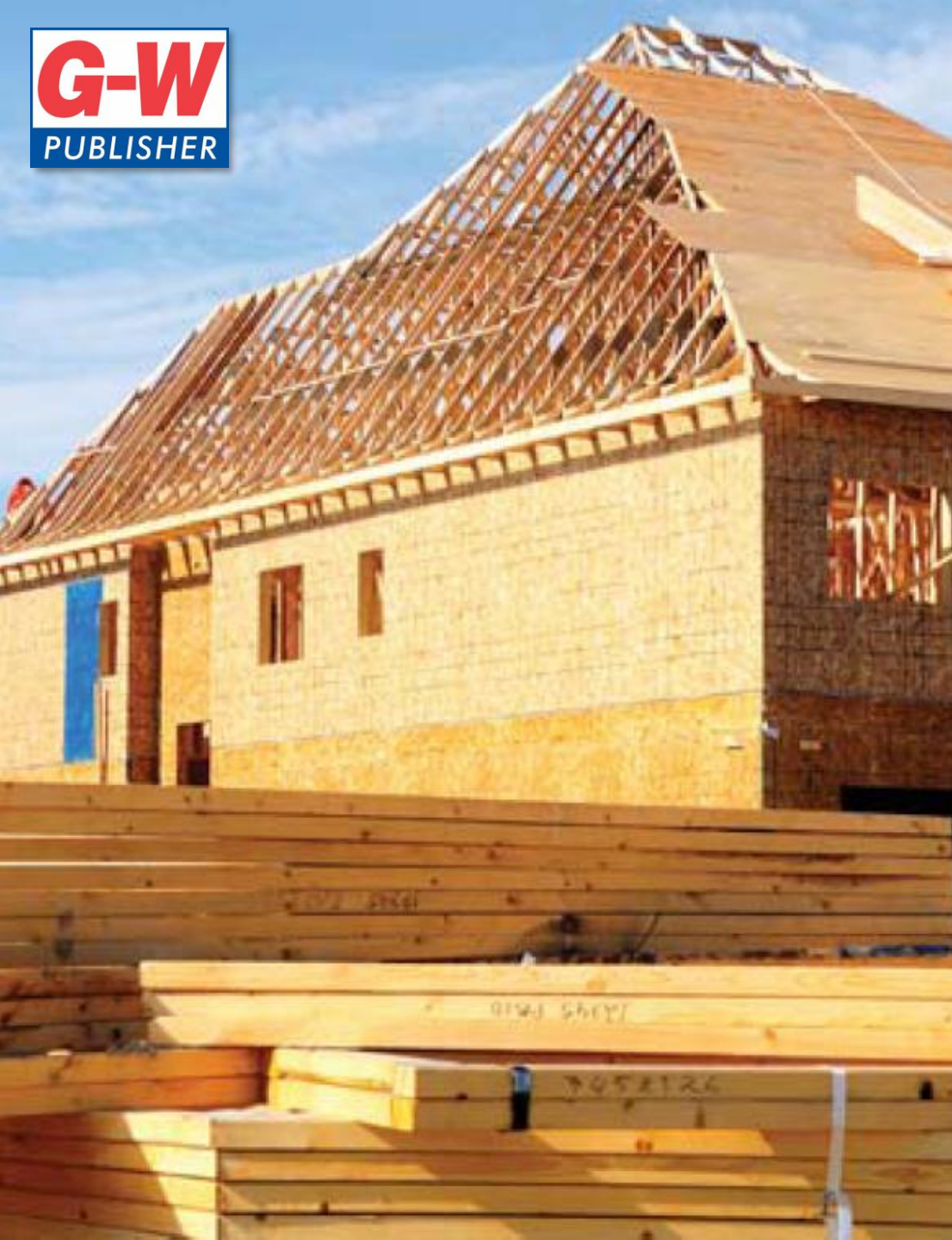
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