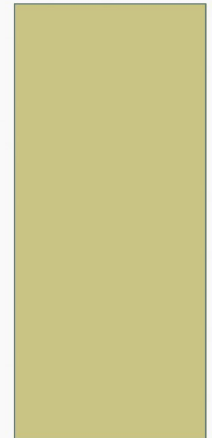


BUILDING MATERIALS

USE IN RESIDENTIAL CONSTRUCTION



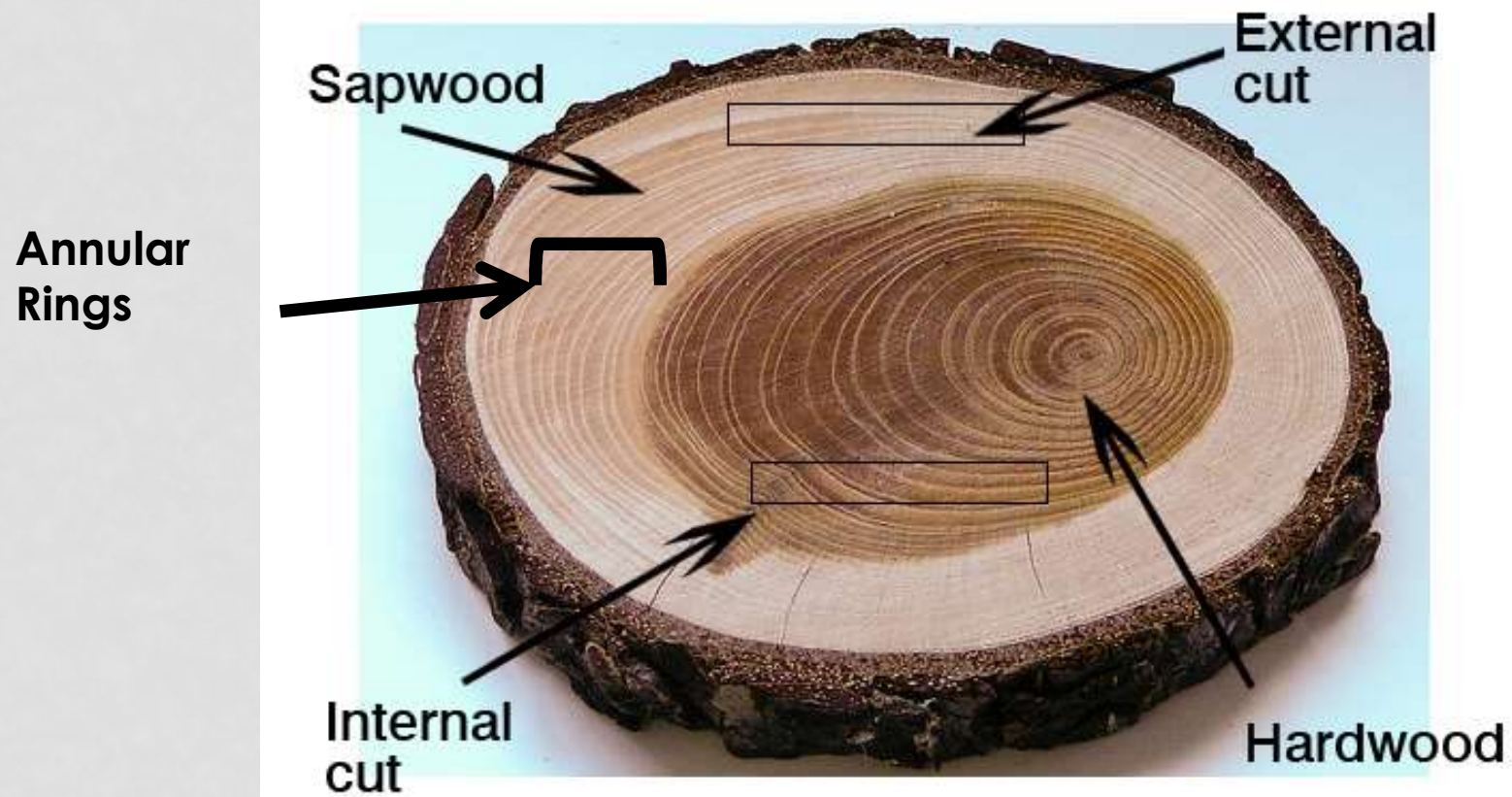
OBJECTIVE

- Students will:
 - Be able to identify various types of lumber and building materials and their uses.
 - Identify the different gradings and markings of lumber and building materials.
 - Identify the safety precautions associated with lumber and building materials.
 - Calculate the quantities of lumber and wood products using industry-standard methods.
 - Describe fasteners, anchors, and adhesives used in residential construction.

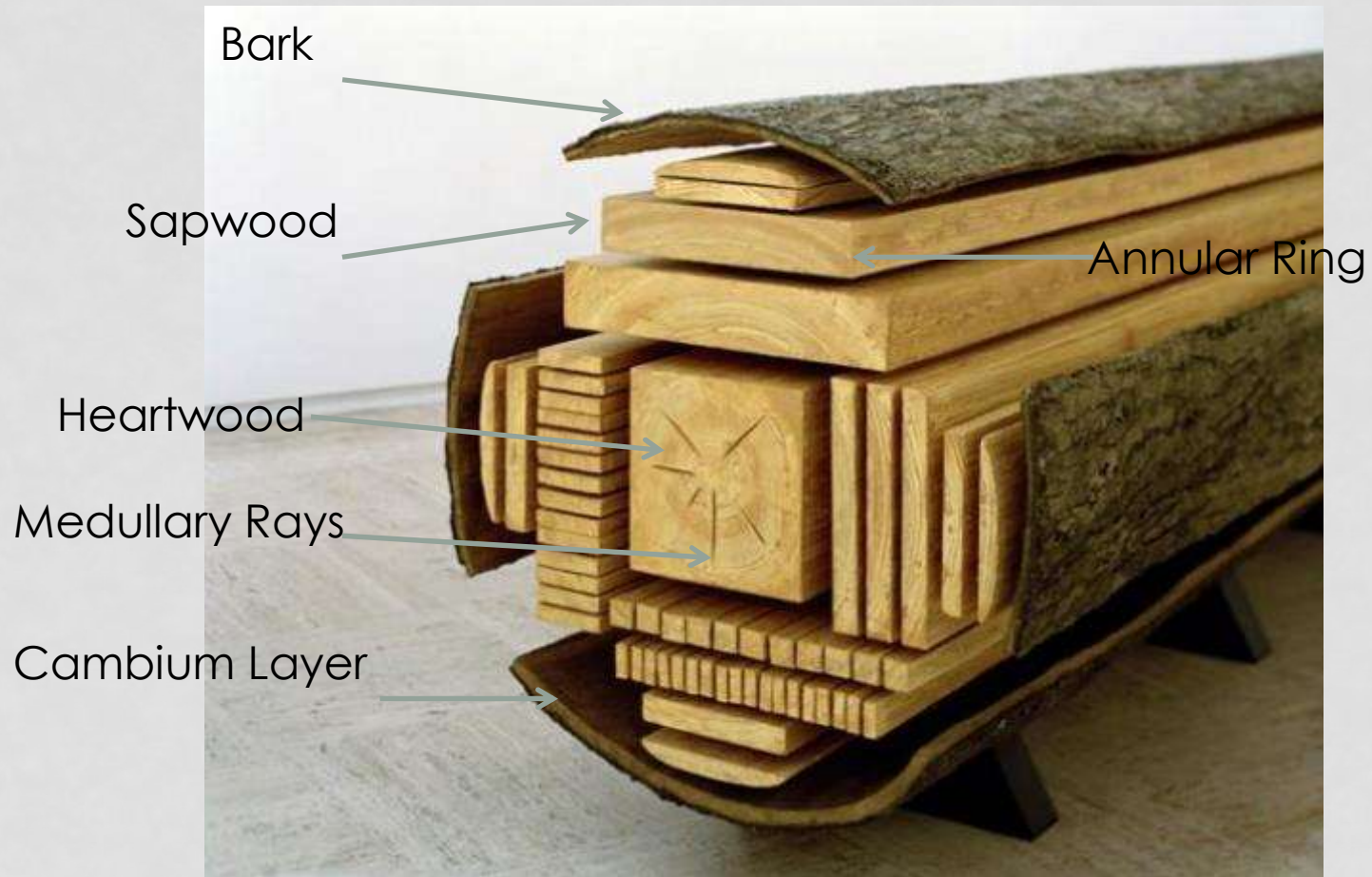
LUMBER

- Wood has several advantages as a building material:
 - It is easily worked.
 - It is durable.
 - It has beauty.
 - It can absorb shock from sudden loads.
 - It is free from rust and corrosion.
 - It is light-weight.
 - It is adaptable to many uses.

LUMBER

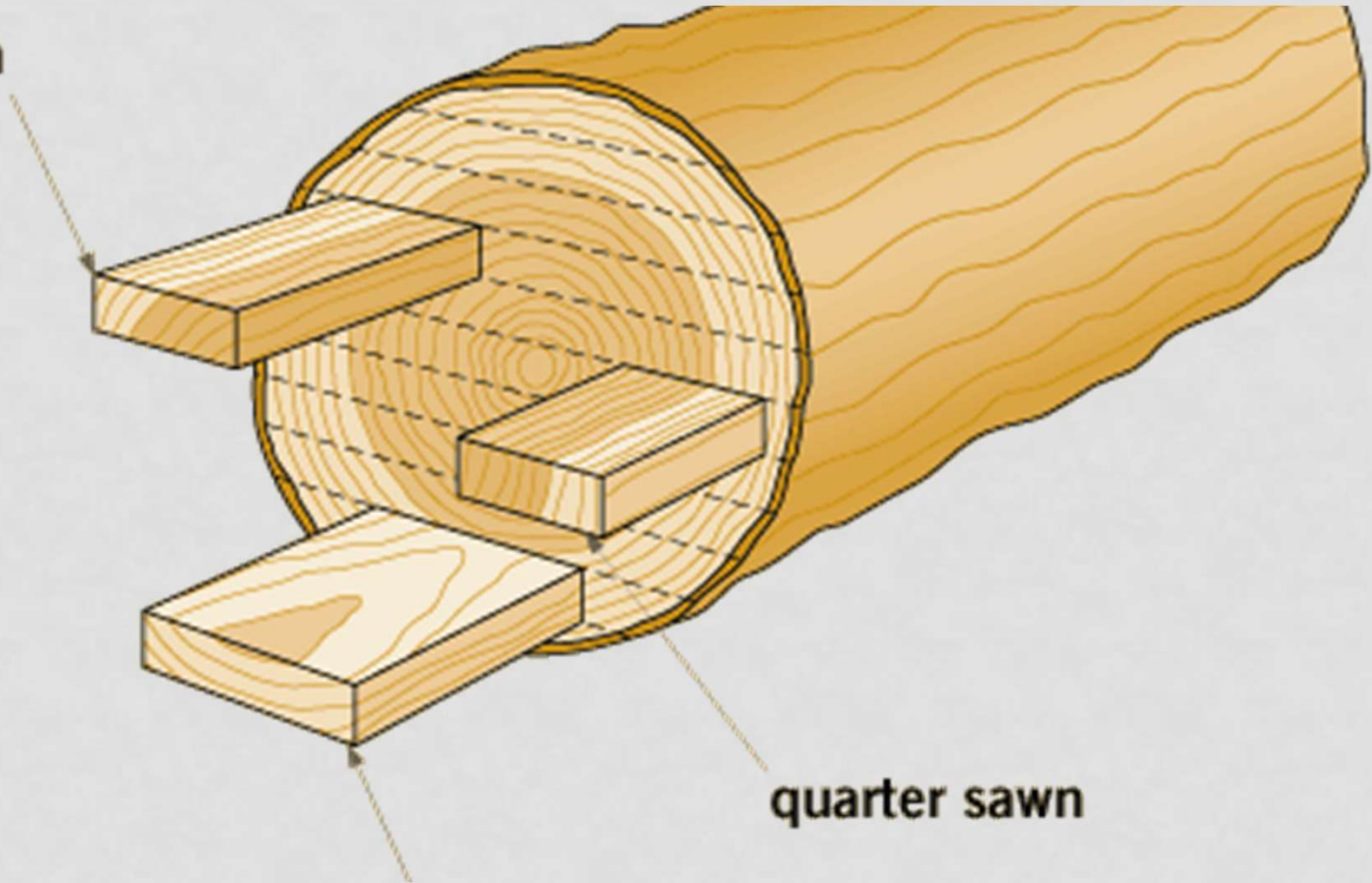


LUMBER



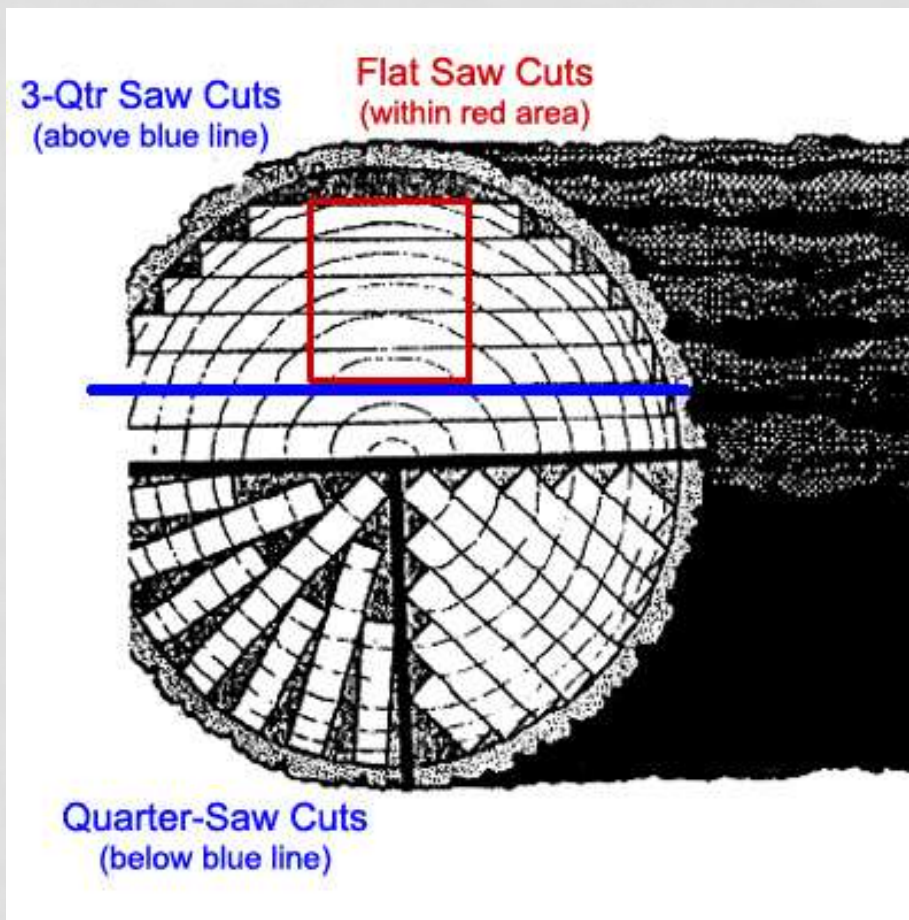
LUMBER

rift sawn



quarter sawn

LUMBER



HARDWOOD VS. SOFTWOOD

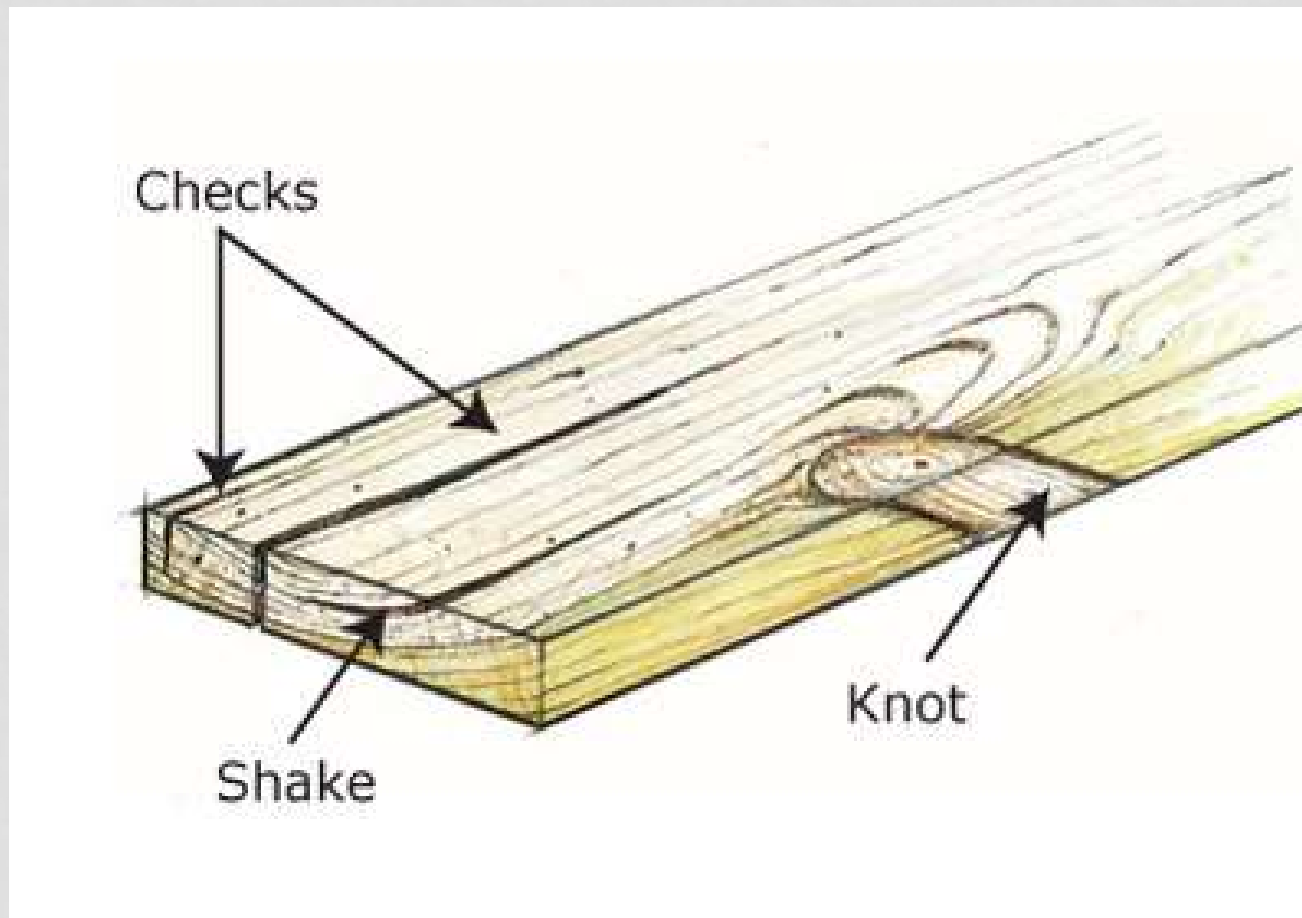
- Hardwood is from deciduous trees (leaf bearing)
 - Ash, Mahogany, Maple, Oak, Poplar, Walnut
- Softwood is from coniferous trees (cone-bearing).
 - Cedar, Fir, Hemlock, Pine, Spruce
- Some “softwoods” are actually harder than some “hardwoods.”

DRYING LUMBER

- Kiln Drying
 - Most common
 - Only takes a few days
 - Results in lower moisture content
- Air Drying
 - Less common
 - Takes up to three months,
 - Results in higher moisture content

DEFECTS IN LUMBER

- Surface Check



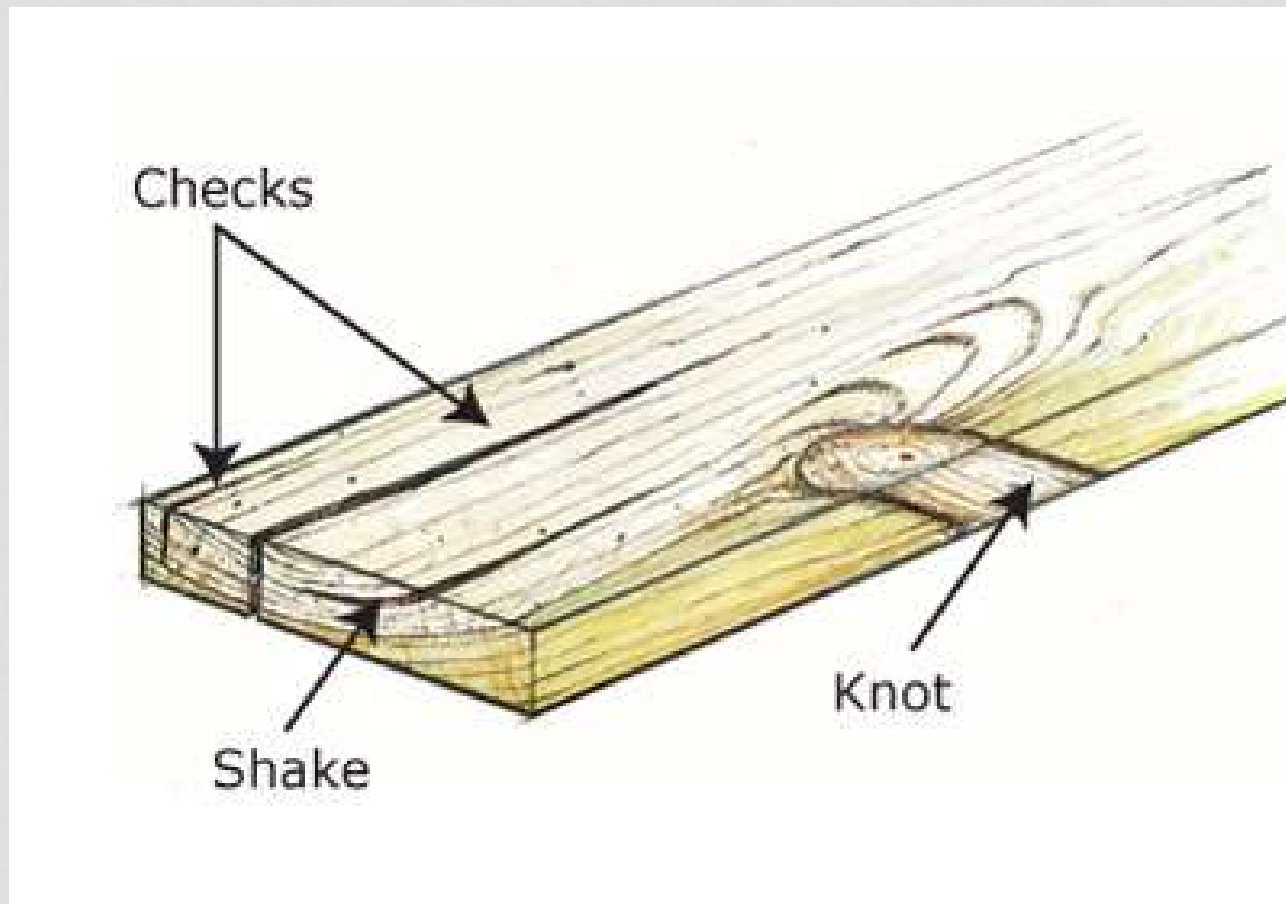
DEFECTS IN LUMBER

- Pitch Streak



DEFECTS IN LUMBER

- Shake



DEFECTS IN LUMBER

- Split



DEFECTS IN LUMBER

- Cup
- Bow
- Crook (Crown)
- Twist



DIMENSIONAL LUMBER

DIMENSIONAL LUMBER

North American Softwoods

- The length of a unit of dimensional lumber is limited by the height and girth of the tree it is milled from.
- In general the maximum length is 24 ft.
- Pre-cut studs save a framer much time, because they are pre-cut by the manufacturer for use in 8-, 9-, and 10-ft ceiling applications, which means the manufacturer has removed a few inches of the piece to allow for the sill plate and the double top plate with no additional sizing necessary.

DIMENSIONAL LUMBER

- In the Americas, *two-by's*,
 - (2×4s, 2×6s, 2×8s, 2×10s, and 2×12s)named for traditional board thickness in inches, along with the 4×4, are common lumber sizes used in modern construction.
- They are the basic building blocks for such common structures as platform-frame housing.
- Dimensional lumber made from softwood is typically used for construction, while hardwood boards are more commonly used for making cabinets or furniture.

DIMENSIONAL LUMBER

- Lumber's *nominal* dimensions are larger than the actual standard dimensions of finished lumber.
- Historically, the nominal dimensions were the size of the green (not dried), rough (unfinished) boards that eventually became smaller finished lumber through drying and planing (to smooth the wood).
- Today, the standards specify the final finished dimensions and the mill cuts the logs to whatever size it needs to achieve those final dimensions.
- Typically, that rough cut is smaller than the nominal dimensions because modern technology makes it possible to use the logs more efficiently.

DIMENSIONAL LUMBER

- For example, a "2×4" board historically started out as a green, rough board actually 2 by 4 inches.
- After drying and planing, it would be smaller by a nonstandard amount.
- Today, a "2×4" board starts out as something smaller than 2 inches by 4 inches and not specified by standards, and after drying and planing is reliably 1 ½ by 3 ½ inches.
- The standardization of lumber sizes makes for efficiency in planning and carrying out the construction process.

LUMBER GRADING

- Lumber Terms:
 - Dimensional Lumber
 - Dimensional lumber is lumber that is supplied in nominal 2", 3", or 4" thicknesses with standard widths.
 - Light framing, studs, joists, and planks are classified as dimensional lumber.
 - Nominal size is the size by which a piece of lumber is **known** and sold on the market.
 - Dressed (actual) Size.
 - The dressed size of lumber is the dimensions of lumber after it has been surfaced (planed) on a surfacing machine.
 - A 2 x 4 is dressed to 1 ½" x 3 ½"

DIMENSIONAL LUMBER

- North American softwood dimensional lumber sizes:

One-by's					Two-by's				
Nominal			Actual		Nominal			Actual	
Thickness		Width	Thickness	Width	Thickness		Width	Thickness	Width
1	by	2	$\frac{3}{4}$ "	$1\frac{1}{2}$ "	2	by	2	$1\frac{1}{2}$ "	$1\frac{1}{2}$ "
1	by	4	$\frac{3}{4}$ "	$3\frac{1}{2}$ "	2	by	4	$1\frac{1}{2}$ "	$3\frac{1}{2}$ "
1	by	6	$\frac{3}{4}$ "	$5\frac{1}{2}$ "	2	by	6	$1\frac{1}{2}$ "	$5\frac{1}{2}$ "
1	by	8	$\frac{3}{4}$ "	$7\frac{1}{2}$ "	2	by	8	$1\frac{1}{2}$ "	$7\frac{1}{2}$ "
1	by	10	$\frac{3}{4}$ "	$9\frac{1}{2}$ "	2	by	10	$1\frac{1}{2}$ "	$9\frac{1}{2}$ "
1	by	12	$\frac{3}{4}$ "	$11\frac{1}{2}$ "	2	by	12	$1\frac{1}{2}$ "	$11\frac{1}{2}$ "

DIMENSIONAL LUMBER

- Posts and Beams:

Four-by's					Six- & Eight-by's				
Nominal			Actual		Nominal			Actual	
Thickness		Width	Thickness	Width	Thickness		Width	Thickness	Width
4	by	4	3 1/2"	3 1/2"					
4	by	6	3 1/2"	5 1/2"	6	by	8	5 1/2"	7 1/2"
4	by	8	3 1/2"	7 1/2"	8	by	8	7 1/2"	7 1/2"

LUMBER GRADING

Dimension

Light Framing 2" to 4" thick 2" to 4" wide	Construction Standard Utility Economy	This category for use when high strength values are <i>not</i> required; such as studs, plates, sills, cripples, blocking, etc.
	Stud Economy Stud	An optional all-purpose grade limited to 10 feet and shorter. Characteristics affecting strength and stiffness values are limited so that the "Stud" grade is suitable for all stud uses, including load bearing walls.
Structural Light Framing 2" to 4" thick 2" to 4" wide	Select Structural No. 1 No. 2 No. 3 Economy	These grades are designed to fit those engineering applications where higher bending strength ratios are needed in light framing sizes. Typical uses would be for trusses, concrete pier wall forms, etc.
Structural Joists and Planks 2" to 4" thick 6" and wider	Select Structural No. 1 No. 2 No. 3 Economy	These grades are designed especially to fit in engineering applications for lumber six inches and wider, such as joists, rafters, and general framing uses.

LUMBER GRADING

- Grading Terms
 - Boards (BD)
 - Light Framing (LF)
 - Joists & Planks (J&P)
 - Beams & Stringers (B&S)
 - Posts & Timbers (P&T)

LUMBER GRADING

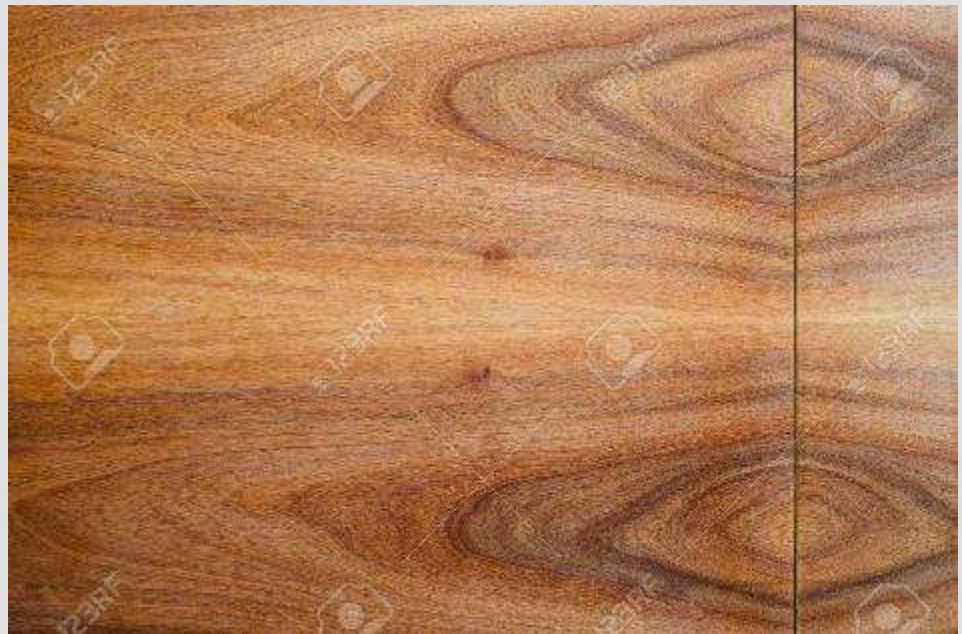
- Other Lumber Terms:
 - Dressed Lumber
 - Dressed lumber is that which has been surfaced on a planing machine.
 - S1S Surfaced on one side
 - S2S Surfaced on two sides
 - S1E Surfaced on one edge
 - S2E Surfaced on two edges
 - S4S Surfaced on all four sides

LUMBER GRADING

- Other Lumber Terms:

- Matched Lumber

- Matched lumber is edge-dressed or end-dressed and shaped to make a close tongue & groove (T&G) joint at the edges or ends when laid edge-to-edge or end-to-end.



LUMBER GRADING

- Other Lumber Terms:
 - Patterned Lumber
 - Patterned lumber is shaped to a pattern in addition to being dressed, matched, or ship-lapped, or any combination of these workings.



LUMBER GRADING

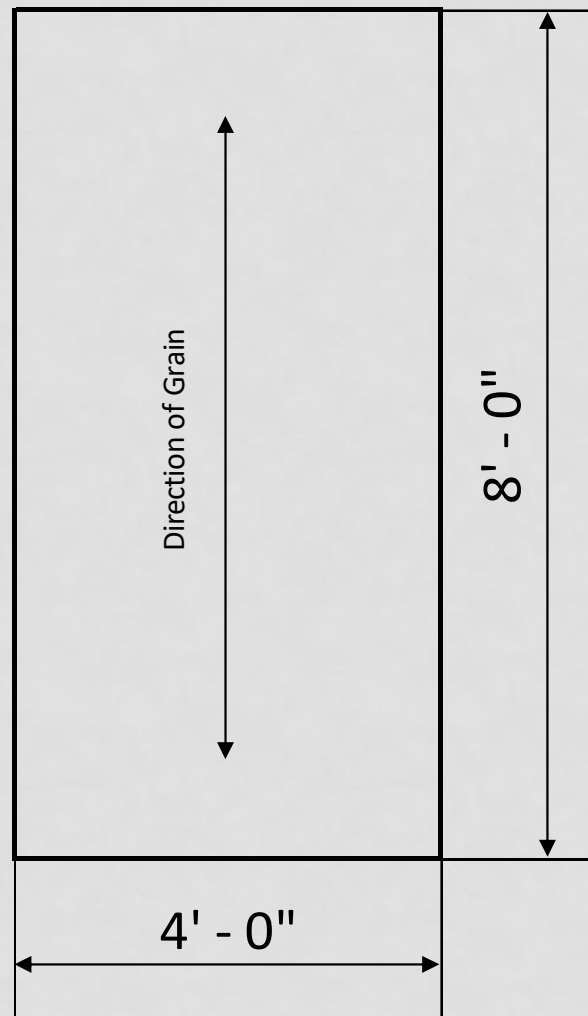
- Other Lumber Terms:
 - Rough Lumber
 - Lumber as it comes from the sawmill prior to any dressing operation is called rough lumber.
 - Stress-Grade Lumber
- Stress-grade lumber is that which has assigned working stress and elasticity values in accordance with
- Surface Lumber
- Framing Lumber
- Finish Lumber
- Select Lumber

SHEET GOODS

SHEET GOODS

- Sheet goods used in construction are different kinds of material that are manufactured, and are a standard size to fit the type of framing used in the US today.
- The standard size of plywood and other sheet goods is 4' – 0" x 8' – 0", with the grain of the wood running in the long (8') direction.

SHEET GOODS



SHEET GOODS

- Plywood
- Hardboard
- Particle Board
- High-Density Overlay (HDO)
- Medium Density Overlay (MDO)
- Oriented Strand Board (OSB)
- Mineral Fiberboards

SHEET GOODS

- **Plywood**

- Plywood is made of layers (plies) of wood veneers.
- A layer/ply may be 1/16" to 5/8" thick.
- There will always be an *odd number* of plies.
- The center layer is called the "core."
- As layers are added they are placed alternately at right angles.
- Layers with the grain at right angles to the core are called "crossbands."
- The outer exposed layer is called "veneer."

SHEET GOODS

- Veneers are made by the rotary cutting of wood.
- In the final manufacturing process, hot glue is applied by machine to the core, crossbands, faces, and plies.
- The rough plywood sheet is compressed in a hot press to near the final thickness.
- Sheets are then cut to size (width and length) and then sanded to the final thickness.

SHEET GOODS

- **Plywood Sizes**
- 4' – 0" x 8' – 0" is the standard size for residential and commercial construction.
- Other sizes are available for specialty applications.

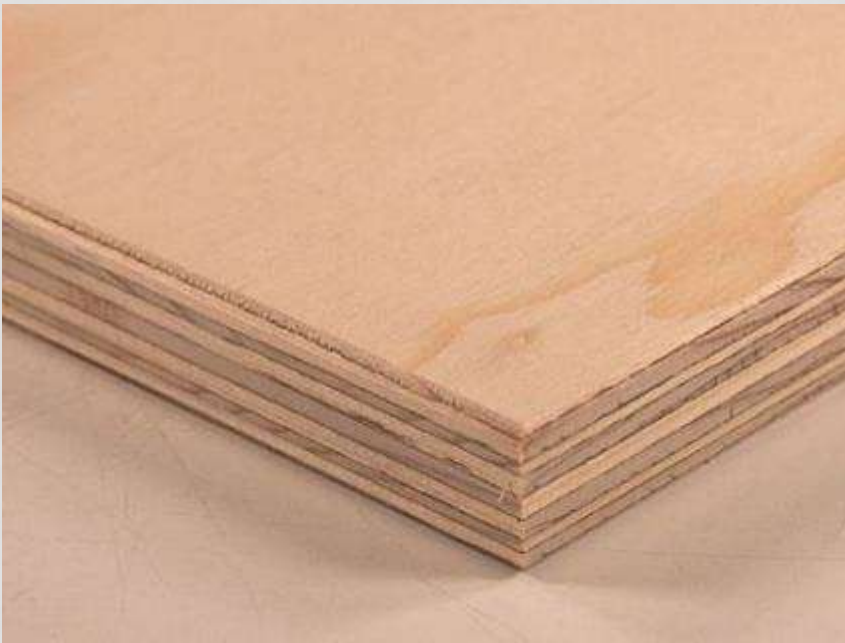
SHEET GOODS

- Plywood Thicknesses

<u>Nominal</u>	<u>Actual</u>
1/8"	3/32"
1/4"	5mm
3/8"	11/32"
1/2"	15/32"
5/8"	19/32"
3/4"	23/32"

PLYWOOD

Higher quality (more plies).

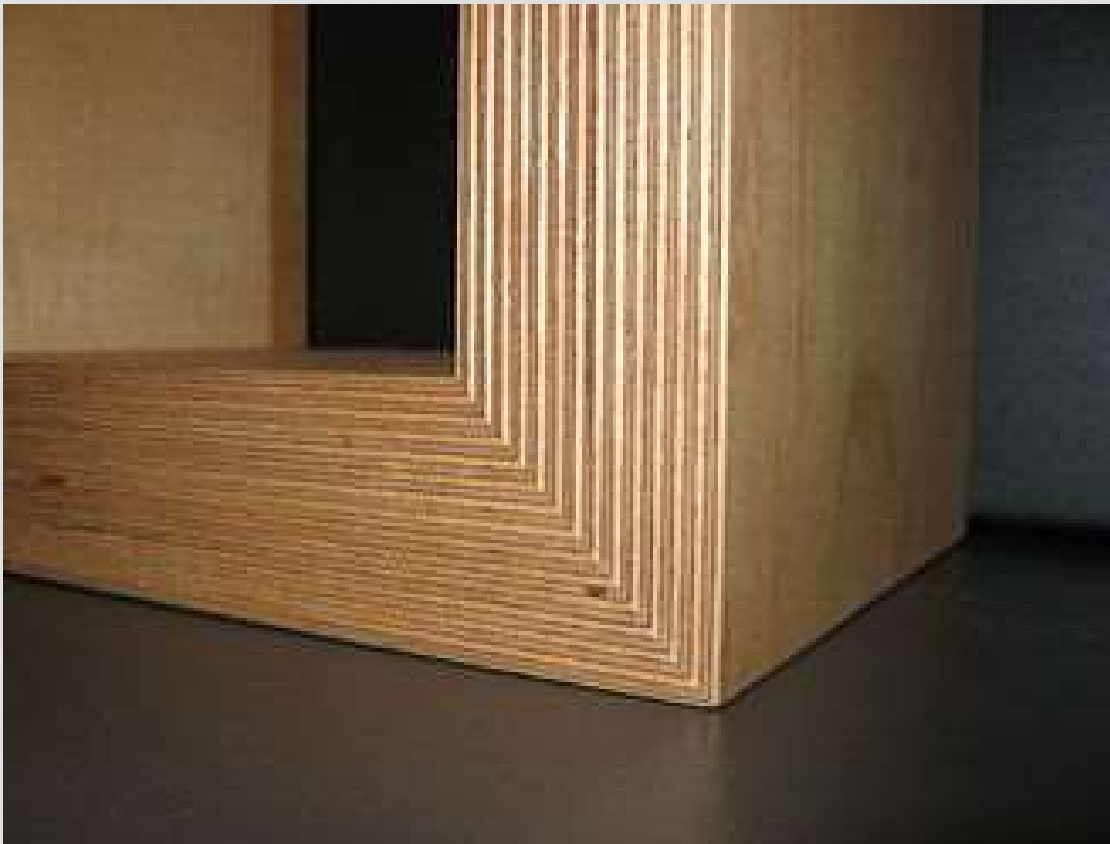


Average quality (fewer plies).



PLYWOOD

- Very high quality (Birch, many plies).



PLYWOOD GRADES

Grade	Description
A	Face and back veneers practically free from all defects.
A/B	Face veneers practically free from all defects. Reverse veneers with only a few small knots or discolorations.
A/BB	Face as A but reverse side permitting jointed veneers, large knots, plugs, etc.
B	Both side veneers with only a few small knots or discolorations.
B/BB	Face veneers with only a few small knots or discolorations. Reverse side permitting jointed veneers, large knots, plugs, etc.
BB	Both sides permitting jointed veneers, large knots, plugs, etc.
C/D	For structural plywood, this grade means that the face has knots and defects filled in and the reverse may have some that are not filled. Neither face is an appearance grade, nor are they sanded smooth. This grade is often used for sheathing the surfaces of a building prior to being covered with another product like flooring, siding, concrete, or roofing materials.
WG	Guaranteed well glued only. All broken knots plugged.
X	Knots, knotholes, cracks, and all other defects permitted.
WBP	Weather and Boil Proof used in Marine Ply. Designation replaced by EN 314-3.

ORIENTED STRAND BOARD

- **Oriented strand board (OSB)** is a type of engineered wood similar to particle board, formed by adding adhesives and then compressing layers of wood strands (flakes) in specific orientations.
- It was invented by Armin Elmendorf in California in 1963.
- OSB may have a rough and variegated surface with the individual strips of around 2.5 cm × 15 cm (1.0 by 5.9 inches), lying unevenly across each other and comes in a variety of types and thicknesses.

ORIENTED STRAND BOARD

- **Uses**

- OSB is a material with favorable mechanical properties that make it particularly suitable for load-bearing applications in construction.
- It is now more popular than plywood, commanding 66% of the structural panel market.
- The most common uses are as sheathing in walls, flooring, and roof decking.

ORIENTED STRAND BOARD

- Uses (cont.)
 - For exterior wall applications, panels are available with a radiant-barrier layer pre-laminated to one side; this eases installation and increases energy performance of the building envelope.
 - OSB also sees some use in furniture production.

ORIENTED STRAND BOARD

- OSB in production before pressing in a thermal press.



ORIENTED STRAND BOARD

- OSB, closeup of corner.



ORIENTED STRAND BOARD

- OSB used in housing construction.



ORIENTED STRAND BOARD

ORIENTED STRAND BOARD