

## UNIT III - BUILDING CONSTRUCTION

### Lesson 8: Roofing Materials

**Competency/Objective:** Select roofing materials.

#### **Study Questions**

1. What different types of roofing materials are available?
2. What are the advantages and disadvantages of different types of roofing materials?
3. What are the structural components of a roof?
4. How are different types of roofs attached?

#### **References**

1. *Agricultural Structures (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1999, Unit III.
2. Transparency Master
  - a) TM 8.1: Structural Components of Roofs
  - b) TM 8.2: Applying the Starter Course
  - c) TM 8.3: Three-Tab Shingle Application
  - d) TM 8.4: Applying Cap Shingles
3. Activity Sheet
  - a) AS 8.1: Applying Roofing Materials



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### Lesson 8: Roofing Materials

#### TEACHING PROCEDURES

##### B. *Review*

Lesson 7 discussed the roof support systems found in agricultural structures. The support system is only part of the roof, however. Lesson 9 explores the roofing materials that are commonly used, their advantages or disadvantages, and how roofing materials are used in roof construction.

##### C. *Motivation*

Display a few different types of shingles, a piece of roll roofing, and a few sections of metal roofing (both galvanized and painted). Identify the different materials and ask students to name places they have seen these materials in use.

##### D. *Assignment*

##### E. *Supervised Study*

##### F. *Discussion*

1. Discuss the different materials listed below with the class. If the samples suggested in the motivation section are available, use them to illustrate the various types. If not, use clippings from magazines as examples of these products.

#### **What different types of roofing products are available?**

- a) Asphalt - roll or shingle form
  - b) Fiberglass - shingles
  - c) Metal - galvanized or painted
2. Discuss the advantages or disadvantages of these materials in comparison to each other.

#### **What are the advantages and disadvantages of different types of roofing materials?**

- a) Asphalt
  - 1) Advantages
    - (a) Lower in cost than either metal roofing or fiberglass shingles
    - (b) Roll asphalt - simple installation
  - 2) Disadvantages
    - (a) Roll asphalt - least attractive roofing material
    - (b) Relatively brief life span of 15 to 25 years under normal conditions
    - (c) Burns readily
- b) Fiberglass shingles
  - 1) Advantage
    - (a) Moderate in cost
    - (b) Long life span, around 30 years
  - 2) Disadvantage - flammable
- c) Galvanized metal
  - 1) Advantages

- (a) Relatively inexpensive
    - (b) Very fire resistant
    - (c) Very long life span of 50 years or longer
    - (d) Very durable material
  - 2) Disadvantage
    - (a) Plain silver appearance, which may not make it suitable for all uses
    - (b) Noise caused by rain or hail striking the roof
  - d) Painted metal
    - 1) Advantages
      - (a) Fire resistant
      - (b) Long life span of 30 or more years
    - 2) Disadvantages - generally more expensive than asphalt shingles, galvanized metal, or fiberglass roofing
3. Use TM 8.1 as an aid in explaining the structural parts of a roof system. Discuss the structural components of roofs.

**What are the structural components of a roof?**

- a) Rafters or trusses
  - b) For roll or shingle asphalt or fiberglass shingles, a solid decking system to which the roofing material is attached
    - 1) The decking may be either some form of sheathing material, such as plywood or oriented-strand board, or dimensional lumber (usually 3/4" thick).
    - 2) The decking is nailed or screwed over the top of the roof support system.
  - c) For metal roofing, a purlin system to which the roofing material is attached
    - 1) Purlins are pieces of dimensional lumber, commonly 1" × 4", in varying lengths.
    - 2) They are nailed perpendicular to the rafters.
    - 3) The spacing of the purlins is dependent on many variables, such as the roof span, the strength of the material used for the purlins, and pitch.
4. Collect some examples of common roofing materials to display while discussing this part of the lesson. Describe how different types of roofs are attached, using TMs 8.2, 8.3, and 8.4 to illustrate shingling. Have students work on AS 8.1. Enough of the model shingles to complete the activity should be photocopied and given to the students before beginning the activity.

**How are different types of roofs attached?**

- a) Roofing materials in roll or shingle form
  - 1) They are fastened with galvanized or aluminum nails.
    - (a) The nails are usually 1¾ inches long.
    - (b) They have a large, flat head to hold the material securely and resist tearing the shingle.
  - 2) Shingles may also come with an adhesive on them to help secure them to the decking.
  - 3) The first step in attaching shingles is to nail or staple a layer of building felt, or underlayment, in place.
    - (a) Building felt is a tar-soaked fabric that will repel water.
    - (b) Place the felt across the length of the roof horizontally starting at the bottom, with successive layers overlapping about 4 inches.
    - (c) Apply a drip edge to the bottom and sides of the roof over the underlayment to prevent moisture from seeping under the underlayment.
  - 4) Apply the shingles to the roof, starting at the bottom with each successive layer or course of shingles overlapping the layers below.
  - 5) The first layer of shingles is made of half shingles.
    - (a) For three-tab shingles, cut the shingle lengthwise at the top of the tabs.
    - (b) Cut the first shingle in the starter course to a length of 30 inches to offset the end with the first course of full shingles.

- (c) Place the long edge of the shingle along the edge of the roof.
  - (d) Attach the shingles as square to the edge as possible; use a hand level to make sure the first layer is level.
  - (e) Apply nails in the sealer strip, with one nail on each end of the shingle and above each weep.
- 6) Lay the remaining courses.
  - (a) The starter course will be completely covered by the next course of shingles.
  - (b) The shingles in each remaining course overlap the previous course halfway, or just above the top of the weeps.
  - (c) Stagger the weeps of each course equally from the previous course to form a brick-type pattern.
  - (d) Cut the first shingle in each course at six-inch increments, producing shingles that are 30, 24, 18, 12, and 6 inches long.
  - (e) Lay out these shingles at the edge of the roof in sequence.
    - (1) Start with a full shingle and continue across the roof with full shingles.
    - (2) Cut the last shingle in the course even with the side of the roof.
    - (3) Start the second course with a 30-inch shingle, the third with a 24-inch shingle, etc., creating a pattern that is repeated every six rows.
  - (f) The cut-off material may be used at the other end of a course.
  - (g) Any pieces over 12 inches long may be used on the peak of the roof.
- 7) At the peak of the roof, finish the cap.
  - (a) One method is to cut three-tab shingles into three sections and lay them over the top courses on each side of the ridge.
  - (b) Another method involves using special cap shingles at the peak of the roof.
  - (c) Overlap the shingles to prevent rain from getting under them.
  - (d) The direction of overlap depends on the normal wind direction.
- b) Metal roofing
  - 1) Metal roofing materials are attached with ring shank screws or nails with an attached neoprene or lead washer.
    - (a) They are generally 2½ inches in length.
    - (b) Overlap the ribbing running the length of the material.
    - (c) Place the nails or screws through the ridges of the roofing material, not in the flat areas.
    - (d) The placement of fasteners will vary depending on the type of ribbing; the manufacturer's recommendations should always be followed.
  - 2) Aluminum and galvanized metal materials should not be used together, since the combination will result in an electrolyte reaction that causes corrosion.

#### G. *Other Activities*

1. Have students collect pictures of the roofs of different agricultural structures. Have the class assemble these into a scrapbook that can be used as a reference in the future.
2. Divide the class into groups; have each group prepare a report about one of the basic types of roofing materials covered in this lesson. They could provide information on variations in quality, life span warranties among similar products, and manufacturer's recommendations for their use. The groups should be prepared to present their findings to the class.
3. Have students watch "Application of Three-Tab Composition Shingles" (15 min.), available from MVRC.

#### H. *Conclusion*

Roofing materials are made from asphalt, fiberglass, or metal. Each of these materials has advantages and disadvantages. The structural components of the roof and how the roofing material is attached will vary depending on the materials used.

#### I. *Answers to Activity Sheet*

1. To allow the water to drain off without leaking

2. By determining how many square feet needed to be covered. Shingles are sold in squares, and one square is enough to cover 100 square feet.
3. The starter course determines how straight and square each course above will be.

J. *Answers to Evaluation*

1. b
2. c
3. a
4. d
5. b
6. Shingles and roll roofing
7. Galvanized metals
8. Shingles or roll roofing
9. To nail or staple a layer of building felt in place

EVALUATION

**Circle the letter that corresponds to the best answer.**

1. The roofing material that generally has the longest life span is:

- a. Painted metal.
- b. Galvanized metal.
- c. Asphalt.
- d. Fiberglass.

2. Which roofing material costs the least?

- a. Painted metal
- b. Galvanized metal
- c. Asphalt
- d. Fiberglass

3. Purlins are nailed:

- a. Perpendicular to the rafters.
- b. Diagonal to the ridge board.
- c. Parallel to the rafters.
- d. Perpendicular to the ridge board.

4. The roofing material that generally has the shortest life span is:

- a. Painted metal.
- b. Galvanized metal.
- c. Asphalt.
- d. Fiberglass.

5. Where should the first row of shingles be laid?

- a. At the top of the roof
- b. At the bottom of the roof
- c. At the left edge of the roof
- d. At the right edge of the roof

**Complete the following short answer questions.**

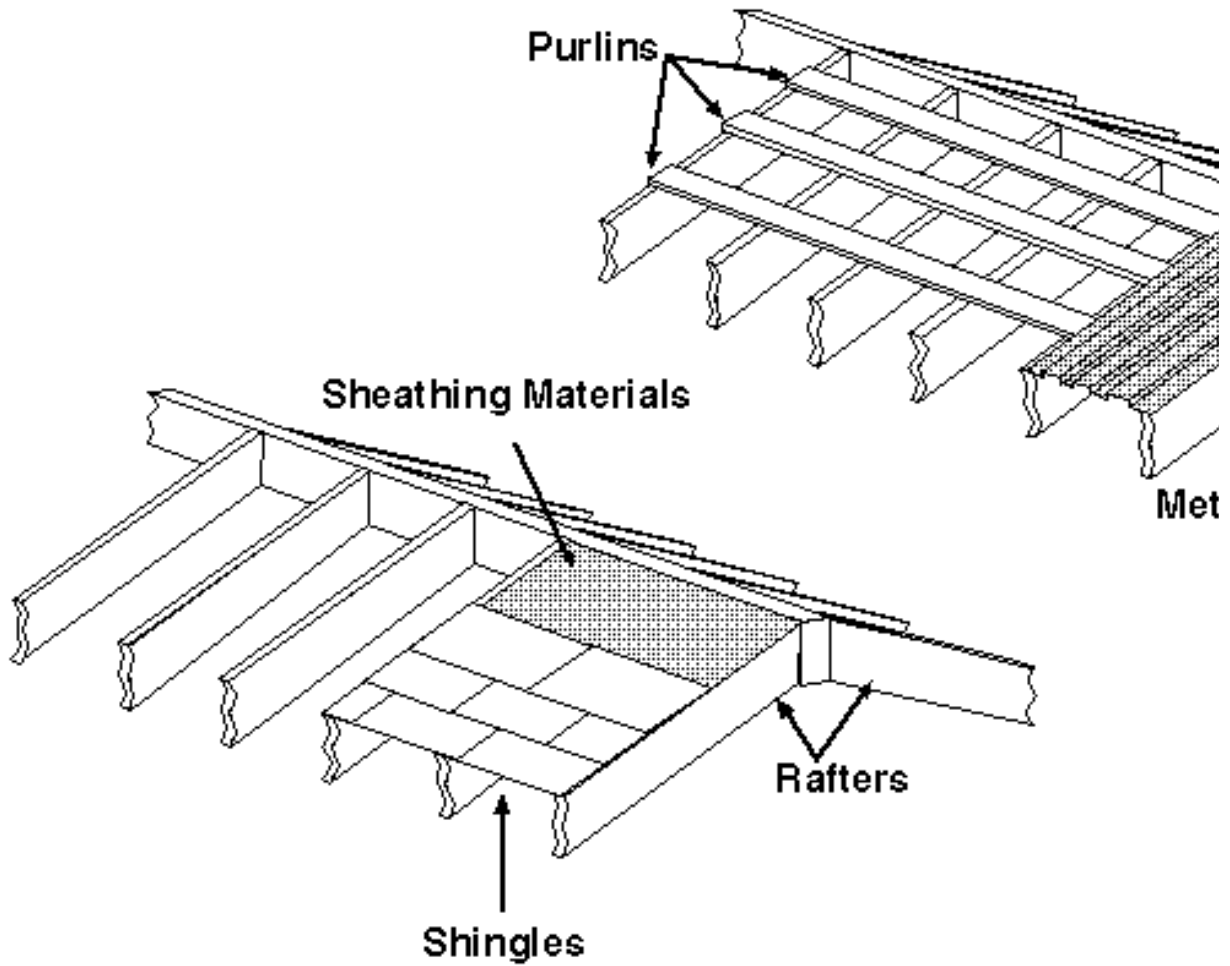
6. What two forms does asphalt roofing material come in?

- a.
- b.

7. What type of roofing material cannot be attached with aluminum fasteners?
8. What types of roofing material must be applied over a solid decking?
9. What is the first step in attaching roofing shingles?

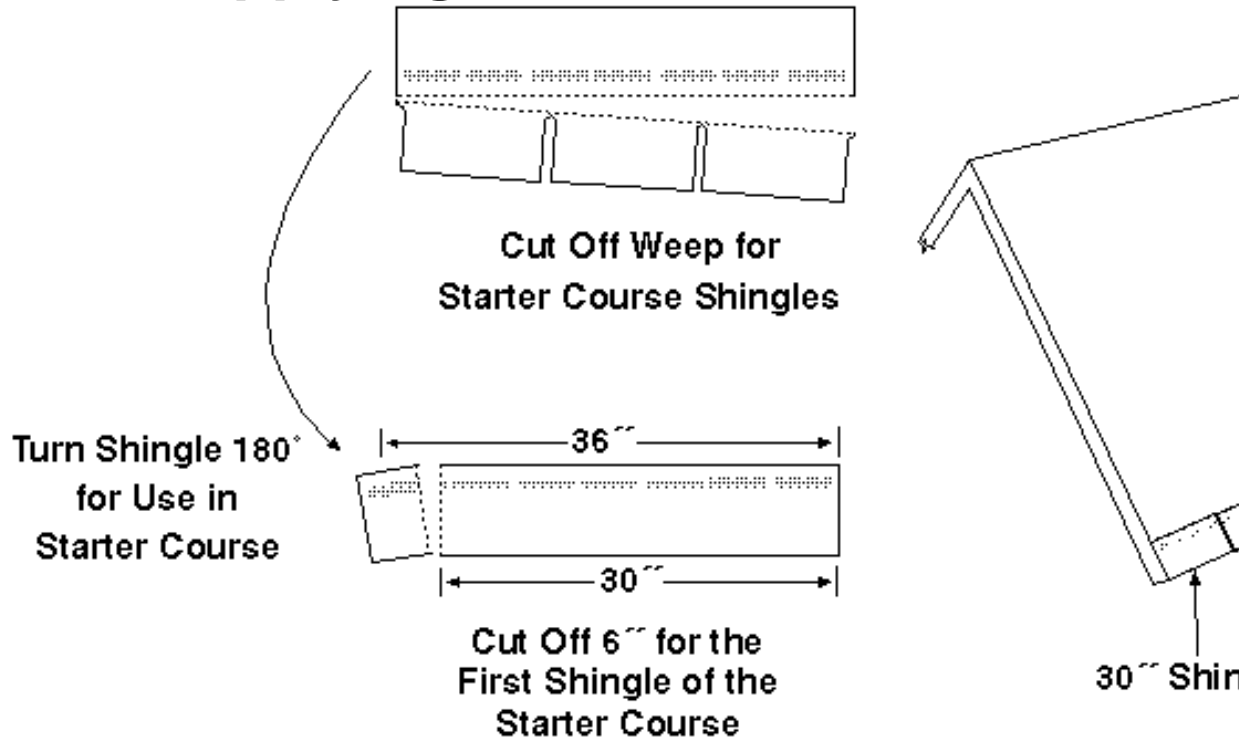


# Structural Components of Roofs



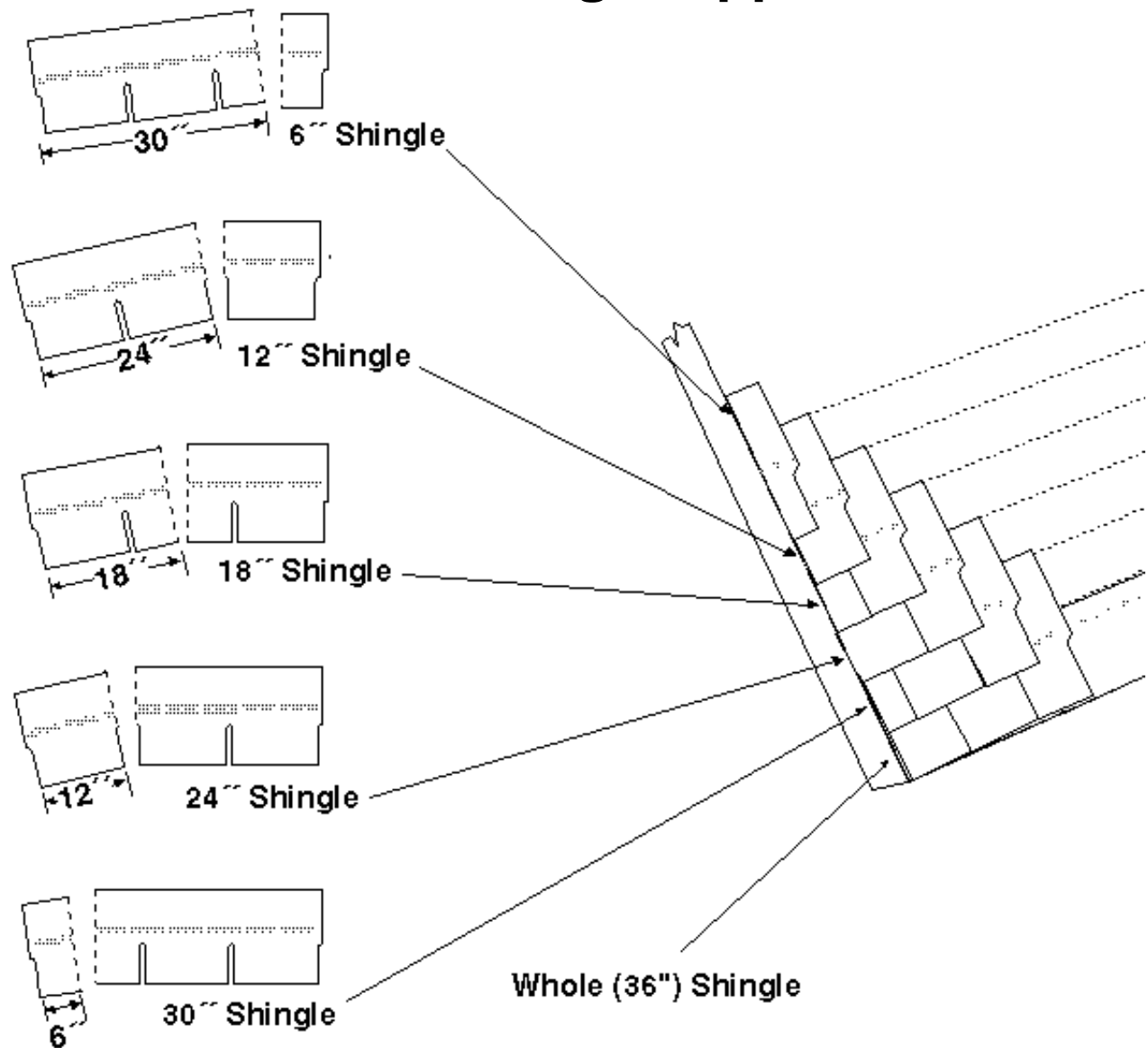


# Applying the Starter Course



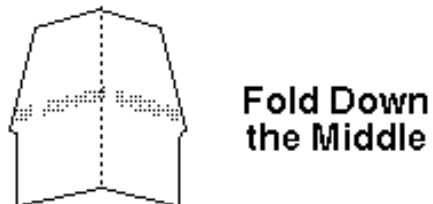
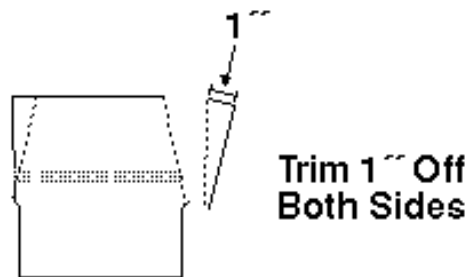
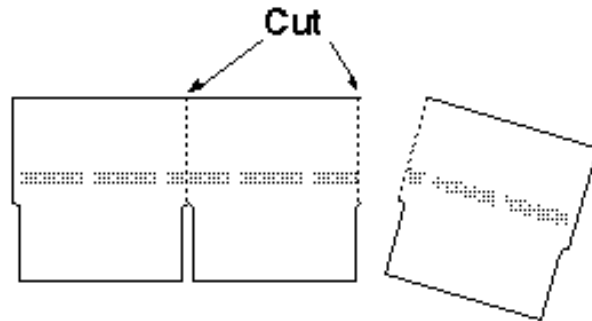


# Three-Tab Shingle Application



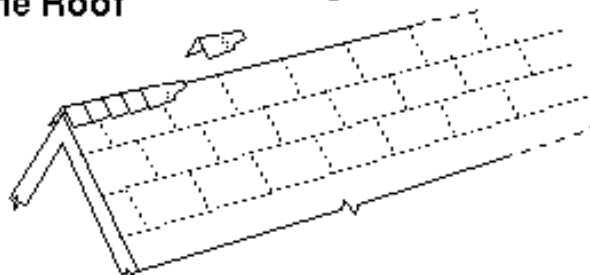


# Applying Cap Shingles



**Edges of Cap Shingles  
Will Overlap the Last Course  
on Each Side of the Roof**

**Overlap Cap  
Shingles**







## Lesson 8: Roofing Materials

Name \_\_\_\_\_

**Applying Roofing Materials****Objective:** Apply different types of roofing materials.**Materials and Equipment:**

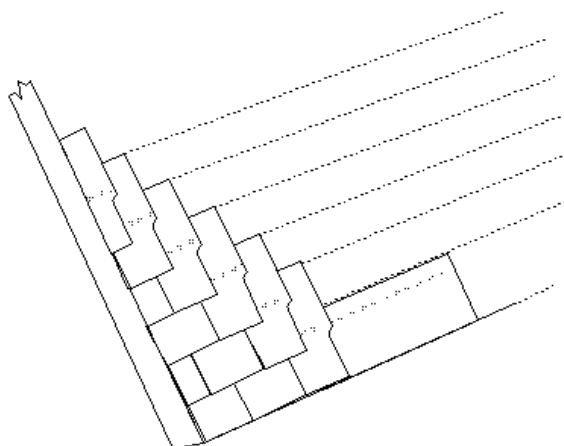
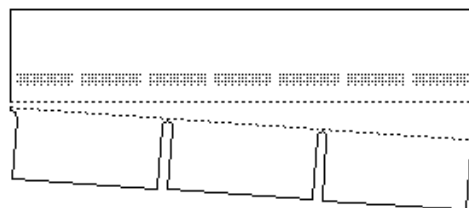
Classroom or shop tables

Paper models of shingles

**Procedure:**

For this activity, assume that one edge of the table is the bottom of a roof. Place the model shingles on the "roof's" surface, starting at the bottom. The paper shingles are 9 inches long,  $\frac{1}{4}$  the size of a real shingle. All cuts in the shingle must be scaled to the appropriate length.

1. Make half shingles by cutting the shingle at the top of the tabs (Figure 1.1). Cut first shingle to  $7\frac{1}{2}$  inches in length and place the long, uncut side of the shingle along the bottom edge.
3. Apply the starter course to the table using tape at the top of the shingle. Make sure the shingles are as square to the edge as possible.
4. Make partial shingles at the end of each course by cutting the last shingle as appropriate.
5. Lay the first full course over the starter course. Apply the entire course with tape, making sure the shingles are square.
6. For the next course, cut  $1\frac{1}{2}$  inches off the first shingle.
7. Apply the course, laying the shingles halfway over the first course (just above the weeps).
8. Lay the rest of the courses across the table surface, staggering the shingles in a brick-type pattern (Figure 1.2). Keep the shingles as square to the edge as possible.



10. At the peak, apply the cap. Cut three-tab shingles into three sections at the weeps to use as cap shingles. Angle trim each cap shingle from the top of the shingle to the top of the weep (Figure 1.3).
11. Place the cap shingles over the top course. They should overlap each other as if the wind is coming from the left side of the table.

**Key Questions:**

1. Why are the layers of shingles overlapped?
2. How would you determine how many shingles to buy for a construction project?
3. Why is it important to make sure the starter course is straight and square?

