

CHAPTER 33

Exterior & Interior Paint

Section 33.1

Finishing Basics

Section 33.2

Exterior Painting

Section 33.3

Interior Painting

Chapter Objectives

After completing this chapter, you will be able to:

- **Describe** the differences between the two basic types of finishes.
- **List** the basic ingredients of paint.
- **Identify** the steps in painting a house exterior.
- **List** the steps in painting an interior.
- **Examine** problems with painted finishes.
- **Explain** how to paint windows and doors.



Discuss the Photo

Painting The painter in the photo is painting the exterior of a house. *What concerns might arise when attempting to protect exterior paint?*



Writing Activity: Create an Advertisement

Brushes and rollers are the primary interior painting tools. Write an advertisement that you feel would be effective in attracting buyers to a high-quality brush. Your ad should draw attention, arouse interest, create desire, and cause action.

Chapter 33 Reading Guide



Before You Read Preview

Paints, coatings, and other finishes have been used for thousands of years to decorate and protect surfaces. Choose a content vocabulary or academic vocabulary word that is new to you. When you find it in the text, write down the definition.

Content Vocabulary

- summerwood
- sheen
- binder
- carrier
- solvent
- primer
- flagged bristles
- edging

Academic Vocabulary

You will find these words in your reading and on your tests. Use the academic vocabulary glossary to look up their definitions if necessary.

- synthetic
- compatibility

Graphic Organizer

As you read, use a chart like the one shown to organize information about content vocabulary words and their definitions.

Content Vocabulary	Definition
summerwood	the dense, dark-colored portion of the wood

Go to glencoe.com for this book's OLC for a downloadable version of this graphic organizer.

Academic Standards



Mathematics

Number and Operations: Understand numbers, ways of representing numbers, relationships among numbers, and number systems (NCTM)

Problem Solving: Solve problems that arise in mathematics and in other contexts (NCTM)

Algebra: Represent and analyze mathematical situations and structure using algebraic symbols (NCTM)



English Language Arts

Use written language to communicate effectively (NCTE 4)

Use different writing process elements to communicate effectively (NCTE 5)



Science

Science in Personal and Social Perspectives: Natural and human-induced hazards (NSES)

Earth and Space Science: Energy in the earth system (NSES)

Physical Science: Interactions of energy and matter (NSES)

Physical Science: Chemical reactions (NSES)

Industry Standards

Exterior Finishes

NCTE National Council of Teachers of English
NCTM National Council of Teachers of Mathematics

NSES National Science Education Standards

Finishing Basics

Understanding Wood Finishes

What factors determine the ability of a wood to accept a finish?

Paints, coatings, and other finishes have been used for thousands of years to decorate and protect many materials. Finishes are particularly important for wood because they prolong its life and improve its appearance. For example, exterior surfaces of a home require finishes that will protect against weathering, sunlight, and moisture. Interior finishes must be durable and easy to clean. As a general rule, hardwoods are given a clear finish, while softwoods are given either an *opaque* (not clear) finish or a clear finish.

Wood is the most common building material. Therefore, this chapter is about paint and painting techniques for wood. The information generally applies to new construction. When repairing, removing, or recoating an existing finish, many additional surface preparation steps are required that are not covered here.

While all woods can be finished, some take finishes better than others. The ability of a wood to accept a finish is determined by four basic factors: species, grade, grain, and manufacture.

Species

In general, denser species of woods are less accepting of finish than less dense woods. Cedar and cypress hold paint best of all the woods used for siding and trim. Northern white pine, western white pine, and sugar pine are almost as good. Western yellow pine, white fir, and hemlock come next. Serious flaking of paint occurs soonest on southern yellow pine, Douglas fir, and western larch.

Grade

Top-quality grades of wood accept finishes better than lower-quality grades that contain defects such as knots and pitch pockets. The knots of yellow and white pines cause more trouble than the knots of such woods as cedar, hemlock, white fir, and larch.

Grain

Quartersawn boards hold paint much better than plain-sawn boards because the bands of summerwood are very narrow. **Summerwood** is the dense, dark-colored portion of the wood. Its cells have thick walls and small cavities. The more porous, light-colored springwood accepts finish more readily. Flat-grained boards hold paint better on the bark side than on the pith side.

Manufacture

The natural expansion and contraction of solid wood can reduce the durability of a finish. Engineered-wood products, however, are manufactured in ways that reduce this problem. From a finishing standpoint, engineered wood has some advantages over solid wood, particularly when used for exterior trim. It behaves predictably and its surface is uniform. It is dimensionally stable over a wide range of widths and thicknesses. It does not have the defects commonly found in solid lumber.

Some engineered-wood trims are primed at the factory. Others may have an unusually smooth finish that takes paint well. For more on this topic, see Chapter 13.



Reading Check

Recall How do hardwood finishing options differ from softwood finishing options?

Types of Finishes

Why are film-forming finishes the most popular of all interior finishes?

Many types of finishes can be used to protect and beautify wood. Finishing technology is constantly improving. New products are introduced to the market each year. It is therefore important to review manufacturer's recommendations for each type that you use. Pay particular attention to any instructions about health and safety.

Finishes can have many different characteristics. For example, a finish can be clear or opaque. It might be suited for exterior use or only for interior use. It can have different levels of sheen. **Sheen** is a description of how shiny a surface is. However, all finishes fall into two basic categories. *Film-forming finishes* coat the wood surface. *Penetrating finishes* soak into the wood.

 **Build It Green** Finishes containing VOCs (volatile organic compounds) are discouraged in many parts of the country. VOCs contribute to air pollution. Regulations restricting their use have been enacted in some states, and other states are now taking steps to restrict the amount of VOCs that can be used in paints and other finishes. Low-VOC finishes are increasingly available and help to minimize the harmful health and environmental effects of VOCs.



 **Figure 33-1 Protection From the Weather**

Protection and Color Paint protects wood from the weather and also adds color and architectural interest to a house.

Film-Forming Finishes

Many finishes protect wood by leaving a coating, or film, on the wood. The most common type of film-forming finish is paint surface (see **Figure 33-1**). Some clear finishes, such as varnish and polyurethane, also fit into this category. The film protects the wood against moisture and seals in natural resins. Pigments may be added to protect wood from ultraviolet (UV) rays. They also add color.

Paint Any paint contains ingredients that make it suitable for a particular use. However, all paints contain the following:

Pigments *Pigments* are either finely ground natural minerals or synthetics. A pigment gives paint color and makes it opaque. A greater percentage of pigment increases opacity.

Binder A **binder** is a resin that holds particles of pigment together. The particles form a film after the liquid evaporates.

Carrier A **carrier** (sometimes called the *vehicle*) is a liquid that keeps the pigments and binders in suspension. A carrier also keeps pigments and binders evenly dispersed (spread out) during application.

Oil-Base Paint Paints that have oil-base binders suspended in a mineral spirit carrier are referred to as *oil-base paints*, or *oil paints*. There are two types of oil-base binders. *Vegetable oil binders* are chiefly linseed oil,



Science: Toxic Gases

VOCs VOCs are toxic chemicals that can cause harmful damage to your lungs, eyes, and central nervous system. In addition, they can combine with other molecules in air and with sunlight to create ozone, a poisonous gas. Ozone in the *troposphere*, or lowest level of atmosphere, is a major source of air pollution. Air pollution damages both animal and plant life. What safety equipment and practices could help protect you when using VOCs?

Starting Hint Review equipment and practices related to breathing safety.

a yellowish oil pressed from flaxseed. *Alkyd binders* are **synthetic**. They are sometimes mixed with linseed oil.

Oil-base paints are less flexible than latex paints. This is an advantage where a tough, stable surface is required. However, oil-base paints tend to become brittle over time. This can cause the paint film to crack. Special solvents are needed to clean tools and equipment used with oil-base paints. A **solvent** is a material that dissolves another material. Solvents include mineral spirits (made from petroleum distillates) and turpentine (made from the resin of pine trees). Check the paint label for manufacturer's recommendations for suitable thinners or solvents.

Latex Paint *Latex paints* have latex-base binders suspended in water. There are two types of latex-base binders. *Acrylic latex* is a synthetic resin that is flexible and very durable. *Vinyl latex* is a synthetic resin that is somewhat less durable than acrylic latex.

Latex paints were first developed for interior use but are now readily available for exterior painting. In fact, research indicates that a good-quality acrylic latex outdoor house paint will generally outlast a good-quality oil-base outdoor house paint. In general, latex paints have the following characteristics:

Versatility Latex paints are easy to apply, even on slightly damp surfaces.

Flexibility The paint film expands and contracts slightly with wood movement. It is less likely to crack than an oil-base film.

Permeability Latex paints do not trap moisture within the wood. This makes it unlikely that water vapor will cause the paint to bubble.

Quick Drying This helps to speed construction.

Easy Cleanup Tools can be washed clean with water before the paint on them dries.

Exterior latex paints have one disadvantage, however. Siding woods such as redwood and cedar contain water-soluble extractives that can bleed through latex paint. This sometimes creates dark stains. To prevent this, paint all surfaces of the wood with an oil-base primer before installation. Then top coat it with acrylic latex paint.

Primer Most paint manufacturers make a primer, or undercoat, for use with their house paints. A **primer** is a paint that has a higher proportion of binder than standard paint. This enables it to hold particularly well to unpainted wood surfaces. Because a primer does not block UV radiation, it must be covered with two coats of standard paint.

Primers are available in oil-base or latex forms. They are typically white but may be tinted slightly for use under dark-colored paints. When painting metal, use a special rust-preventative primer.

Solid-Color Stain Solid-color stain is similar to a thin paint. It comes in latex and oil-base forms and is applied in almost the same way as paint. It is not as durable as paint, however. Solid-color stains are used mainly where they can be recoated frequently.

Penetrating Finishes

Unlike film-forming finishes, penetrating finishes actually soak into the wood. They fill the wood's surface pores. Some are clear,

while others contain pigments. Penetrating finishes are very easy to apply. They allow the wood grain to show, as shown in **Figure 33-2**.

There are several types of penetrating finishes. Some are used primarily on exterior wood. These include oil-base semi-transparent stains and clear water-repellent finishes. (Latex semi-transparent stains are available. They are actually a type of film-forming finish and do not soak into the wood.) Some penetrating finishes are used primarily on interior wood, including furniture. These include Danish oil and tung oil.

Semi-transparent stains work very well on rough surfaces, such as plywood siding and some types of beveled siding. They can also be applied to weathered surfaces without much surface preparation. The pigment in semi-transparent stain protects the wood from UV damage. Penetrating finishes that do not contain pigment are not as effective in protecting wood from UV radiation. High-quality products also contain wood preservatives and water repellents.

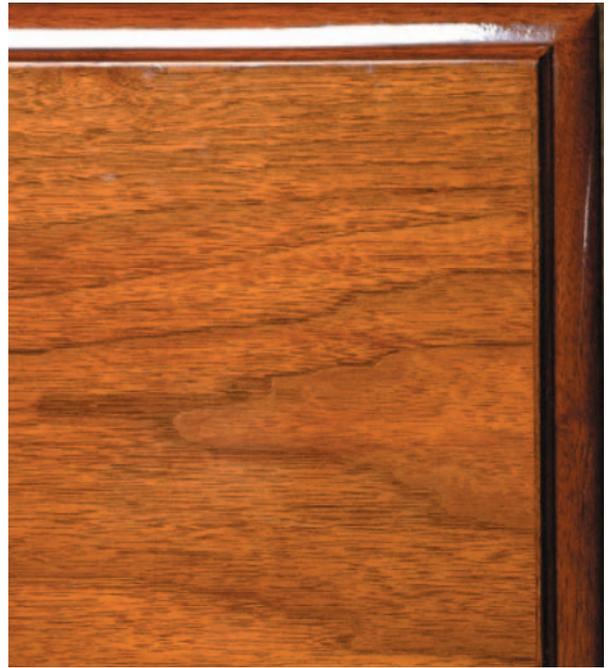


Figure 33-2 Penetrating Finish
The Beauty of Wood A penetrating finish allows the grain of the wood to show. It can be protected with a coat of clear finish.

Section 33.1 Assessment

After You Read: Self-Check

1. What is the purpose of pigments?
2. What is a binder and how does it behave?
3. What is the basic difference in mixtures between oil-base paint and latex paint?
4. Why is it important to cover primer with standard paint?

Academic Integration: Mathematics

5. **Word Problems** Estimate the number of gallons and the cost of acrylic wall paint needed to paint all walls of a rectangular $42' \times 58'$ basement that has walls 7' high. The paint costs \$22.27 per gallon and has a spread rate of 250 sq. ft. per gallon.

Math Concept Some word problems ask for more than one solution component. This problem asks you to find both the number of gallons and the cost of the paint.

Step 1: Calculate the surface area of all walls, floor, and ceilings to be painted.

Step 2: Divide the surface area by the spread rate. Round up to the nearest gallon.

Step 3: Multiply the number of gallons needed by the per-gallon cost of the paint.

 Go to glencoe.com for this book's OLC to check your answers.

Exterior Painting

Preparing to Paint

How can exterior paint reduce cooling costs?

The most common type of exterior finish is paint. In part, this is because paint is available in many colors. Light-colored paints reflect heat away from the house. A

white house, for example, can reflect almost 90 percent of the sun's rays. This can reduce interior temperatures and thus reduce cooling costs. See **Table 33-1** for differences in how colors reflect light.

Paint lasts longer than other exterior finishes. In general, it lasts seven to ten years before requiring recoating. A solid-color

Table 33-1: Light Reflectivity of Colors

	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Black	█									
Light Brown	█	█								
Apple Green	█	█	█							
French Blue	█	█	█	█						
Light Gray	█	█	█	█	█					
Silver Gray	█	█	█	█	█	█				
Coral	█	█	█	█	█	█	█			
Sea Green	█	█	█	█	█	█	█			
Cream	█	█	█	█	█	█	█	█		
Light Buff	█	█	█	█	█	█	█	█		
Pastel Green	█	█	█	█	█	█	█	█		
Oyster White	█	█	█	█	█	█	█	█	█	
Light Cream	█	█	█	█	█	█	█	█	█	
Sunlight Yellow	█	█	█	█	█	█	█	█	█	
Ivory	█	█	█	█	█	█	█	█	█	█
Light Orchid	█	█	█	█	█	█	█	█	█	█
White	█	█	█	█	█	█	█	█	█	█

stain generally lasts only three to seven years. For best appearance and maximum durability, three coats of exterior paint are best over bare wood. This means a primer followed by two finish coats of standard paint. To ensure **compatibility** between primer and finish coats, choose a primer and finish paint of the same brand and type.

Many manufacturers make several paints of differing quality and cost. However, the cost of the paint is a fairly small portion of the total cost of painting a home, and problems can be expensive to correct. It is therefore wise to use only top-quality products.

Supplies and Equipment

Equipment needed for painting exteriors includes the following basic items.

- A stepladder for lower areas and an extension ladder for the highest spots. Include attachments like a paint hook, as in **Figure 33-3**.
- Drop cloths to protect plants and walks from drips
- Caulking gun for sealing joints
- Hammer, nail set, putty, and putty knife
- Mixing pails
- Brushes
- Solvents for cleaning brushes and other equipment
- Cleaning cloths
- Rubber or latex gloves for use when using solvents
- Safety glasses or goggles for use with solvents or when preparing surfaces
- Roller, roller cover, and paint tray for painting large, flat surfaces

Exterior paint can also be sprayed on using a compressor, a paint pot, and a spray gun, such as the rig shown in **Figure 33-4**.



Recall What color exterior paint would you recommend using to reduce cooling costs? Why?

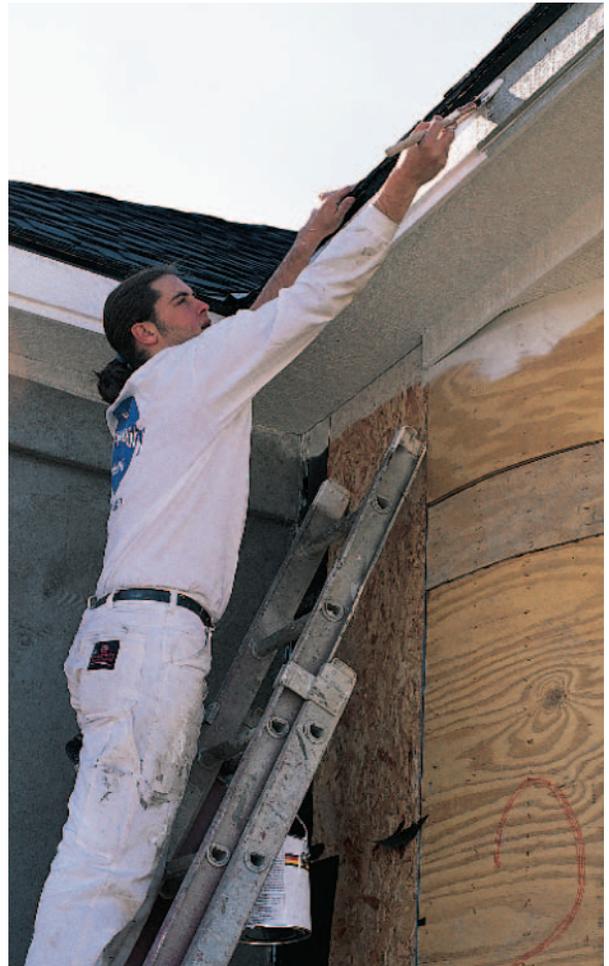


Figure 33-3 Using a Paint Hook
Comfort and Safety When brush painting from a ladder, use a paint hook to support the paint can. The hook hangs on a ladder rung.



Figure 33-4 Equipment for Spray Painting
Speedy and Consistent A rig for spray painting should include a pressure gauge on the compressor (at right) as well as on the paint pot (at left).

Builder's Tip

PROTECTING PLANTS Be careful when covering plantings. Heavy canvas tarps can damage fragile shrubs and flowers. Plastic drop cloths can cause plants to overheat, particularly when in full sun. Where possible, cover plants with light-colored, lightweight cotton sheets or similar drop cloths. They allow plants to breathe and will not be too heavy for small plants. Remove all coverings as soon as painting is complete and do not leave them on overnight.

Planning the Job

Exterior construction should be complete before painting begins. Surfaces to be painted must be properly prepared. Usually, the following steps can be completed before the primer is applied.

Place drop cloths under the area you are about to paint. Cover nearby walks and shrubs. This will shorten cleanup time.

Nail heads may be left at the surface of the wood or sunk below it. Use a nail set and hammer to sink nail heads. Fill them with an exterior-grade wood putty. Seal any knots with primer to prevent stains from bleeding through the finish later.

JOB SAFETY

EXTENSION LADDERS An extension ladder makes painting high areas of the house more convenient. However, you should always check for what is overhead before moving a ladder or tilting it up. An aluminum extension ladder that comes into contact with power lines could conduct electricity with deadly results. Even a wood ladder can conduct electricity, particularly when wet. For more on ladders, see Chapter 7.

Go to glencoe.com for this book's OLC for more on job safety.

Use paintable caulk or high-quality sealant around door and window frames where necessary. Tightly sealed joints help weatherproof the house and prevent moisture damage. Joints between dissimilar materials, such as brick and wood, require extra attention, as shown in **Figure 33-5**.

Painting Techniques

When would it be useful to work from scaffolding?

Many painters prefer to apply primer and finish coats with a brush. This works paint into the wood surface and ensures that every surface and edge is coated. However, the large, flat areas of panel siding are sometimes painted using rollers.

Spray application is faster than brush painting but tends to deposit paint only on the very top surface of the wood. To ensure proper coverage on rough surfaces (such as plywood siding), *roll in* sprayed paint by going over the area with a dry roller. This works the paint into the uneven surface. Rolling in should be done a section at a time immediately after spraying.

Morning dew or water from a brief shower should be wiped off and at least an hour of warm sunshine should follow



Figure 33-5 Sealing Joints

Blocking Water Always caulk around window and door moldings to prevent moisture from rotting the wood.

before any painting is done. After a hard rain, several days may be needed before a surface is dry enough to paint. Always avoid painting when a surface will be heated by full sun.

Applying Paint

The outdoor temperature must stay above 40°F (4°C) for at least 24 hours after oil-base paints are applied. The temperature must stay above 50°F (10°C) for at least 24 hours after latex paints are applied. When using paintable water-repellent wood preservatives prior to painting, best results are obtained when the temperature is above 70°F (21°C).



Reading Check

Summarize List one advantage spray application has over brush painting.

Cleanup

Protect your tools by cleaning them immediately after use, especially brushes and rollers. After using oil-based paints, thoroughly work solvent into the brush bristles. Be sure to wear rubber gloves to protect your skin. Squeeze out as much paint and solvent as possible, then repeat the process of working it into the bristles. Repeat this operation until the paint disappears. Give the brushes a final rinse in clear solvent. Then wash them in soapy water, rinse thoroughly, and spin them dry as shown in **Figure 33-6**.

To clean a roller cover, remove it from the roller frame and scrape off as much paint as possible, as shown in **Figure 33-7**. Then immerse the cover in a generous amount of the correct solvent. Work the solvent into the roller cover until it is clean. Then wash the cover in a mild detergent solution and rinse it in clear water. Disposable roller covers have cardboard cores and generally cannot be cleaned. Solvents used for cleanup of oil-base paints are flammable. Always use them in a well-ventilated area away from pilot lights and other flames.



Figure 33-6 Spinning a Brush

Spin Clean Spin brushes to remove excess water or solvent. Center the brush in a bucket to contain the spray.



Figure 33-7 Cleaning a Roller Cover

5-in-1 Tool A 5-in-1 tool, sometimes called a painter's tool, can be used to scrape excess paint from a roller cover prior to cleaning.

Step-by-Step Application

Basic Painting Technique Primer and finish coats call for the same basic techniques.

Step 1 Even if the paint dealer has mixed the paint mechanically, mix it again just before and during painting. Stir the contents of the can from the bottom up. Then *box* the paint by pouring it from one can into a larger can and stir it again. This evens out any slight variations in color between cans.



Step 2 Load the brush by dipping it about two inches into the paint and tapping the excess off against the inside of the can. Repeat several times.

Step 3 Start painting at the top of the house and work down. This prevents drips and splatters from spoiling previously painted areas. Wearing safety glasses will protect your eyes from paint splatters.

Step 4 Apply the paint generously along siding joints, distributing it evenly. Do not bear down too hard. *Feather* the ends of your brush strokes. This helps avoid a distinct edge and ensures smoothness where one painted area meets another. Always paint with the grain.



Step 5 After painting the gable end of the house, start at a corner and work across. It makes no difference whether you work from the left or right. However, before you move or shorten the ladder, finish an area about four or five feet square.

Step 6 Paint windows with a narrow sash brush. Paint the mullions first, then the rails, and then the stiles. Paint the casing and trim last. Move the sash up and down before the paint dries to prevent sticking.

Step 7 For a panel door, first paint the molding and then the panels. Paint the rails next and finally the stiles.

Step 8 Paint shutters separately. Install them after the rest of the job has been completed.



Go to glencoe.com for this book's OLC for additional step-by-step procedures, applications, and certification practice.

JOB SAFETY

SPONTANEOUS COMBUSTION Any material that has been in contact with a solvent-based product must not be disposed of in the regular trash. This also applies to materials saturated with oil-base or alkyd-base paints and stains. Under the right conditions, rags, paper towels, newspaper, or steel wool can ignite (burst into flame) without being exposed to a heat source or a spark. The process is called *spontaneous combustion*, and it has caused many fires on construction sites. Contaminated materials must be stored in an airtight metal container. An alternative is to soak them thoroughly in water and leave them outdoors to air dry. Proper storage or disposal of contaminated materials will reduce the risk of spontaneous combustion.

Go to glencoe.com for this book's OLC for more on job safety.

To clean brushes used with latex paints, follow the same steps as on page 953, but use soapy water instead of solvent. Rinse the brushes with clear water. Allow them to dry thoroughly before storing.

To protect bristles as they dry, wrap brushes in heavy paper or a cardboard sheath as shown in **Figure 33-8**, and lay or hang them in a dry place. Some painters hang brushes to dry. Store roller covers on

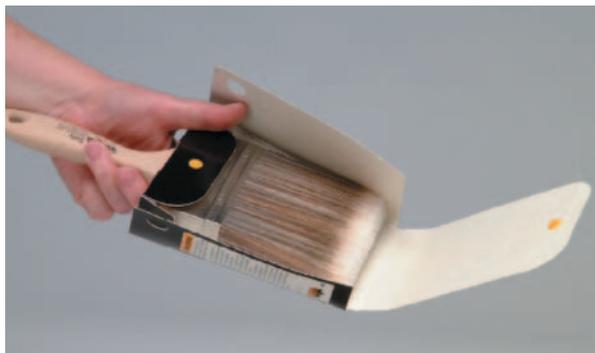


Figure 33-8 Protecting Bristles
Brush Sheath A loose-fitting cardboard cover protects bristles as they dry. Good-quality brushes are usually sold with such a cover.

end so that their nap is not flattened. Allow drop cloths to dry, if damp, before folding them for storage.

If paint has fallen on walkways, scrub it out with a suitable solvent and a stiff brush. Scrub off spatters from latex paint with soapy water before the paint dries.

Paint Problems

Why is mildew such a persistent problem for painters?

Problems caused by improper painting may not show up for months or even years. To avoid these problems, it is important to understand the ways in which paint fails. This section describes some common problems, their causes, and their solutions. Before applying any primer or house paint, always check the label. There you will find recommendations on surface preparation and compatibility with caulks, sealants, and primers.

Cracking and Alligating

If paint cracks, as in **Figure 33-9**, it may have been applied in several heavy coats without sufficient drying time between

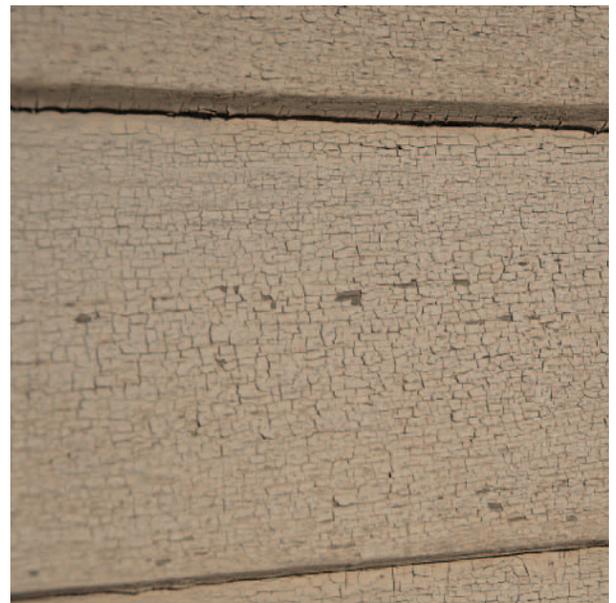


Figure 33-9 Cracking and Alligating
Heavy Coats This can occur when bottom paint layers did not dry sufficiently.



This estimating and planning exercise will prepare you for national competitive events with organizations such as SkillsUSA and the Home Builder's Institute.

Exterior Painting

Paint Jobs

Estimating quantities and expenses for an exterior painting job calls for calculations of materials and labor.

Materials

Step 1 To estimate the amount of paint needed for the exterior of a house, first determine the number of square feet to be covered. Figure the siding area below the roofline by measuring the total distance around the house and multiplying this figure by the height. For the house shown below, the perimeter is 120'; $40' + 40' + 20' + 20' = 120'$. Multiply this number by the height to determine the area: $120' \times 12' = 1,440$ sq. ft.

Step 2 For the gables, multiply the height of the gable at its highest point by half the width of the gable. Do this for each gable. In the example, $6'$ (gable height) \times $10'$ (half the gable width) \times 3 (number of gables) = 180 sq. ft.

Step 3 Add the area for gables to the area for siding below the roofline:

$$180 + 1,440 = 1,620 \text{ sq. ft.}$$

Step 4 Primer and topcoats typically cover different amounts per gallon. Always check the coverage recommendations on the product label. In general, though, divide the total number of square feet by 450 to find how many gallons of primer will be needed. Divide by 500 to find the number of gallons required for each finish coat:

$$1,620 \div 450 = 3.6 \text{ gal. of primer}$$

$$1,620 \div 500 = 3.24 \text{ gal. of paint}$$

Labor

To estimate labor for exterior painting, refer to **Table 33-2** to determine the number of hours required. Multiply this number by your local labor cost per hour to find the total cost.

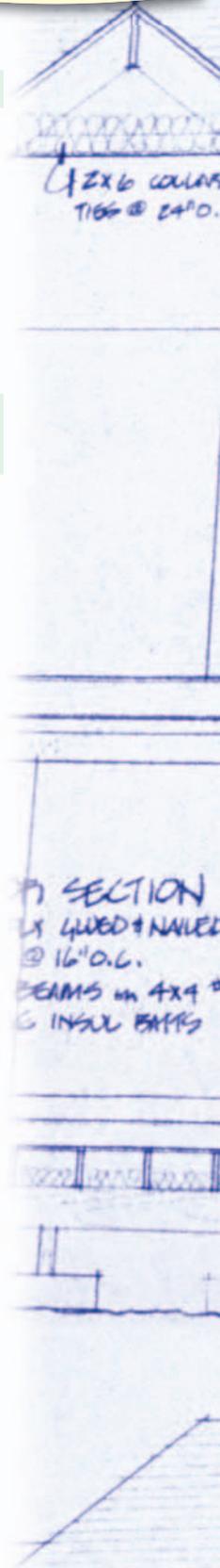
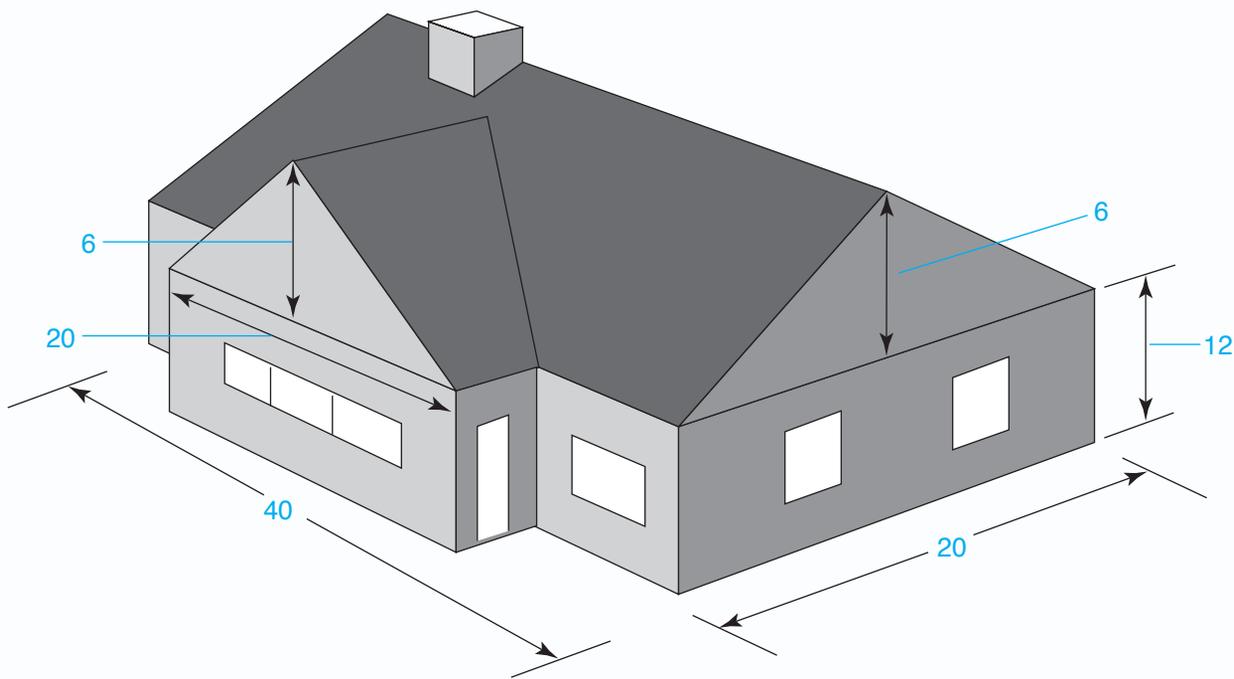


Table 33-2: Estimating Labor for Exterior Painting

Preparation of siding and trim (sanding and puttying)	175 sq. ft. per hr.
Preparation of trim only (brick veneer or masonry construction)	100 sq. ft. per hr.
Brushing windows and door frames	175 lineal ft. per hr.
Brushing wood siding	175 sq. ft. per hr.
Brushing asbestos shingle siding	75 sq. ft. per hr.
Brushing wood shingle siding	150 sq. ft. per hr.
<i>Note: No allowance is included for preparatory work or for setting up scaffolding.</i>	

coats. Also, the primer may not be compatible with the finish coat. To correct the problem:

1. Sand the cracked or alligatored surface smooth.
2. Apply one coat of primer and one top coat of house paint.



Explain What can cause paint to crack?

Localized Peeling

Peeling results when moisture trapped in siding is drawn from the wood by the sun's heat and pushes the paint from the surface, as shown in **Figure 33-10**. One

cause is improper installation of a vapor barrier beneath the siding. To correct the problem:

1. Locate and eliminate sources of moisture. Is the area near a poorly ventilated bathroom or a kitchen? Is there seepage or leakage from eaves, roof, or plumbing?
2. Reduce future moisture by installing bathroom and kitchen exhaust fans.
3. Scrape off the old paint. Scrape down to the wood over the entire board or for a distance of 12" around the peeling area.
4. Sand the surface to fresh wood and spot prime with a recommended primer.
5. Apply a top coat of house paint.



Figure 33-10 Localized Peeling
Peeling Paint Moisture and heat cause peeling.



Figure 33-11 Flaking
Flaking Paint Moisture contributes to flaking.

Flaking

Flaking is caused by the alternate swelling and shrinking of siding as the moisture behind it is absorbed and then evaporates. Brittle paint cracks under the strain and pulls away from the wood, as shown in **Figure 33-11**. To correct the problem:

1. Locate and eliminate sources of moisture. Is the affected area near a bathroom or kitchen? These areas generate a great deal of moisture vapor. Is there seepage or leakage from eaves, roof, or plumbing?
2. Scrape off the flaking paint to expose the wood for about 12" around the area.
3. Sand the surface to fresh wood and spot prime with a recommended primer.
4. Seal all seams, holes, and cracks against moisture, using suitable caulk.
5. Apply a top coat of house paint.

Mildew

Mildew is a microscopic fungus that thrives on many household surfaces, including painted siding such as that shown in **Figure 33-12**. A warm, wet, or humid environment provides the best conditions for its growth. Although mildew is unattractive, it does not cause the wood to decay. However,



Figure 33-12 Mildew
Fungus Mildew thrives in humid environments.

if painted over, it will grow through the new coat of paint. To correct the problem:

1. Gently scrub the entire surface with a solution of $\frac{1}{3}$ cup of trisodium phosphate (TSP) or a comparable substitute, $\frac{1}{2}$ cup of household bleach, and 4 quarts of warm water. Standard TSP is not available in some areas that limit phosphate-based detergents for environmental reasons.
2. Apply one coat of primer. Add mildew-resistant additives to a primer if the likelihood of mildew is high.
3. Apply one top coat of mildew-resistant latex house paint. This product contains a *biocide* that discourages mildew growth.

Extractive Staining

Staining is caused by moisture in redwood and cedar siding that dissolves extractives in the wood. Extractives are natural chemicals found in these woods and tend to be dark in color. The colored moisture seeps into the paint through breaks in the paint film. A stain forms when the water dries. To prevent the problem:

1. Locate and eliminate moisture sources before painting.
2. Back prime the siding boards before installation.



Figure 33-13 Blistering
Blister in the Sun Paint is pushed to the surface by the sun's heat.

To correct the problem:

1. Wash stained surfaces with a mixture of 50 percent denatured alcohol and 50 percent clean water.
2. Allow the surface to dry for 48 hours. Then apply two coats of the house paint.

Blistering

Blistering, like peeling, is caused when moisture trapped in the siding is drawn from the wood by the sun's heat. This pushes paint from the surface, as shown in **Figure 33-13**. To correct the problem:

1. Locate and eliminate the sources of moisture.
2. Scrape off the old paint for a distance of about 12" around the blister condition.



Figure 33-14 Nail Head Staining
Rust Stains A nail head stain on siding. *What causes nail head stains?*

3. Sand the surface to fresh wood and spot prime with primer.
4. Use caulk to seal all seams, holes, and cracks against moisture entry.
5. Apply a top coat of house paint.

Nail Head Staining

Nail head stains are caused when excessive moisture rusts uncoated or poorly coated steel nails used to install the siding, as shown in **Figure 33-14**. To correct the problem:

1. Sand the stained paint and remove the rust down to the bright metal of the nail head.
2. Countersink the nail head $\frac{1}{8}$ " below the surface of the siding. Immediately spot prime the nail head.
3. Fill primed, countersunk holes with exterior-grade putty. Apply two top coats of house paint.

Section 33.2 Assessment

After You Read: Self-Check

1. Why is it important to use good-quality exterior paint?
2. What does it mean to *box* paint and why is boxing paint important?
3. What type of paintbrush is used to paint the mullions of a window?
4. What type of environment is best when using solvents for cleanup of oil-based paints?

Academic Integration: English Language Arts

5. **Preventing Staining** Staining is caused by moisture in redwood and cedar siding that dissolves extractives in the wood. Write a set of step-by-step instructions that will help a first-time painter prevent the problem of staining. Use short, clear sentences and include effective transition words.

 Go to glencoe.com for this book's OLC to check your answers.

Interior Painting

Preparing to Paint

In which rooms would you use a low-sheen paint?

Many different kinds of interior paints are available. The most popular are latex paints, which are easy to apply and dry quickly. Interior paints can make surfaces easy to clean and give them wear resistance. They seal surfaces against moisture and vapor penetration. They also add to the room's attractiveness.

Interior paints are available in various sheens. High-sheen paints are easier to clean, but low-sheen paints have a softer, less glaring appearance. High-sheen paints are used where cleanup is important, such as in kitchens and baths. Low-sheen paints are used in living rooms and bedrooms. Following is a list of paint types in order of their sheen, from greatest to least:

- enamel
- semi-gloss enamel

- pearl
- eggshell
- flat.

Supplies and Equipment

Brushes and rollers are the primary interior painting tools. Other items may be needed to prepare the surface, protect floors and furniture, mix the paint, and cleanup.

Good-quality brushes are expensive but worth the money. With a good brush, you get better results with less effort. The types of brushes shown in **Figure 33-15** are the most common. A 3" or 4" wide brush is recommended for painting trim and for *cutting in* corners and edges. Cutting in means to brush paint carefully along a straight line, such as along the edge of trim. Brushes should be 5" to 7" long and have dense bristles with flagged, not square-cut, ends. **Flagged bristles** are slightly splayed at the tips.



Figure 33-15 Types of Brushes

Most Common These brushes are the ones most often used for interior painting.

Rollers are easier to use and faster than brushes for painting large flat areas. Paint is held in a tray instead of a can. A fibrous sleeve called a *roller cover* is shown in **Figure 33-16**. It is mounted on a metal roller frame. Short-nap roller covers are suitable for most paints and surfaces. Lambswool covers are used for flat finishes on rough or imperfect surfaces. Mounting the roller on an extension pole has several advantages. The painter stands several feet away from the surface being painted so that he or she can better see areas that have not yet been covered properly. Loading the roller or painting low portions of the wall do not require bending over. A ladder is not needed to reach high portions of most walls.

Preparing Surfaces

Good preparation makes the painting job much easier and faster. On remodeling projects, many experienced painters spend more time preparing surfaces than actually painting. Be sure the room is dry, well ventilated, and at a comfortable temperature. Cover finished floors with drop cloths. Mask hardware such as doorknobs and hinges. Also mask wall switches and receptacles. If ceiling fixtures are in place, lower the canopy (the domed portion covering the electrical box) so that you can paint under it.



Figure 33-16 Roller Covers

Choosing the Nap Roller covers come with naps of various lengths, such as $1\frac{1}{4}$ ", 1", $\frac{3}{4}$ ", and $\frac{1}{2}$ ". Longer naps are best for surfaces with a rough texture. Shorter naps are best for smooth surfaces.

Start with a clean surface. On new construction, the walls do not have to be washed. A thorough dusting of the surfaces is usually enough. Fine cracks in walls or nail holes in wood trim should be filled with spackling compound or painter's putty.

When painting ceilings and walls, protect windows and other areas from being splattered with paint by *masking off* with tape. This is even more important when surfaces will be painted with spray equipment. Do not use standard masking tape for masking off. It will leave a sticky residue when removed and interfere with paint adhesion. Instead, use painter's masking tape. It is easily removed and will not mar glass or painted surfaces. To mask off large areas quickly, use masking rolls. This product combines painter's masking tape with a continuous length of either plastic or paper. However, many painters feel that it is better to rely on painting skill than on masking products. They feel that it is faster to carefully cut in than to mask off.

Painting a Room

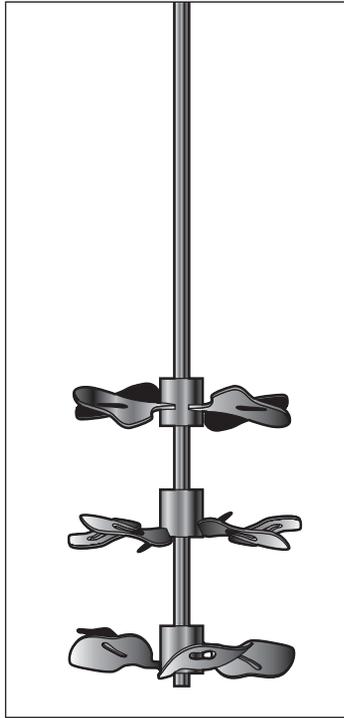
Why is it important to paint the ceiling before the walls?

When surfaces have been prepared and the room is clean, painting can begin. Brushes are used to paint trim and to paint into corners. Rollers are generally used to paint all other surfaces. Sometimes paint may be applied to a room with a combination of spray equipment, rollers, and brushes.

Even if the paint has been mechanically shaken at the paint store, mix it well just before using. Stir rapidly, working pigment up from the bottom of the can. Professional painters buy paint in five-gallon pails. Mixing paddles driven by a heavy-duty, variable-speed electric drill can be used to stir it, as shown in **Figure 33-17** on page 962. When a great deal of paint must be mixed, a heavy-duty paint mixer can be clipped to a five-gallon paint bucket.

Figure 33-17 Mixing Paint

Time Saver A paint mixing paddle and an electric drill can be used to mix paint. A detail of the paddle is shown on the left.



Always start with the ceiling, and then paint the walls. Complete the job by painting wood trim and doors. Clean up as follows:

- Wipe up spatters and spills immediately.
- Clean brushes, rollers, and other tools as soon as you finish using them.

- Wear rubber gloves when cleaning brushes and rollers. The gloves will protect your hands and make cleanup faster.

Interior surfaces are normally under longer and closer observation than are exterior surfaces. Hence, the brushing on, smoothing out, and leveling off of the paint must be done with care. Most plaster and drywall surfaces are finished with two coats of flat paint over a single coat of primer or sealer. Primers and sealers reduce penetration of succeeding coats, so less paint will be needed for good coverage.

Ceilings

Generally ceilings are painted first. This prevents paint splatter from falling on finished walls. Scaffolding or stepladders may be needed if ceilings are unusually high. However, a paint roller mounted on an extension pole is often all that is needed. You will need a small brush for edging the

JOB SAFETY

AVOID FALLS Drop cloths are often used to protect floor surfaces when walls and ceilings are being painted. Plastic sheets can be used but can be slippery. For this reason, many painters prefer to use canvas tarps as drop cloths. Canvas is more durable and slip resistant than plastic.

Go to glencoe.com for this book's OLC for more on job safety.

ceiling. **Edging** is using a brush to paint along the corners between large flat surfaces, where a roller cannot reach.

Roll paint in two- or three-foot strips across the shortest dimension of the ceiling. By doing this, you can paint the next strip before the last edge is dry. Overlapping a dry edge sometimes leaves a mark that shows later. Light strokes help to eliminate lap marks.

Walls

Cut in the edges of a wall by first painting a narrow strip around doors, windows, baseboards, and any other adjoining surfaces. Then edge the top of the wall adjacent to the ceiling as shown in **Figure 33-18**. Finally, fill in the large areas with a roller. Finish one entire wall before beginning the next one.

Builder's Tip

WHAT TO PAINT FIRST There is no general agreement among painters about whether trim or walls should be painted first. Many painters feel that it is easier to cut in when painting trim. Others prefer to paint the trim first and then cut in when painting the walls. Novice painters should try both methods and see which method works better for them.

When using a roller, pour paint into the deep portion of the tray. Work the paint into the roller by moving it back and forth in the tray until the paint is evenly distributed on the roller.



Figure 33-18 Edging a Wall

Outlining with Paint A roller cannot reach into corners or get close to intersecting surfaces, so these areas must be edged first.

Estimating and Planning

Interior Painting

Two-Part Process

Calculating material requirements for interior painting is a two-part process. Wall and ceiling areas are calculated based on square footage. Trim is calculated based on lineal footage. Primer or sealer over smooth walls will cover 575 to 625 sq. ft. per gallon. The first and second coats of paint will cover 500 to 550 square feet. Trim may require a different paint, such as enamel.

Labor costs are based on hourly wage rates or figured as a portion of square footage rates.

Materials

To determine the amount of paint for a room, first calculate the total wall area.

Step 1 To find the area of one wall, multiply the length of the wall by the height of the wall.

If the entire room is to be painted, multiply the perimeter of the room by the height. Windows and doors are not usually subtracted from the total paint requirement unless they are unusually large or numerous.

As an example, see the bedroom in the lower right corner of the floor plan in **Figure 33-19**. Assume that the ceiling height is 8' and that the entire room is to be painted. The end walls are each 10' long and the front wall and closet wall are each 14' long. The perimeter of the room is therefore 48 lineal feet:

$$10 + 10 + 14 + 14 = 48$$

Multiply this figure by the room height to obtain the total wall area:

$$48 \times 8 = 384 \text{ sq. ft.}$$

This room will require 1½ to 2 gallons of paint, depending on the coverage.

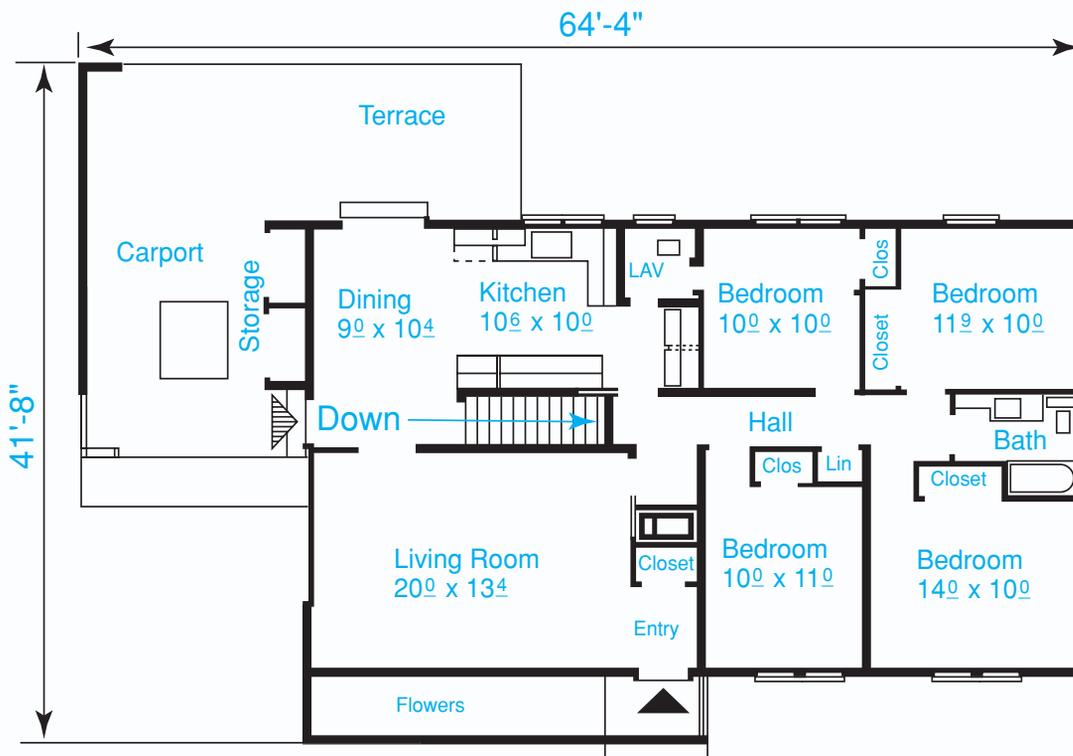


Figure 33-19 Floor Plan



This estimating and planning exercise will prepare you for national competitive events with organizations such as SkillsUSA and the Home Builder's Institute.

Step 2 A window's trim and frame require $\frac{1}{4}$ pint of paint. The bedroom has three windows, for a total of $\frac{3}{4}$ pint. A door frame and door require $\frac{1}{2}$ pint. The closet door is equal to two doors. A total of three doors would then require $1\frac{1}{2}$ pints of paint. Doors and windows together require a total of $2\frac{1}{4}$ pints:

$$(\frac{3}{4} + 1\frac{1}{2} = 2\frac{1}{4})$$

Like the walls, the trim will need both primer and finish coats. For our example, the trim will take one coat of primer ($2\frac{1}{4}$ pints) and two coats of finish ($4\frac{1}{2}$ pints). Since paint is sold in cans no smaller than 1 quart, it will be necessary to buy 2 quarts of primer and 3 quarts of finish. However, this will provide enough extra for painting the baseboard, with some left over to allow for future touch-ups by the homeowner.

Step 3 To determine the amount of paint needed for the ceiling, calculate the area by multiplying the length of the room by its width. In the example, the bedroom ceiling area is 140 sq. ft.:

$$(10 \times 14 = 140)$$

Labor

Step 1 To estimate labor for interior painting, refer to **Table 33-3**. For example, the time needed to apply one coat of paint to one window is about $\frac{3}{4}$ of an hour. If there are ten windows and two coats of finish paint are to be applied, the total time will be 15 hours:

$$10 \times \frac{3}{4} = \frac{30}{4}$$

$$\frac{30}{4} \times 2 = \frac{60}{4} \text{ or } 15$$

Step 2 Multiply this figure by the labor rate per hour to find the total labor cost.

Estimating on the Job

Calculate the amount of paint needed for a room that measures $9' \times 12'$. The ceilings of the room are 9' high, and it has one door and two windows. Include one coat of primer and two coats of finish paint for walls, ceiling, doors, and windows.

Table 33-3: Estimating Labor for Interior Painting

Preparation of trim (including sanding and spackling)	115 lineal ft. per hr.
Molding (chair rails and other trim up to 6" wide)	150 lineal ft. per hr.
Windows (including sash, trim, sills, and apron)	Each coat $\frac{3}{4}$ hr. per window
Paneled door (including door and trim)	Each coat $\frac{3}{4}$ hr. per door
Flush door (including door and trim)	Each coat $\frac{1}{2}$ hr. per door
Finishing walls and ceiling:	
Brush	150 sq. ft. per hr.
Roller	300 sq. ft. per hr.

Note: No allowance for preparatory work or for setting up scaffolding is included.



Figure 33-20 Rolling a Wall

Basic Technique After the wall has been edged, roll paint on the wall in a W pattern. Note the use of an extension handle.

Next, start on one side of the wall and paint a **W** on the surface as shown in **Figure 33-20**. Use slow, smooth strokes. Quick strokes and heavy uneven pressure may cause bubbles or splatters. When you have covered a few square feet, use parallel vertical strokes to spread the paint evenly.

Trim

Paint interior trim and woodwork using a 1½" sash brush for windows and a 2" brush for other parts of the trim. Complete one small area at a time, brush on the paint with back-and-forth strokes. Level the paint with even strokes in one direction. Work quickly but carefully. Never go back to touch up a spot that has started to dry, because this will mar the surface.

In general, trim is painted from the top down. For example, crown molding would be painted first and baseboards last. This



Figure 33-21 Using a Paint Guard

Floor Protector When painting baseboard, use a paint guard to protect the floor and to keep the brush from picking up dirt.

prevents finished work from being splattered by paint from above. A cardboard, metal, or plastic guard held flush against the bottom edge of the baseboard protects the floor, as shown in **Figure 33-21**. It will also prevent the brush from picking up dirt.

Painting windows calls for particularly careful work. Adjust a double-hung window so that you can first paint the lower part of the upper sash. Then raise the upper sash almost to the top to finish painting it. Paint the lower sash next. With the window open slightly at the top and bottom, it can be finished easily. Paint the recessed part of the window frame next, then the frame, and finally the windowsill.

When painting a door, paint the jambs and casing first. Then paint the edges of the door itself. Finally, paint the front and back face of the door. When painting the face of a raised-panel door, paint the panel molding first, starting at the top as shown in **Figure 33-22**. Keep a clean cloth handy to wipe off any paint that gets on the area surrounding the panels. Then paint the remainder of the door.



Recall In general, how should trim be painted?

Cleanup

The cleanup of tools and equipment used for interior painting is no different than that for exterior painting (see Section 33.2). Remember that some paints and solvents (such as mineral spirits) are flammable.

- Use paints and solvents in a well-ventilated area.
- Store or dispose of rags and newspapers in the proper manner.
- Wipe up spatters and spills immediately.
- Clean brushes, rollers, and other tools as soon as you finish using them.
- Wear rubber gloves when cleaning brushes and rollers. The gloves will protect your hands and make cleanup faster.

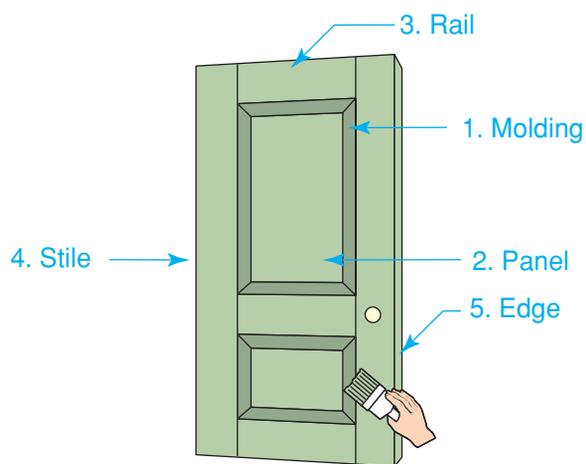


Figure 33-22 Painting a Door
Painting Strategy To paint a raised-panel door, follow the sequence shown here. In general, try to work from the center out, and paint rails before stiles.

Section 33.3 Assessment

After You Read: Self-Check

1. Which rooms in a home are low-sheen paints typically used in?
2. What is edging?
3. Describe two ways to prevent the brush from picking up dirt from the floor when painting baseboard.
4. Which part of a raised-panel door should be painted first and which part second?

Academic Integration: Mathematics

5. **Knowns and Variables** To paint the walls and ceiling of an average room in a house, it takes 45 minutes to move or cover furniture and assemble materials, 15 minutes of preparation per 100 sq. ft., 45 minutes of painting per 100 sq. ft., and 30 minutes to clean up. Write an algebraic equation that could be used to compute the total time it takes to paint any room.

Math Concept An algebraic equation uses knowns and variables. Variables are quantities that may change. They are represented by symbols such as letters.

Step 1: Convert time measurements to the same unit of measure.

Step 2: Let T equal the total time in hours. Let A equal the area to be painted.

Step 3: Write the equation using known and variable values. Simplify.

Go to glencoe.com for this book's OLC to check your answers.

Review and Assessment

Section

33.1

Chapter Summary

Film-forming finishes coat the wood surface. Penetrating finishes soak into the wood. In each type of finish are pigments, binders, and carriers that make that finish suitable for a particular use. Paint is the most common type of film-forming finish.

Section

33.2

Surface preparation is important when painting wood. To get the best results, finishes are best applied by brush. On new wood, the first coat of paint should be primer, followed by two top coats of standard paint. Paint should not be applied if temperatures are not suitable. Proper application of paint avoids many problems that are difficult to correct later.

Section

33.3

Interior painting procedure should minimize paint splatter and cleanup. Various tools, such as rollers, can be used to make the work go more quickly. These tools can improve the quality of the job as well and minimize strain on the painter.

Review Content Vocabulary and Academic Vocabulary

- Use each of these content vocabulary and academic vocabulary words in a sentence or diagram.

Content Vocabulary

- summerwood (p. 946)
- sheen (p. 947)
- binder (p. 947)
- carrier (p. 947)
- solvent (p. 948)
- primer (p. 948)
- flagged bristles (p. 960)
- edging (p. 963)

Academic Vocabulary

- synthetic (p. 948)
- compatibility (p. 951)

Speak Like a Pro

Technical Terms

- Work with a classmate to define the following terms used in the chapter: *opaque* (p. 946), *film-forming finishes* (p. 947), *penetrating finishes* (p. 947), *pigments* (p. 947), *vehicle* (p. 947), *oil-base paints* (p. 947), *vegetable oil binders* (p. 947), *alkyd binders* (p. 948), *latex paints* (p. 948), *roll in* (p. 952), *box* (p. 954), *feather* (p. 954), *spontaneous combustion* (p. 955), *biocide* (p. 958), *cutting in* (p. 960), *roller cover* (p. 961), *masking off* (p. 961).

Review Key Concepts

- Identify the two basic types of finishes.
- Name the basic ingredients of paint.
- List the steps in painting a house exterior.
- Identify the steps in painting an interior.
- Identify problems with painted finishes.
- Demonstrate how to paint windows and doors.

Critical Thinking

9. **Discuss** Why is it important to clean and store painting tools immediately after use?

Academic and Workplace Applications

STEM Mathematics

10. **Buying Enough Paint** Sharon estimated the amount of acrylic latex ceiling paint needed to paint the ceilings in her new house. The living room measures 13 ft. by 18 ft., the hallway measures 4 ft. by 18 ft., the dining room measures 13 ft. by 14 ft., 3 bedrooms measure 12 ft. by 12 ft., and the master bedroom measures 16 ft. by 20 ft. The paint has a spread rate of 400 sq. ft. per gallon. Sharon bought 3 gallons and 1 quart of paint. Will she have enough paint?

Math Concept When solving a word problem, translate the wording into smaller numeric equations using key words.

Step 1: Calculate the total area of the ceilings to be painted.

Step 2: Calculate the spread rate of 3 gallons and 1 quart of paint.

Step 3: Compare the total area of the ceiling to the spread rate of the paint.

STEM Science

11. **Natural Paints** Though many paints are now made with zero or low VOCs, they may still contain toxic chemicals such as formaldehyde. Natural paints can be made with bases of milk, clay, or plant oils. Research information about one type of natural paint. Summarize your findings in a one-page report.

21st Century Skills

12. **Communication Skills** As you know, each trade involved in the construction of a new home has the potential to affect the work of other tradespeople. Assume you were hired to paint the interior of a newly constructed home. In your preparation, you notice that the drywall surfaces in several rooms are uneven. Write a one-page letter to the homeowner explaining the problem. Explain to them the possible reasons why the drywall is uneven. Suggest which tradespeople they could contact to fix the deficient work.

Standardized TEST Practice



Short Response

Directions Write one or two sentences in response to the following questions.

13. Why are finishes important to wood?
14. How long should one wait before painting an exterior surface after a hard rain?
15. What size brush is recommended for painting trim and for cutting in corners and edges?

TEST-TAKING TIP

Before the day of the test, ask your teacher if the test will include multiple choice, true or false, and/or essay-style questions. Just knowing the type of questions will help you prepare for a test.

*These questions will help you practice for national certification assessment.