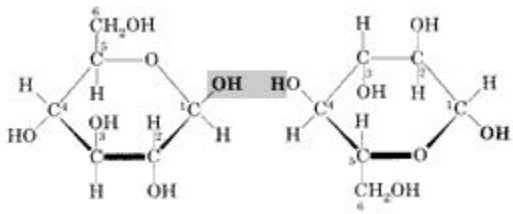
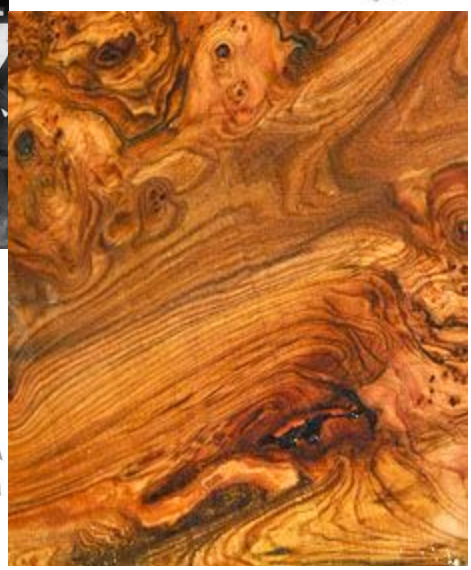
WOOD TECHNOLOGY

ENGLISH TEXTBOOK





CONTENT

This textbook was compiled as an appendix to the bachelor thesis Design of a textbook for the field of study "Wood Technology" at the Faculty of Forestry and Wood Technology. I would like to dedicate this textbook to all struggling students of the study programme Wood Technology who were my greatest inspiration.

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UNIT 1: WOOD SCIENCE

Reading: Basics of the wood structure

Take a tree and peel off the outer "skin" or (1) and what you'll find is two kinds of wood. Closest to the edge there's a moist, light, living layer called (2) packed with tubes called xylem that help a tree pipe water and nutrients up from its roots to its leaves; inside the sapwood there's a much darker, harder, part of the tree called the (3), which is dead, where the xylem tubes have blocked up with resins or gums and stopped working. Around the outer edge of the sapwood (and the trunk) is a thin active layer called the (4) where the tree is actually growing outward by a little bit each year, forming those famous (5) that tell us how old a tree is. Slice horizontally through a tree, running the saw parallel to the ground (perpendicular to the trunk), and you'll see the annual rings (one new one added each year) making up the cross-section. Cut vertically through a tree trunk and you'll see lines inside running parallel to the trunk formed by the xylem tubes, forming the inner structure of the wood known as its (6). You will also see occasional wonky ovals interrupting the grain called (7), which are the places where the branches grew out from the trunk of a tree. Knots can make wood look attractive, but they can also weaken its structure .

Recent wood can often be identified by macroscopic characteristics, particularly by colour, (8), odour, weight and structure. As such characteristics are generally modified or destroyed in fossil, historic or carbonized wood, only a few species or species groups of the indigenous flora can be identified with the naked eye or only with the aid of a magnifier (5 to 20x).

Coniferous wood

In coniferous wood it is possible to distinguish the species which have (9) from those which do not. The transition from earlywood to latewood can be sharp or continuous. Within a conifer's trunk, the majority of the wood is comprised of long, thin cells called tracheids.

Ring porous dicotyledonous wood

The diameter of the pores in the earlywood is much greater than the diameter of the pores in latewood. Arrangement and size of pores in the latewood, fine and large (10) can be differentiated.

Semi-ring to diffuse porous dicotyledonous wood

In semi-ring porous woods, the pores are more numerous in earlywood, in diffuse porous woods the size of pores and distribution is more regularly. Arrangement and size of pores, fine and large rays differ from species to species

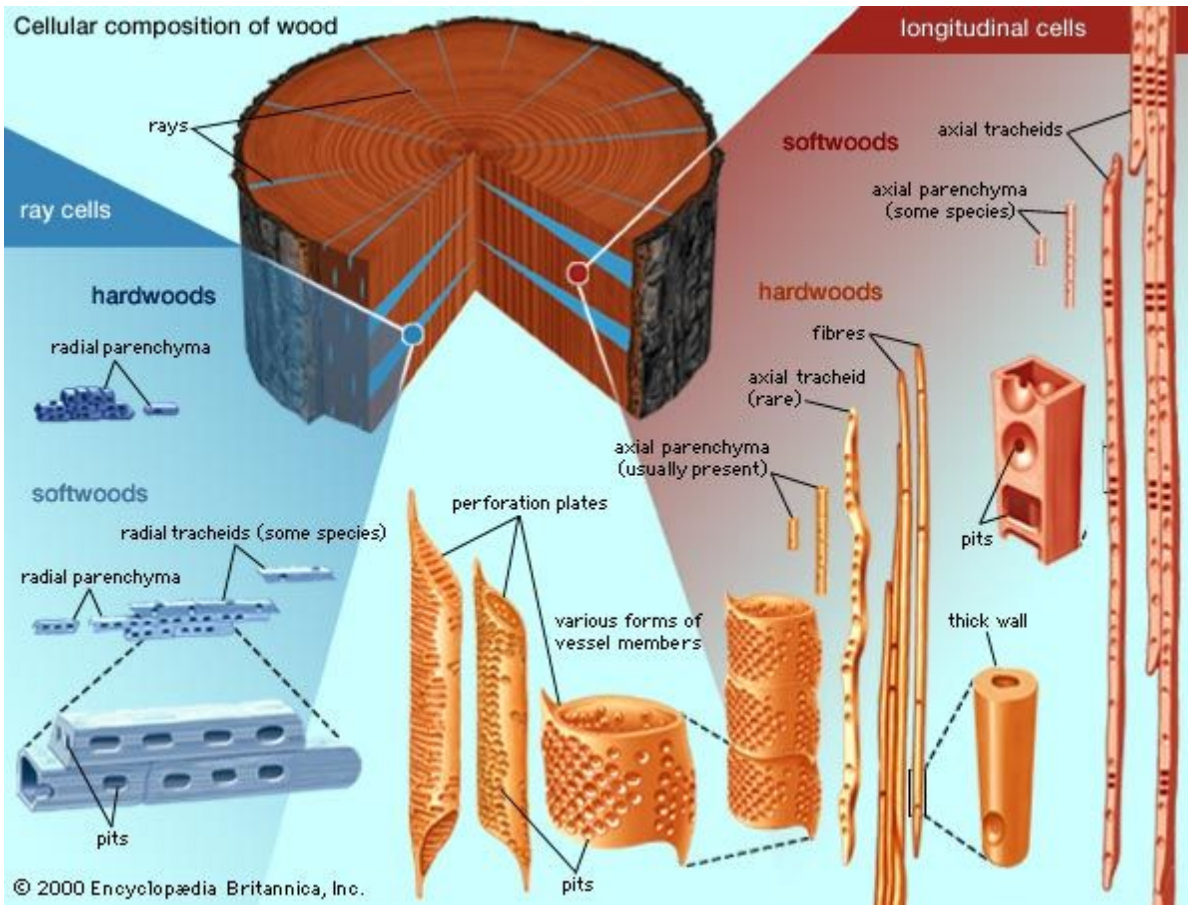
Task 1: Fill in the gaps with appropriate term from the following selection.

resin canals - bark - cambium - knots - heartwood - latewood - grain - sapwood - annual rings - rays - gloss

Task 2: Can you think of other features of microscopic and macroscopic structure of wood which were not mentioned in the reading? Discuss it in pairs.

Hardwoods:

Softwoods:



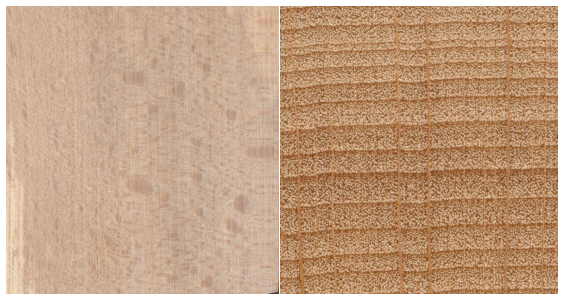
Task 3: Try to name following kinds of wood. You can use the latin name to help you. Identify if the wood belongs to the coniferous (C), ring porous dicotyledonous (RPD), semi-ring dicotyledonous (SRD) or diffuse porous (DR) group of woods.

1. *(Quercus)*

2. *(Pinus)*

3. *(Taxus)*

4. *(Fagus)*



5. *(Picea)*

6. *(Fraxinus)*

7. *(Betula)*

8. *(Prunus)*

9. *(Juglans)* 10. *(Malus)*

Task 4: Match antonyms

compression wood	lignin
cellulose	broadleaf
latewood	shrinking
needle-leaved	tension wood
swelling	earlywood

Nanocellulose is a new wonder material that is simply wood/plant matter that has been carefully smashed to pieces, and then reformed into neatly-woven nanoscale crystals and fibers. You start with wood pulp, remove any non-cellulose impurities (lignin) using a homogenizer, and then gently beat the mixture to separate each of the cellulose fiber. The material has unbelievable use potential and it is transparent. Try to search the internet for the future use of nanocellulose in e.g. car glassing.

Task 5: Decide whether the expression describes mechanical or physical properties of wood

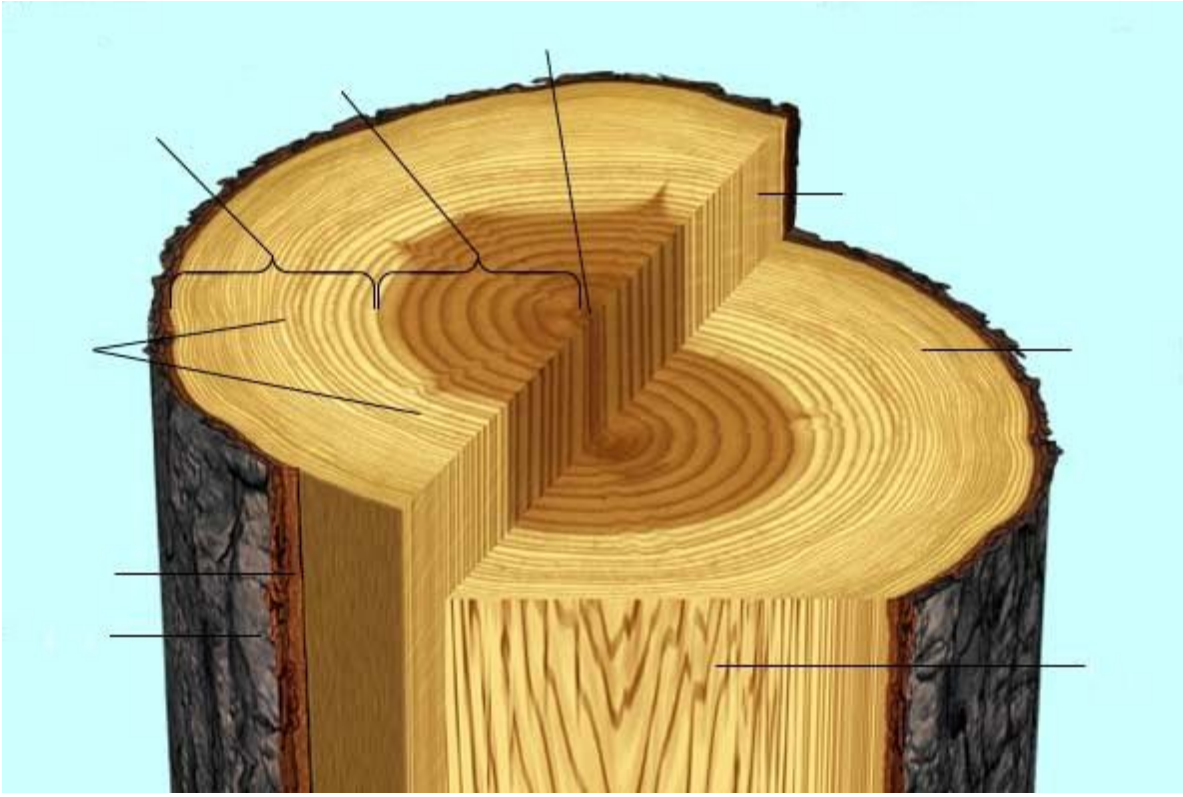
swelling - shear - shrinking - compression - fatigue - moisture content - modulus of elasticity - equilibrium moisture content - tension - density - acoustic properties - thermal properties - fire retardancy - modulus of rupture - hygroscopicity

Mechanical:

Physical:

Task 6: Complete the picture with the expressions from the box

pith - tangential section - inner bark - outer bark - sapwood - radial section - heartwood - transverse/cross section - annual/growth rings



Writing: Description

Task 7: Read the description of walnut wood.

Black Walnut is semi-ring porous, with medium-sized pores throughout and larger pores at the edge of its growth rings. The wood has a low level of shrinkage when drying, and suffers very little seasonal movement. At 1000 lbf Janka, the wood isn't exceptionally hard, but can stand up to a fair amount of abuse. Walnut is straight-grained and remarkably easy to work with in almost every application. The wood cuts and sands evenly, finishes nicely, glues well, and can be steam-bent with stable and predictable results.

Task 8: Write your own description of your favourite wood. Use 50 - 100 words

The wood is

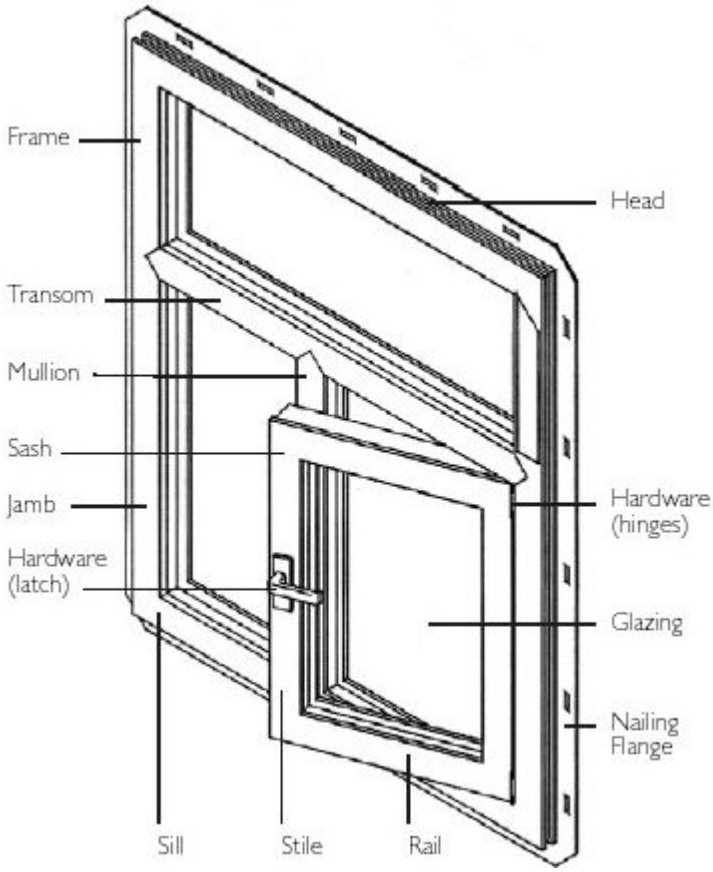
- Avoid summarizing - be specific
- You can include numbers with units but only the most important and contextual ones
- Try to involve senses - how the wood looks, feels, smells or even its acoustic properties
- Include a picture

Reading: Windows

1.

The horizontal and vertical portions that surround the sash. These are usually made of the same materials as the sash and may be manufactured with or without nailing flanges. Together with sash design and construction are important for both energy efficiency and appearance.

2.



It can be a solid sheet of glass, or several panes divided by a ’muntin”.A muntin is a secondary frame that holds the window-panes in the sash. Some are made of tempered glass, to resist breakage, and some are made of laminated glass, which not only reduces breakage, but if the window does break, the glass shards will be too small to cause injury. There two basic groups of windows according the layers: two glazed or three glazed windows.

3.

Windows come either fixed or operable (openable). Fixed windows do not open. Operable windows have a unit assembly of stiles and rails for holding the glass that moves when the window opens. They are available in a variety of sliding or hinged models. It can be made of wood, vinyl, metal or fiberglass and should make a tight seal with the frame when the window is closed. However, if the seal is too tight, the operable portion of the window may be difficult to operate.

Task 1: Study the picture with the basic anatomy of a window. There are three main components of a standard window. Fill in the paragraph headlines in the reading naming these three components.

Task 2: Match the pictures with the definitions of the windows.

Casement window: Hinged on one or two sides and swings open like a door. This design provides the best seal and has the lowest air leakage for a window that opens.

Awning window: Hinged at the top and opens out from the bottom. With an effective seal, this design minimizes air infiltration.

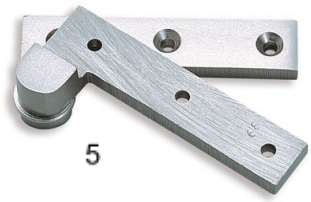
Horizontal slider: Consist of two sashes, one or both of which slide horizontally in the frame.

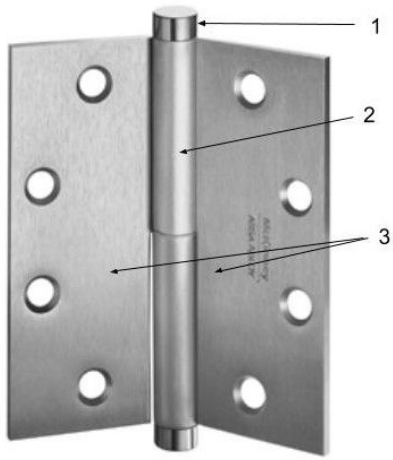
Hopper window: Hinged at the bottom and opens in or out from the top. An effective seal minimizes air infiltration.

Tilt-and-turn window (also called dual-action): swings from the side or pivot from the middle. Others pivot from both the bottom (like a hopper) and the side (like a casement). This allows for cleaning the outside of the window from the inside of the house and can be a valuable feature if a window is in a location where it's difficult to get at from the outside.

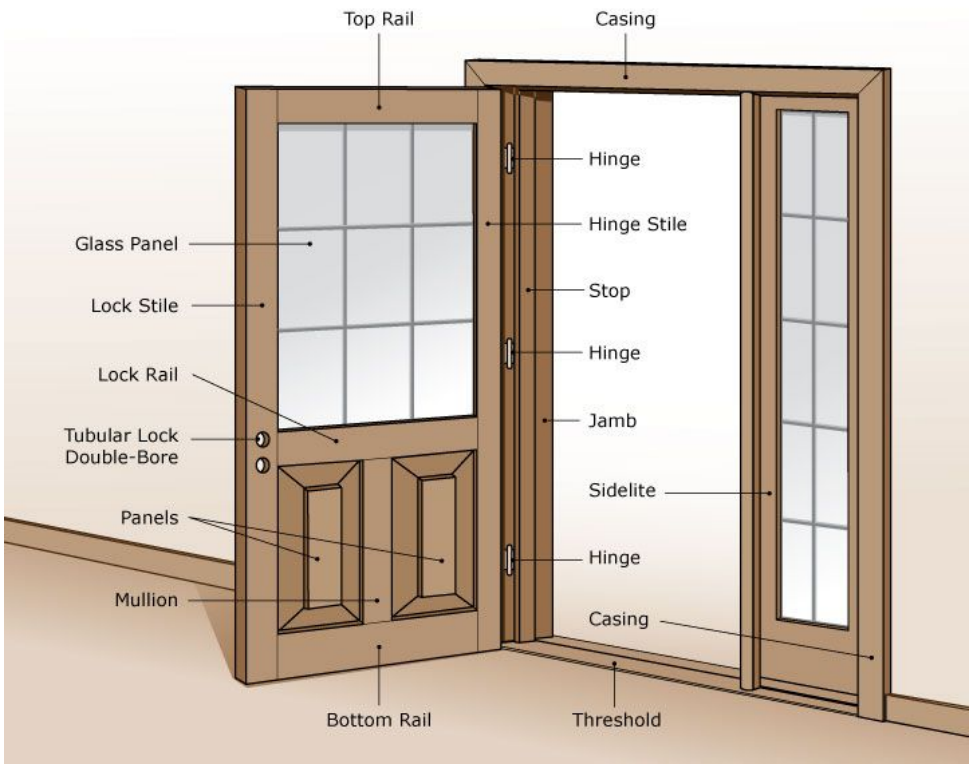
Task 3: Read the short description and label the diagram or vice versa.

A. A butt hinge has two **leaves**, connected by a **knuckle** and a **pin** around which the **leaves** can rotate. Apart from butt hinge there are **continuous hinges** and **pivot hinges.**

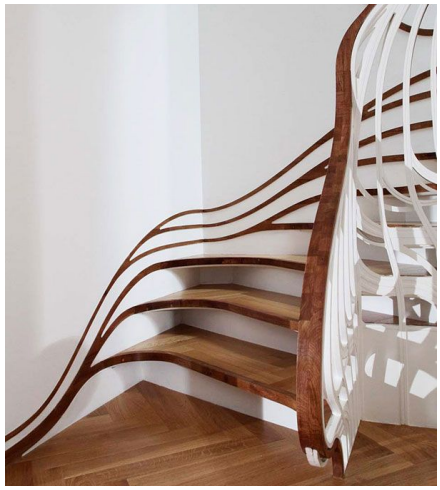




B. The (1) is a part of door which covers the gap between doors and wall. The door itself are hung on (2)which allow the movement. Two part doors as shown in picture have smaller part called (3) in this case it is glazed. The main part of the door is constructed of hinge and lock (4) which are vertical and horizontal (5)according to its position - top, lock, bottom. The filling parts between the rails and stiles are called (6) glass or wooden. The dividing part of panels are called (7). When you go through the door you need to pass (8), the bottom part of the door frame.

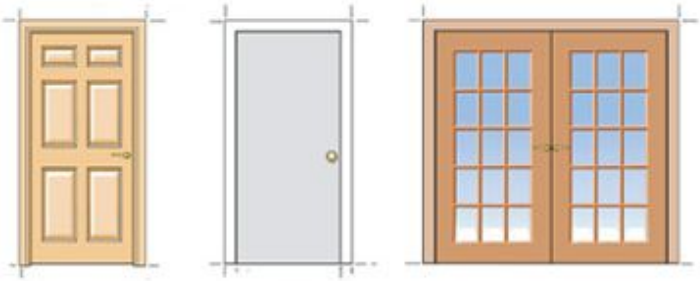


Task 4: Come up with ideas concerning staircase. You can write them in Czech and use dictionary or enclosed glossary to translate your expressions. Use the picture to help you. Focus on the part terminology. Work in pairs.



Task 5: Match the names of indoor/outdoor doors with their names. There is one expression which you need to use twice.

panel - bifold - windowed - decorative carved - storm - french - flush - patio-sliding - pocket - bypass



EXTERIOR DOORS ↑

← INTERIOR DOORS

Writing: Surrey Bespoke Floor Solutions - Wood Floor Installation and Maintenance

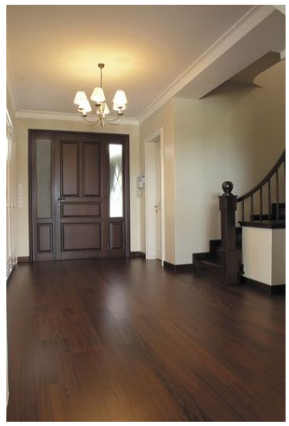
Task 6: Read the following description of service provided by Ben Saunders. Focus on the language used.

Surrey Flooring Solutions

Solid Wood Flooring

Solid wood flooring or real wood flooring which it is also known as is great for that luxury feel. You can find solid wood flooring in a number of finishes and different types of hardwood. With this flooring you will find it is more solid to the touch which will help with sound absorption and warmth underfoot.

Engineered Flooring



Engineered flooring gives the same look of solid wood flooring but is put together in a different way. Engineered flooring is layered flooring designed with a thin hardwood layer on the surface to give you that real wood feel. It can offer more stability to other floors due to the layering of the floor, so it can be used areas where you would like to use under floor heating. Engineered flooring also comes in a variety of finishes and hardwood layers.

Laminate Flooring

Laminate flooring is the most cost effective of the flooring options. It gives the look of real wood flooring and is durable too. With most laminates now coming with glueless click system it can be quick to fit. Laminate flooring can be used in many areas throughout your home.

Sub floor

When looking to fit your new floor Ben will also check the sub floor. He will check this as if the subfloor is not flat or level it will create a problem for the fitting of your new floor. Ben is more than happy to prepare the floor to get the perfect finish.

Floor Sanding and Maintenance

By a process of sanding and finishing it with a lacquer or stain Ben can bring your floor back to its former glory.

Get In Touch

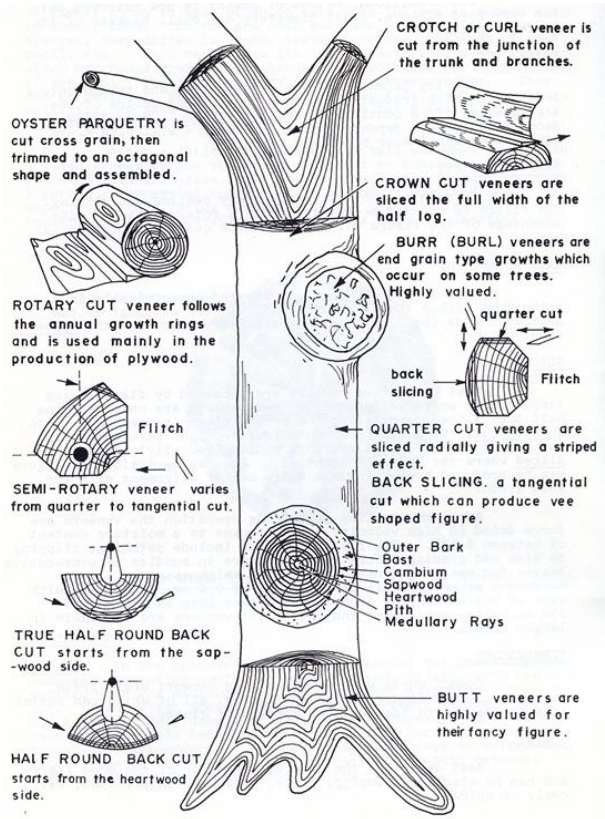
Please don't hesitate to get in touch with Ben for any of your flooring needs. If you have a query about a job you would like undertaking Ben would be more than happy to answer any questions.

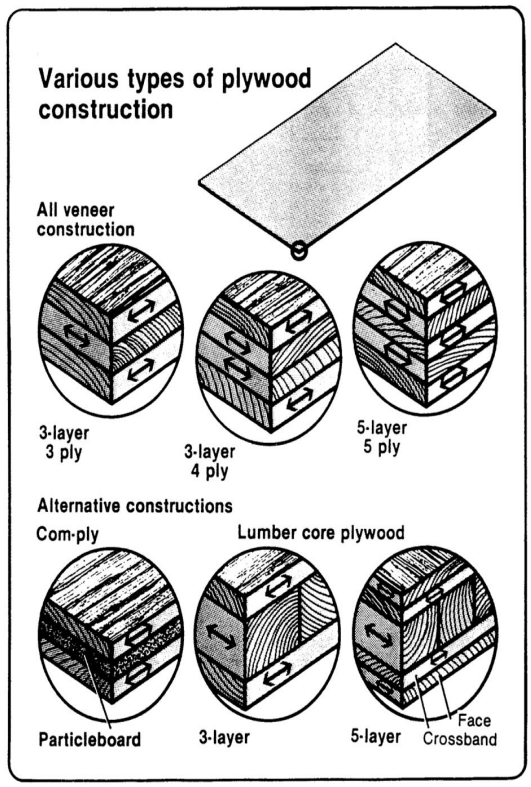
Task 7: Imagine you have your own small carpentry or joinery business. Think of products and/or services you would like to sell and write a similar text which would appear on your website. Be concise and catchy. As Ben, also include paragraph where you address people directly. 150-250 words.

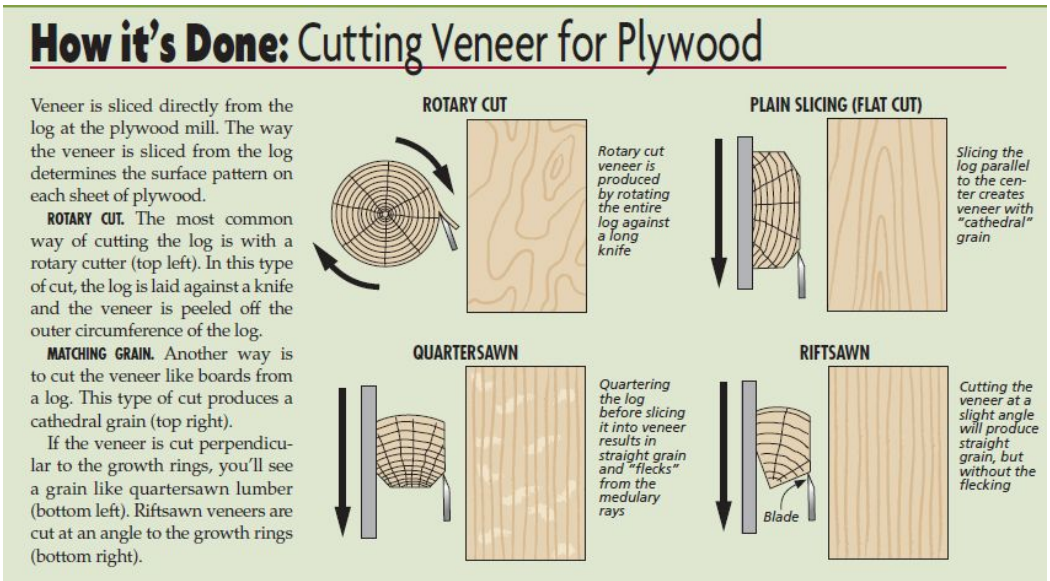
UNIT 3: VENEERS AND PLYWOOD

Veneer is a thin sheet of wood either sliced or peeled from a log or flitch.
Plywood is an engineered panel, typically composed of an odd number of thin layers of wood veneers, called plies, bonded together with a rigid adhesive and with the grain direction of adjacent layers perpendicular to each other.

Task 1: With your partner, discuss the reasons for production of veneers and plywood. Think about economical reasons and mechanical and physical properties.







Reading: Veneer Manufacture

Log Preparation

The logs are first 'debarked' after delivery from the plantation. This is achieved by a machine which mechanically scrapes the bark from the log. It is good practice to 'condition' the log before peeling. This can be achieved by water sprays, immersing in cold or heated water, or by steam treatment. This ensures the log is at a high and consistent moisture content throughout which facilitates peeling and helps yield smooth veneer with less tendency to split or tear. Heating the log softens the timber fibres and further improves veneer quality and yield. Before peeling the logs need to be 'docked' or cut into 'blocks' or 'billets' around 100mm longer than the finished plywood panel, i.e. usually 2½ metres. The log is now ready to be conveyed into the plant for peeling.

Peeling

The initial process in peeling is to load and centre the peeler block in the spindles of the veneer lathe. The peeler block must be centred with the axis of the log along the centre line of the lathe spindles to obtain maximum veneer recovery. This can be done manually, but is best achieved by an 'x - y charging system'. This system uses a laser scanner to measure the block three dimensionally and uses a computer to calculate the largest perfect cylinder within the block. The system then locates the block in the best position for the lathe. The lathe effectively rotates the block against the lathe blade or 'knife' which peels the veneer off in long continuous veneer ribbon of consistent thickness.

Clipping

The ribbon of veneer passes from the lathe through manual or automated clipping machines which cut or 'clip' the veneer to size, or into smaller strips if defective material has been removed. In some mills producing high quality thin veneer, clipping is done after the continuous ribbons of veneer have been dried so as to maximise the number of full sheets obtained.

Drying

The wet veneer is fed through a drier to reduce its moisture content to about 8% from the 'green' moisture content of between 40-140%. The optimum moisture content for gluing depends on the species and density of the veneer, and the adhesive and gluing procedures being used. In mechanical driers the veneer is conveyed through a long chamber in which hot air is circulated. Driers can have one, or as many as five separate conveyors, one above the other. The drying time is regulated by adjusting the speed of the conveyors and/or the temperature of the hot air.

Jointing or Veneer Repair

Small strips of veneer may be jointed into full size sheets by edge gluing, stitching or using perforated tape. Open defects may be repaired by using plugs to upgrade the veneer.

Grading

The dried, clipped and perhaps jointed or repaired veneers are graded in preparation for use in plywood manufacture.

Sliced Veneer

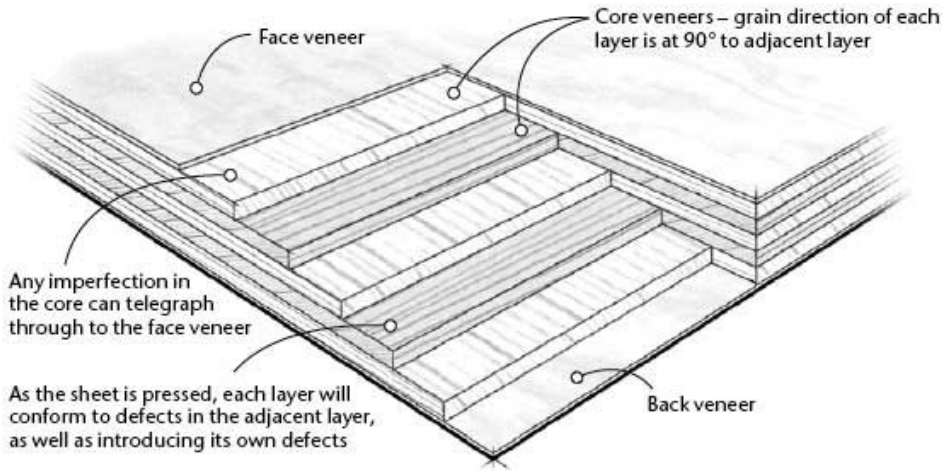
In general plywood manufacture the veneer is rotary peeled. It is used because of its lower cost and higher yield. However, sliced veneer can be produced by a 'slicer', the strips of veneer being cut in a straight line action. Sliced veneers are generally used for decorative faces to highlight the natural timber grain pattern or 'figure'. This pattern can be varied depending on the angle of the slice through the log.

Task 2: Read the text and find the words which fit the description:

1. The wood which has been peeled.
2. The section of a tree which can be used for veneers or sawn.
3. A machine which turns logs into veneer. It has two spindles and needs to be centered.
4. The procedure when veneer is adjusted to the required size.
5. The amount of water in the wood.
6. The process in which the veneer is glued or stitched together
7. The veneer which is manufactured by different machine than lathe and is generally used for decorative purposes.

Task 3: Look at the picture and fill the short text below:

On the top of the plywood, there is a layer of (1). It is glued to the (2) which are always positioned at (3) to the layers above and below. The bottom veneer is called (4). Even if the core is not visible it has to fulfil the standards because its (5) will affect the adjacent layer.



Designers can choose from the various wood species and beyond this, from the range of figure and grain patterns within each species. "**Matching**" refers to the arrangement of veneer strips of similar or varying grain patterns within a given panel or from panel to panel.

Task 4: Match the most common veneer matching with the description:

Pleasing Match

Veneer is matched by color but not by grain pattern.

Random Match

Random matching is just what it sounds like. Usually done with lower grades of veneer, the leaves may be of varying width, colors and grains.

Book Matching

Alternating pieces of veneer are flipped over so they face each other as do the pages within a book. This creates a pleasing, symmetrical pattern.

Slip Matching

Veneer slices are joined in sequence without flipping the pattern. If the grain is straight, the joints will not be obvious.

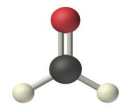
Marquetry is the art and craft of applying pieces of veneer to a structure to form decorative patterns, designs or pictures. The technique may be applied to case furniture or even seat furniture, to decorative small objects with smooth, veneerable surfaces or to freestanding pictorial panels appreciated in their own right.

Task 5: Match following expressions concerning types of veneer and their appearance with their definition and check your answers with the glossary.

backing	side of the sheet of knife-cut veneer that was in contact with the knife as the sheet was being cut (with lathe checks)
burl	veneer from the portion of the tree just below the point where it forks into two limbs - the grain is twisted, creating a variety of flame figures and sometimes resembles a well formed feather
birdseye	uneven contour of the annual rings
crotch veneer	lowest grade veneer which is generally only used as cross band veneer or for non-visible surfaces
loose-side	term given to the small to large eye-shaped marking of figure found throughout select sheets of Maple
checks	log where the element development is in the root and the element is either completely or partially under the ground
tight-side	natural discolorations of the wood substance
underground burl	feature swirling grain around clusters of dormant buds, rings or eyes, e.g. in White Ash, Olive Ash, Carpathian Elm, Maple, Mappa, Myrtle and Walnut
streak, mineral	side of the sheet of the knife-cut veneer that was farthest from the knife as the sheet was being cut and containing no cutting checks (lathe checks)
blister	small slits running parallel to the grain of wood, caused chiefly by strains produced in seasoning

Plywood was invented, in the 19th century, by **Immanuel Nobel**, father of **Alfred Nobel**. Nobel realized that several thinner layers of wood bonded together would be stronger than one single thick layer of wood, and invented the rotary lathe used in plywood manufacturing.

Task 6: Gluing is an important procedure in plywood manufacture. Match the most common adhesives with their definitions:


Formaldehyde, CH_2O

Urea formaldehyde glues	They have similar properties to phenolic glues in quality of performance but being more reactive, can be cured at room temperature. They are more expensive than phenolic glues, and therefore limited in use to special applications.
Polyvinyl acetate glues or polyvinyl acetate/urea formaldehyde	These are not extensively used for plywood gluing but are used where a high grade bond is required, and where black phenolic glues cannot be tolerated. They are used to fortified urea-formaldehyde glues to increase the weathering resistance of the bond. The largest application is in the production of decorative overlays.
Phenol-formaldehyde glues	Adhesives are extensively used for interior and intermediate grade bonding, which covers the majority of plywood produced.
Resorcinol-formaldehyde or phenol/resorcinol-formaldehyde glues	Standard for exterior bonds. They are also used for impregnating veneers and paper overlays for plywood.
Melamine formaldehyde glues	These are used for edge jointing and veneering and are resistant to boiling water..

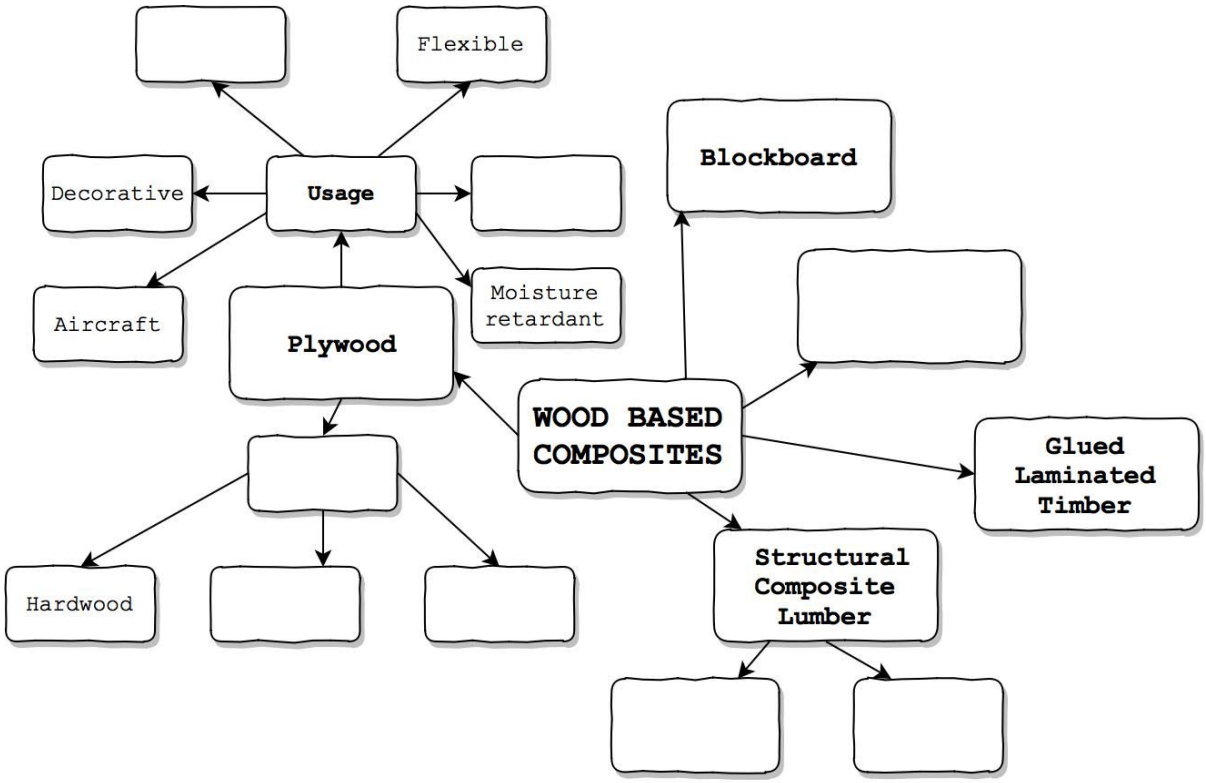
Task 7: There are additional components in the glue mixture. Explain the difference between fillers and extenders and try to come up with two examples for both groups. Work in pairs.

Fillers:

Extenders:

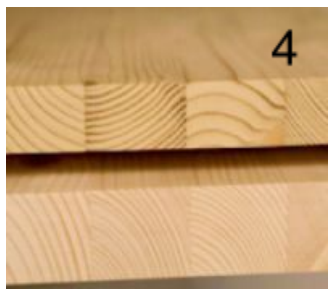
Task 8: Fill in this diagram which summarizes engineered wood products based on solid wood or veneers. Some of the expressions has their definitions or pictures below, match them.

Fire Retardant - Laminated Veneer Lumber (LVL) - Marine - Paralel Strand Lumber (PSL) - Softwood - Wood - Tropical Wood - Joint Board



1. Core board, the core of which is made of strips of solid wood more than 7 mm wide but not wider than 30 mm, which may or may not be glued together.

2. Plywood which is not flat, made by pressing in a mould.



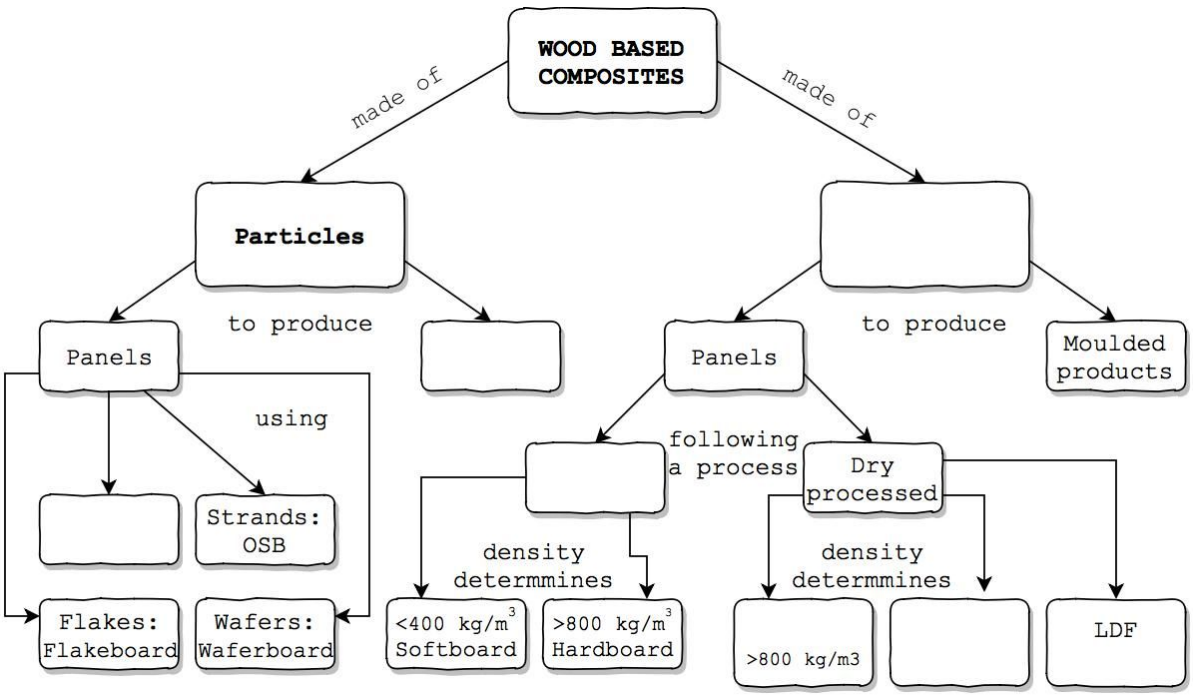
UNIT 4: PARTICLEBOARDS AND FIBREBOARDS

Particleboard is a non-structural composite panel product composed of wood particles bonded with a synthetic resin.
Fibreboard is a composite panel where the building unit is a fibre and the bonding is mediated by activation of lignin adhesive properties and synthetic resin.

Vocabulary

Task 1: Fill in the diagram concerning the distribution of particleboards and fibreboards. Together, with the diagram in unit 3, it gives you outline of the most common wood based materials.

Moulded products - Wet processed - Chips: Chipboard - High density board (HDF) - Middle density board (MDF) - 500-800 kg/m^3 - <500 kg/m^3 - Fibres



Reading: OSB Manufacture

To manufacture OSB, debarked logs are sliced into long, thin wood elements called strands. The strands are dried, blended with resin and wax, and formed into thick, loosely consolidated mats that are pressed under heat and pressure into large panels. A more detailed description of each individual manufacturing step follows.

During stranding, logs are debarked and then sent to a soaking pond or directly to the stranding process. Long log disk or ring stranders are commonly used to produce wood strands typically measuring 114 to 152 mm

long, 12,7 mm wide, and 0,6 to 0,7 mm thick. Green strands are stored in wet bins and dried in a traditional triple-pass dryer, a single-pass dryer combination triple-pass/single-pass dryer, or a three-section conveyor dryer. A recent development is a continuous chain dryer, in which the strands are laid on a chain mat that is mated with an upper chain mat and the strands are held in place as they move through the dryer.

Dried strands are blended with adhesive and wax in a highly controlled operation, with separate rotating blenders used for face and core strands. Typically, different resin formulations are used for face and core layers. Face resins may be liquid or powdered phenolics, whereas core resins may be phenolics or isocyanates. Several different resin application systems are used; spinning disk resin applicators are the most common. The strands with adhesive applied are sent to mat formers.

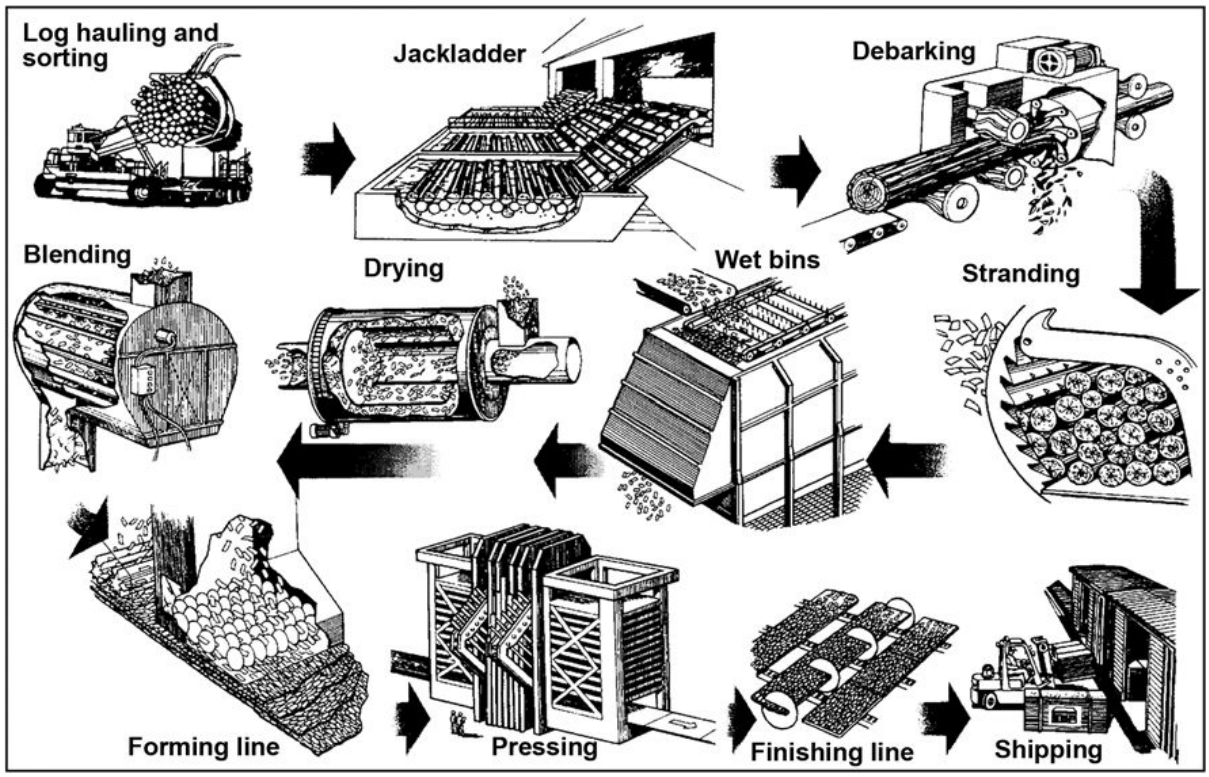
Mat formers take on a number of configurations, ranging from electrostatic equipment to mechanical devices containing spinning disks to align strands along the panel's length and star-type cross-orienters to position strands across the panel's width. All formers use the long and narrow characteristic of the strand to place it between spinning disks or troughs before it is ejected onto a moving screen or conveyor belt below the forming heads.

Oriented layers of strands within the mat are dropped sequentially onto a moving conveyor. The conveyor carries the loose, layered mat into the press. Once the mat is formed, it is hot-pressed.

Hot-pressing consolidates the mat by heating it at 177 to 204°C, which cures the resin in 3–5 minutes. As many as sixteen 3,7 by 7,3 m panels may be formed simultaneously in a multiple-opening press. A more recent development is the continuous press which presses the mat between rollers as it is conveyed.

Task 2: Read the text and answer following questions:

1. What are the most common drying machines used during the production?
2. What is the recent development is the strand drying?
3. What resins are used for bonding of the core?
4. What is the usual length of the single strand?
5. What is the name of the machine which continuously moves the material?
6. What is the name of the machine which can process up to sixteen panels at one time?
7. What is the most common resin application machine



OSB Production

Task 3: Match the names of the boards with their pictures, moisture resistant boards are green.

particleboard

fibreboard

veneered particleboard

hardboard

3-ply plywood

blockboard

moisture-resistant MDF

moisture-resistant particleboard

5-ply plywood

MDF

multiply plywood

Task 4: Read the following statements. Each group of statements describes one engineered wood based material. The expressions in bold are key. Decide whether it is **plywood, MDF, OSB or particleboard.**

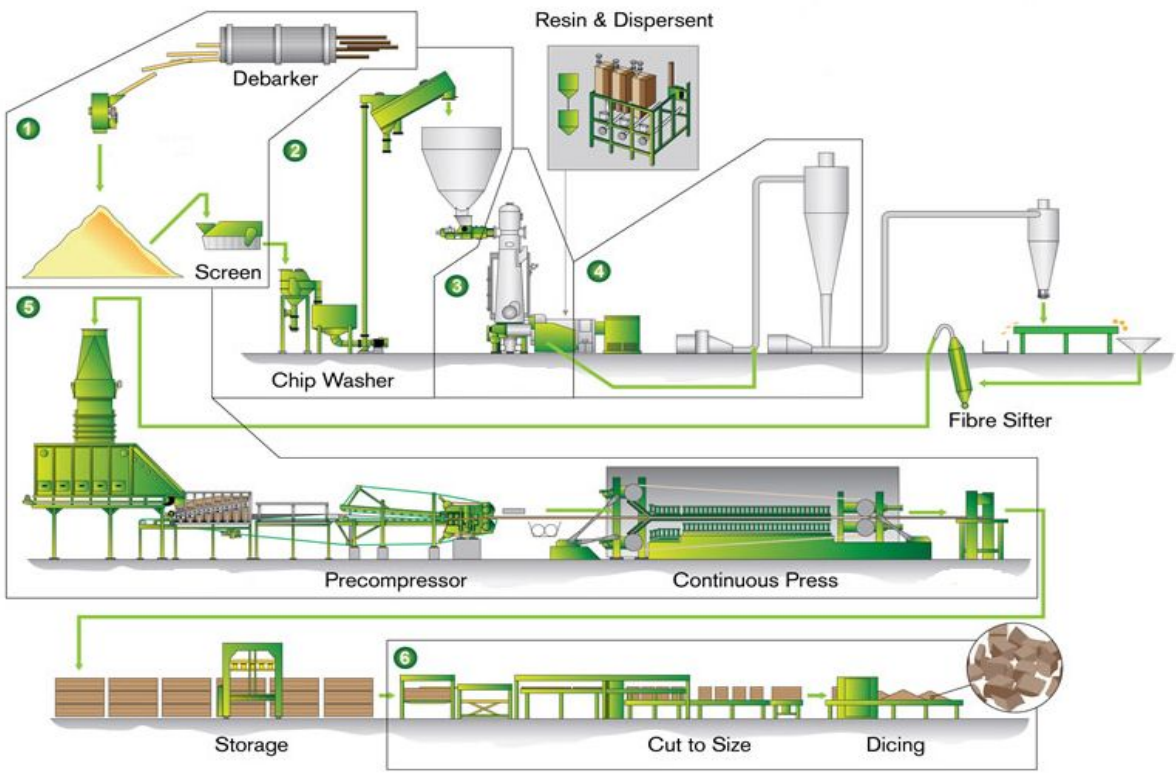
1. **Denser** than particle board.
Smooth finish that takes **paint** very well.
Ideal for interior projects such as built-ins, cabinets, raised panels or simple furniture.

2. Most **economical** of all engineered wood.
Weakest engineered wood.
Ideal for utility **shelves** or inexpensive garage or workshop projects.

3. **Stronger** than particle board as it's made with larger pieces of wood, the strands of which are reversed for each layer.
Can be used in all applications where you would use **lower grade** plywood.

4. Produced in large, standard sized **sheets,** in a dozen thicknesses and a **wide variety** of finishes and wood species.
Stronger and less costly than **solid wood.**
Resistant to shrinking, twisting, warping and cracking.

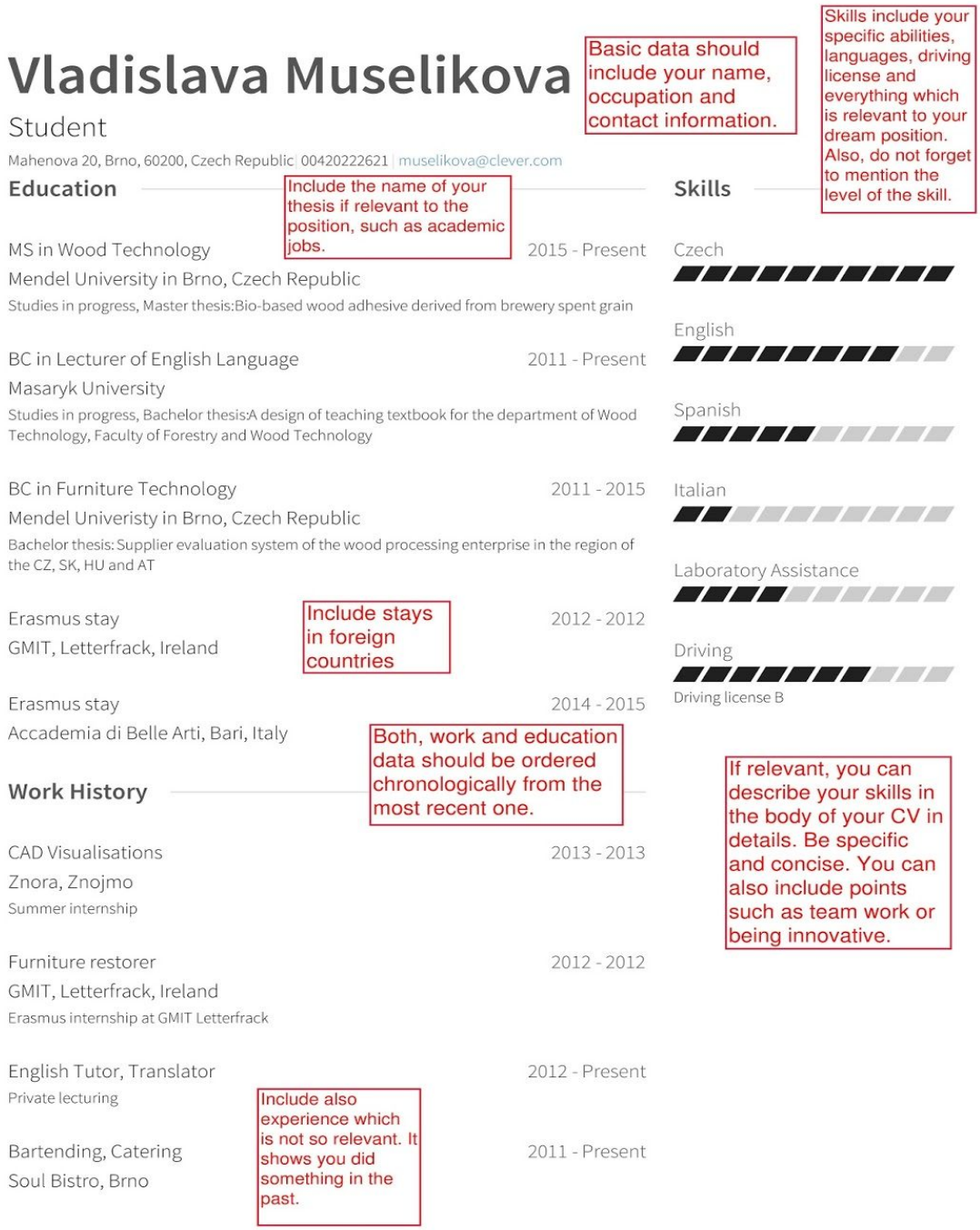
Task 5: Study the process of MDF manufacture. Then fill in the machines which are missing.



defibrator - saw - chipper - dryer

The **defibrator** is a thermo mechanical pulping refiner in which the pulp material, such as wood chips, is ground in an environment of steam between a rotating grinding disc (rotor) and a stationary disc (stator) each with radial grooves that provides the grinding surface. Wood chips are fed into the centre and are broken down as the centrifugal force pushes them towards the circumference of the discs where the grooves are finer to produce wood fibre.

Task 6: Look at the following Curriculum Vitae and write your own following the tips included:



UNIT 5: SAWMILLING AND TIMBER PRODUCTION

Reading: Sawmilling history

Sawmills seem to have existed in the medieval period, as one was sketched by Villard de Honnecourt in c.1250. On the other hand, people think they were introduced to Madeira following its discovery in c.1420 and spread widely in Europe in the 16th century.

The Dutchman Cornelis Corneliszoon (1550-1607) invented his type of sawmill by applying a pitman arm onto a (1), which converted a turning motion into an up-and-down motion. Corneliszoon patented the sawmill on December 15, 1593 and the pitman on December 6, 1597. He built the first sawmill there in 1594.

Before to the invention of the sawmill, boards were sawn by two men with a (2), using saddle blocks to hold the log. Early sawmills simply adapted the whipsaw to mechanical power, generally driven by a water wheel to speed up the process. The circular motion of the wheel was changed to back-and-forth motion of the saw blade by a connecting rod known as a pitman.

Generally, only the saw was powered, and the logs had to be loaded and moved by hand. An early improvement was the development of a (3), also water powered, to steadily move the log through the saw blade.

A small mill was the center of many rural communities in wood-exporting regions, e.g. the Baltic countries and Canada. The output of these mills was be quite low, around 500 (4)per day. They were also generally only operated during the winter, the peak of the logging season.

In the United States, the sawmills were introduced soon after the colonization of Virginia by recruiting skilled men from Hamburg. Later, the metal parts were obtained from the Netherlands, where the (5) was far ahead of that in England.

Early mills were taken to the forest, where a temporary shelter was built, and the logs were skidded to the nearby mill by horse or ox teams, often when there was some snow to provide lubrication. As mills grew larger, they were usually established in more permanent facilities on a (6), and the logs were floated down to them by log drivers.

Technology has changed sawmill operations significantly in recent years, emphasizing increasing profits through (7) minimization and increased energy efficiency as well as improving operator (8).

Task 1: Read the article about the sawmilling history and fill in the following expressions.

technology - movable carriage - boards - waste - river - windmill - safety - whipsaw

Task 2: Match following expressions concerning the timber products with their definitions. Check your answers with the glossary. Give their Czech translations for better understanding.

Edging of timber

edged timber	type of cant with wane on one or both sides
cant	sawn timber without wanes
wane	partially sawn log such as sawn on two sides or squared to a large size and later resawn into lumber
flitch	original rounded surface of a log - with or without bark - on any face or edge of sawn timber

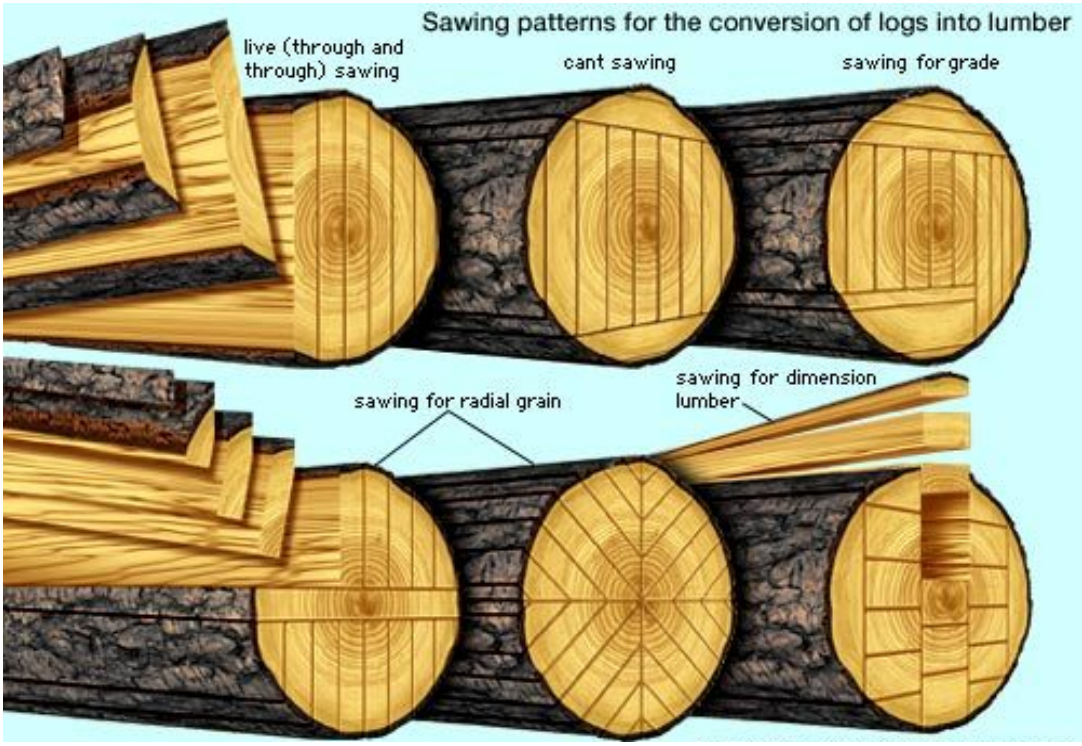
Dimensional timber

batten	squared timber, more than 40 mm wide
plank	less than 38 mm thick, more than 80 mm wide
board	less than 38 mm thick, less than 80 mm wide
lath	more than 38 mm thick, width is three times bigger than thickness

Different use of timber

joist	structural timber bearing the load
post	timber with the larger dimension not more than 51mm greater than the smaller dimension and usually graded for use as a column
beam	horizontal supporting member, usually plank

Task 3: Study the picture and then fill in the gaps in the description of different sawing/cutting patterns.



1. During the first sawing machine cuts the log into side boards and a cant. The cant is then rotated by 90° and cut by the second sawing machine into side boards and centre boards. The second cutting can be also done by the first machine.

2. improves the value of the wood by putting as many defects as possible in as few boards as possible. This is more common in hardwood lumber where random widths are allowable, but can be used with dimension lumber if the sawmill operation has access to an edger.

3. is the most common type of cut. The annual rings are generally 30 degrees or less to the face of the board; this is often referred to as tangential grain. The resulting wood displays a cathedral pattern on the face of the board.

Wood drying (wood seasoning) reduces the moisture content of wood before its use. When the drying is done in a kiln, the product is known as kiln-dried timber or lumber, whereas air drying is the more traditional method. **Unseasoned** timber is classified according to its moisture content. Any timber with a moisture content > 25% is said to be unseasoned or 'green'. **Seasoned** timber has a moisture content between 10 and 15 % according to its future use.

Task 4: There are three kinds of water present in the wood. Match the words from the box and the short descriptions.

chemically bond water – free water – bound water

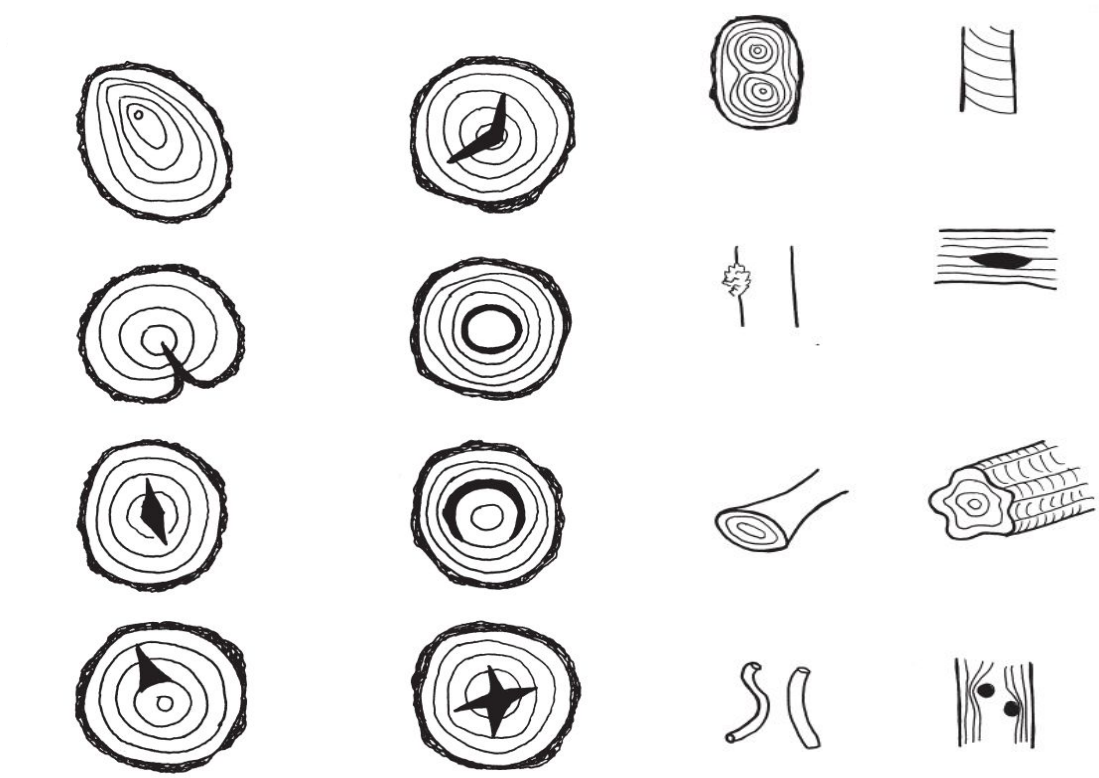
1. This type of water is part of the chemical molecules. It does not play any role in mechanical nor physical properties.

2. The water in the cell walls. It plays significant role in the further processing of the wood. It is bonded to cellulose and hemicellulose.

3. The water in cell lumina which is not chemically bounded.

Task 5: Match the following defects of timber. Use the words from the box.

bark pocket 2x - simple heart shake - knot - ovality - cup shake - burl - flutes - fork-shake - grain slope - ring shake - resin pitch - butt swell - multiple pith - star heart shake - curvature/crookedness



Task 6: Read the article about the wood drying and find 11 expressions concerning the wood drying in the puzzle.

Air drying

The traditional method of seasoning timber was to stack it in air and let the heat of the atmosphere and the natural air movement around the stacked timber remove the moisture. The process has undergone a number of refinements over the years that have made it more efficient and reduced the quantity of wood that was damaged by drying too quickly near the ends.

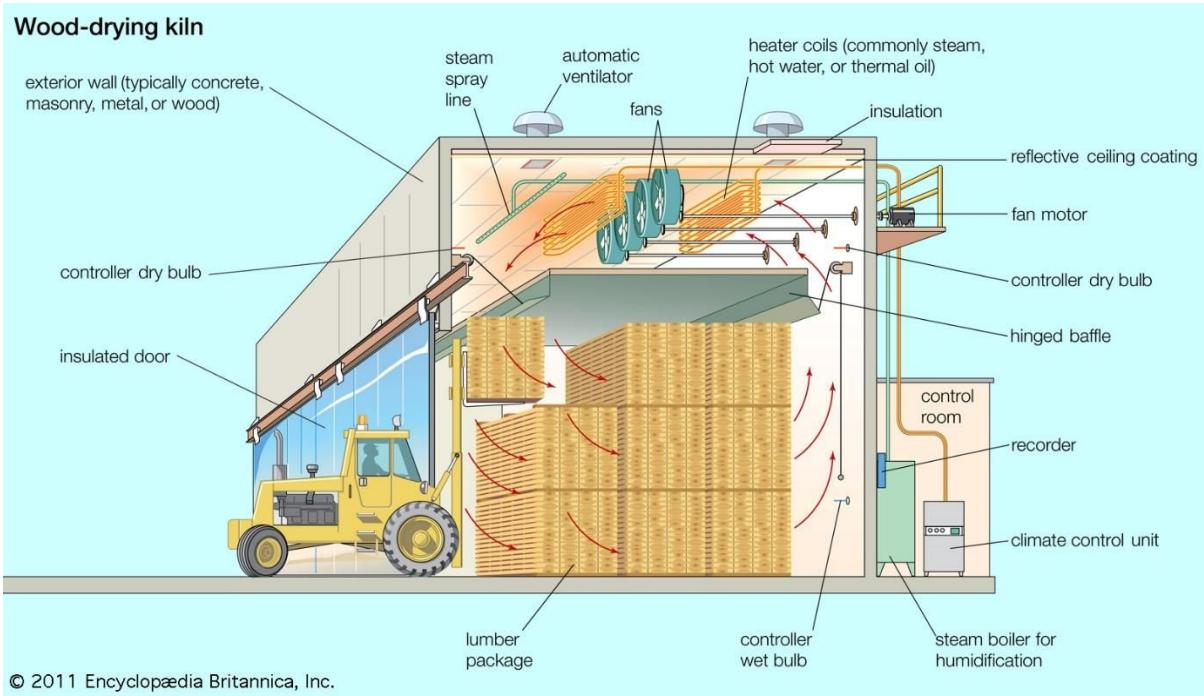
The basic principle is to stack the timber so that plenty of air can circulate around each piece. The timber is stacked with wide spaces between each piece horizontally, and with stickers of wood between each layer ensuring that there is a vertical separation too. Air can then circulate around and through the stack, to slowly remove moisture. In some cases, weights can be placed on top of the stacks to prevent warping of the timber as it dries.

Kiln drying timber

The most common commercial processes for seasoning of timber is kiln-drying. Kiln seasoning accelerates the process of seasoning by using external energy to drive the moisture out.

The timber is stacked in much the same way as it is for air drying, and is placed inside a chamber in which the conditions can be varied to give best seasoning results. Air is circulated around the charge (stacked timber) and the temperature and humidity can be varied to give optimum drying. Each species has different cell characteristics and therefore requires different drying schedules. Typically, the timber may be in the kiln for a period of between two days to one week.

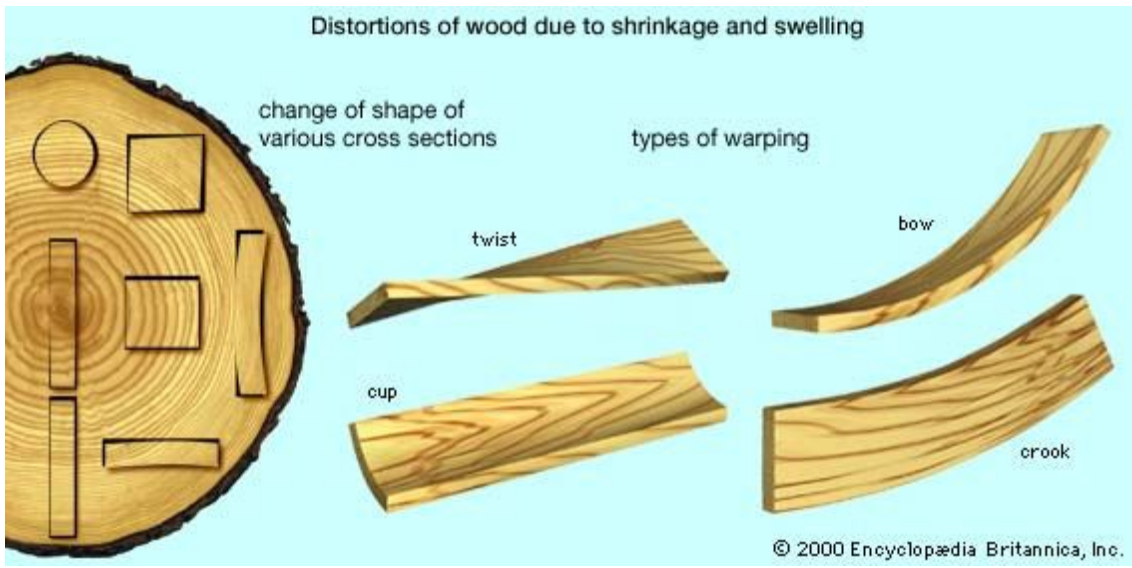
Generally, it is not feasible to kiln-dry structural timber in thicknesses greater than 45 mm, although there are limited amounts of 70



mm thick kiln-dried softwood members in the market place. Kiln-seasoning of softwoods such as pine can be done fairly quickly, however seasoning of hardwoods tends to be a much longer process, due to the different cell structure of hardwoods.

W D F Z P D Y U P H J I
R G D J W X K X L R X G
Z G N I N O S A E S W W
I A N R V R H R W A E T
A W H I S C U R R E C S
I I J X Y T M P L G H L
S A M G S R I U C Q A S
S O K I L N D C C C M J
D W O R G E I R K J B I
W M W J H A T H I E E N
S T A C K X Y F M A R Y
B O S B J F T Q P E H E

Task 7: With your partner, discuss and write down reasons for possible defects of the timber due to shrinking and swelling. You can inspire with the picture.



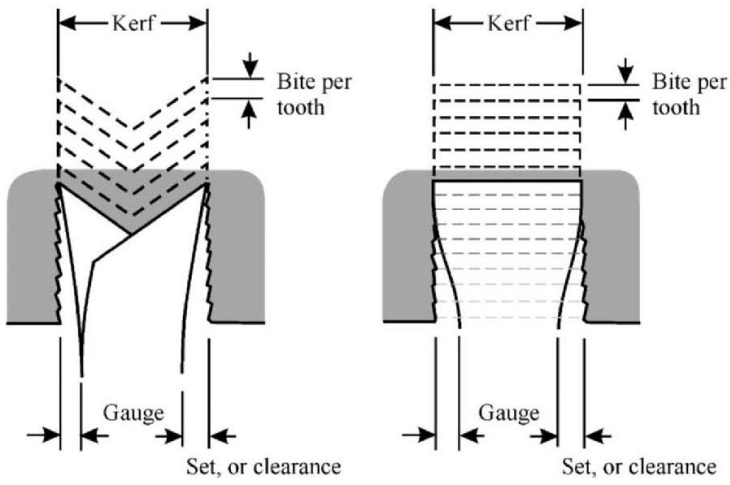
Reading: Basic saw types and blades

A variety of saws is used to break logs into boards or larger dimension timber: circular saws, bandsaws, frame saws and chipper canters. The first three saws generate a saw kerf. The saw kerf is the width of cut that a saw blade produces when sawing lumber . The wood in the kerf is reduced to coarse sawdust. Chipper canters function differently. They chip the edges of logs, cants or flitches to dimensions. The nominal size allows for sawing variation, generate two parallel faces while reducing the waste material to chips that can be sold to the pulp and paper industry. The choice of machinery is influenced by the log resource (quality, size and volume). A variety of saws are used to progressively cut the logs into timber of the desired dimensions. The first saw to cut a log as it enters the mill is the headrig. Other saws are resaws, which further process material coming from the headrig, and edgers, which edge material. Once the wood is faced on four sides it only needs to be crosscut with circular docking saws, either trimming to length or, where necessary, cutting out defects such as large knots. The knowledge and experience of the saw doctor is crucial to an efficient sawmill, if only because a change in any one of a number of factors affects the ability of the saw blade to produce a straight cut. Only when the balance of factors is optimized does the saw run at its most efficient, with minimum power consumption, highest production, and high quality cuts for the maximum time between blade sharpenings.

Task 1: Try to think of factors which must be considered for right functioning of saw.

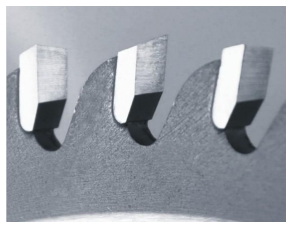
e.g.: blade material

When cutting along the grain the process is termed '**ripping**'. When cutting across the grain the process is termed '**cross-cutting**'. In ripping the removal of the chips is akin to chiselling parallel to the grain, whereas when cross-cutting the individual fibres are being severed by side-pointing teeth moving across the grain. To avoid the saw binding in the cut causing friction and heat, clearance must be provided. This clearance is known as '**set**'. The total width of the saw cut is known as '**kerf**'.



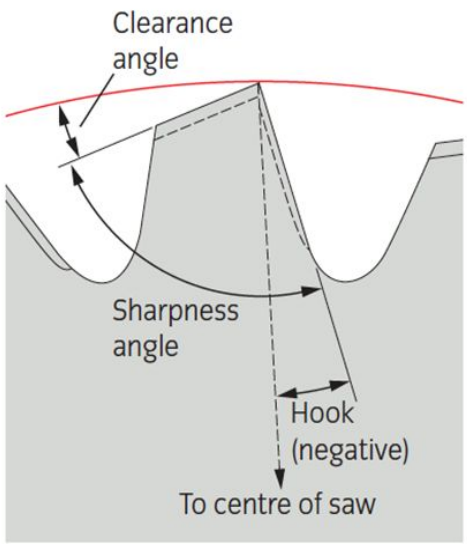
Task 2: There are two main sets of the teeth of the blade: **spring** and **swage** set. Mark the picture of the teeth above.

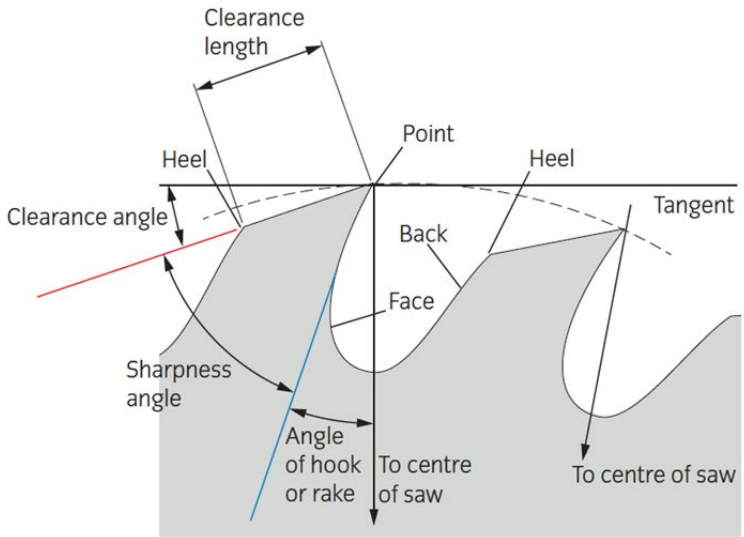
Superior sawing can be achieved by **tipping** the teeth. Wear resistance is substantially increased by having tungsten carbide (very hard but brittle) or cobalt/chrome stellite tips (not so hard, but resistant to chemical corrosion, e.g. eucalypts). The advantages are particularly noticeable when sawing hard and abrasive woods of species with a high silica content.



Task 3: Read a short paragraph about blade types, study the pictures and then decide which picture shows teeth more suitable for ripping and which for cross-cutting.

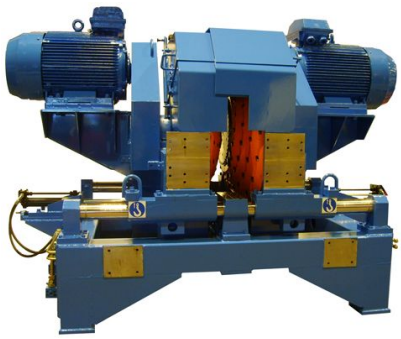
Ripping down the grain requires a different tooth design compared to cutting across the grain. The most important difference between the two is known as the angle of 'hook' or 'rake'. This angle is referred to as **positive** or **negative** angle of hook. Positive angle of hook teeth should only be used for ripping along the grain. They have a tendency to drive and bite progressively into the timber and may cause them to snatch when crosscutting. A negative hook angle can tend to push the timber away from the saw blade. It also makes a stronger tooth point which is capable of withstanding the rigours of cutting across the grain of the timber.





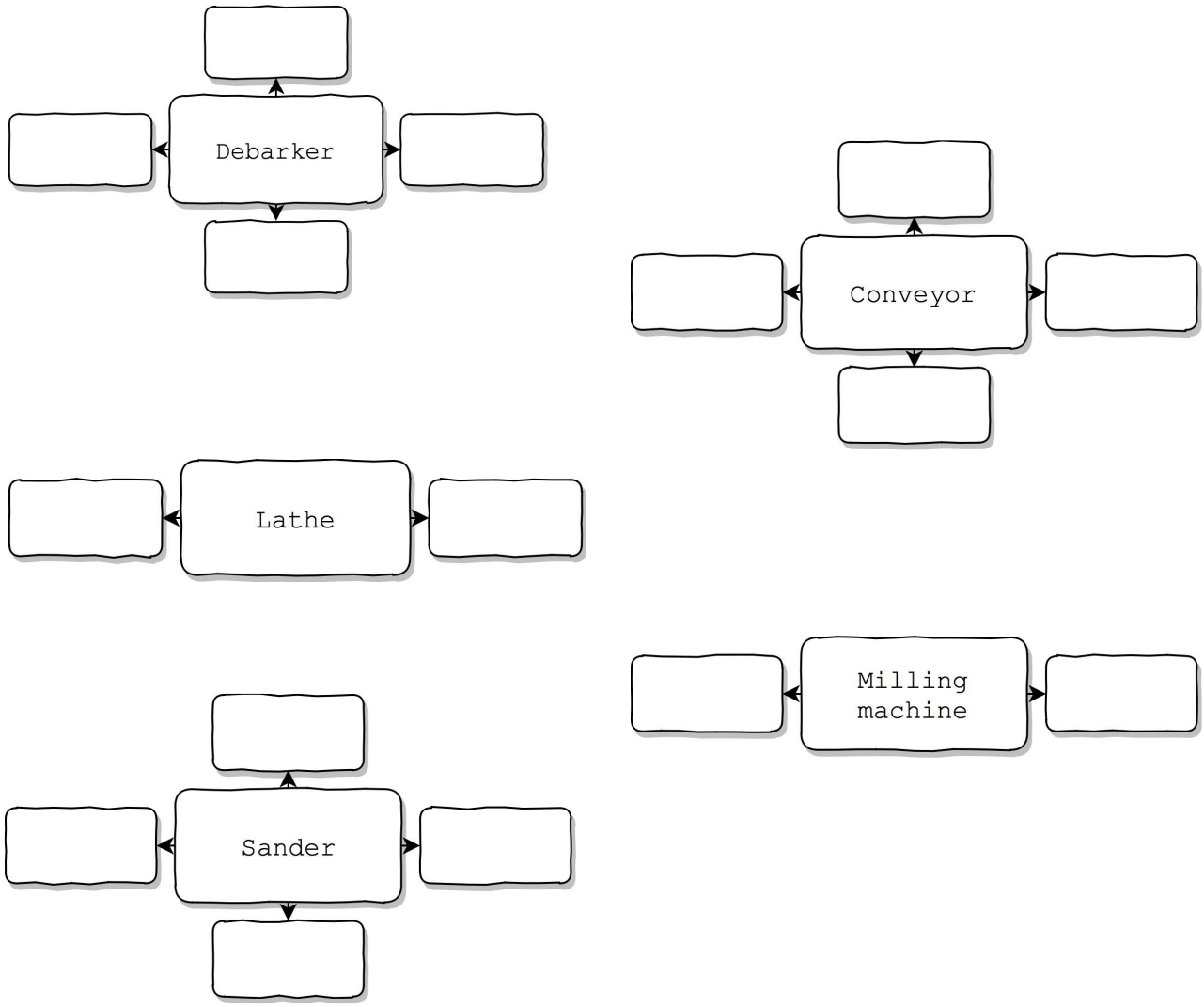
Task 4: Match the pictures with the machine names in the box.

circular saw - horizontal band saw - frame saw - chipper canter - trimmer - vertical bandsaw



Task 5: Fill in the diagrams with the adjectives from the box concerning machines in the woodworking industry. There are more correct solutions and the variety is more diverse than shown here.

drum - belt - roller - turret - horizontal - angle - rosser head - engine - snail - ring - vertica - flail - chain - belt - cylindrical - surface



Milling cutters are cutting tools typically used in milling machines or machining centres They remove material by their movement within the machine or directly from the cutter's shape. Most common operations are plain, side, form and end milling.

Task 6: Match following pictures of milling cutters and their descriptions.

Plain milling cutters are used to produce flat surface

Side milling cutters are used for cutting slots and for face and straddle milling operations ans designed with cutting teeth on its side as well as its circumference

Form milling cutters are used to produce exact shapes and small parts.

Angular milling cutters are used for milling angular surface.

End milling cutters are used in a similar way to drillers but are without the direction limitation.

Task 7: Read the article about maintenance of a frame saw and write your own maintenance guide which will describe a maintenance process of any machinery or tool within the woodworking industry. Use a point structure. 150 - 250 words.

Frame saws, or gang saws as they are often called, can, when properly maintained, produce very accurate well-sawn timber. Due to the vibration which is set up by the actual working motion of any frame saw, the need for well-organized planned maintenance competently carried out is of paramount importance. Automatic oiling and greasing systems and saw tensioning devices have made this a less difficult task but the need for the machine to be operated by skilled personnel remains just as essential. A frame saw should be kept working at all times as running empty is far more likely to cause mechanical problems. A constant work load of logs or cants well within the feed speed capacity of the machine relevant to the species of timber being sawn is therefore a priority objective of the sawyer. Some machines have setting bars which are bolted across the top and bottom of the sash before fitting another set of saws. This or any other type of fixture which speeds up the change of saws is an advantage but accuracy should never be sacrificed for saving a few moments in time. Before fitting a change of saws it is most important to make sure the spacer blocks which are fitted between the saws are free of sawdust and the top and bottom hangers are also clean. A small deposit of sawdust or gum deposit will put the saws out of alignment. Like bandsaws or circular saws the performance of frame saws is, to a large degree, dependent on the condition of the saws themselves. It is always better to change any saw before it gets really dull as this will only cause mis-sawn lumber, cause damage to the saw blade itself and possible mechanical problems with the machine. Running dull saws in frames saws should be avoided even though they continue to cut straight. A good indication of the need to change saws is when the fibres of the timber start to raise up on the faces of the boards being produced. Planned maintenance programmes for frame saws should always be in strict accord with the recommendations of the manufacturer. Log carriage track rails should be kept clean and in good alignment, likewise, the fence and infeed rolls for machines sawing cants.

Dai1y checks

(a) Before sawing

Check lubrication systems and level in lubricant tanks before starting the machine. Make sure infeed and outfeed rolls are clean and pressure rolls are working freely. Lubricate rolls or grease as necessary, making sure grease nipples and grease gum nozzles are cleaned beforehand and old grease is forced out. Check air pressure or hydraulic pressure for correct operational requirements. Check saw blade tension and setting.

(b) After sawing

Thoroughly clean the machine when the saws are removed and make sure no small pieces of timber are hung up anywhere near or on the machine which could fall into feed chains or sash frames when the machine is started up

again. Check connecting rod bearings and sash block guides by touch for overheating. If they are too hot to handle remedial action is necessary. Connecting rod bearings may need washing out and regreasing or the cause may be due to lack of lubrication to the guide blocks which has caused them to overheat and overload the connecting rod bearings.

Weekly checks

Carefully check the connecting rods after they are thoroughly cleaned and make sure they have not suffered damage resulting in deep cuts or scratches which should be ground out. Check chain and belt drives for tension.

Monthly checks

Check and tighten all bolts. Check sash blocks for wear and side play in guides. Check all chains and adjust as necessary. Check feed roll bearings and check rolls for alignment. Check fence for alignment in the case of a machine sawing cants. Check feed mechanism. The need to adjust sash blocks and eliminate excess side play in the guides is usually indicated by a shallow groove left in the face of the boards when the feed is stopped with the saws still running in the cant or log. A chalk mark at this position will prove the point if the groove is obvious on the board faces. The side play can then be checked by placing a piece of timber of suitable size and length between the sash and guides, applying pressure and getting an assistant to check the amount of clearance by inserting feeler gauges. Sash guides should not be adjusted too tight which will make them over heat. If the feed mechanism is a friction drive it is essential that the faces of the friction wheel and the friction rollers are kept clean and dry. Oil or grease on these faces can cause intermittent feeding and loss of drive.

Six-monthly checks

All bearings should be checked according to the recommendations of the machine manufacturer and replaced if necessary. One very essential requirement regarding frame saw operation and maintenance, which cannot be designated as a routine check, is also explained and illustrated as follows: After retoothing or regrinding ensure the ends of the blade are cut or ground off at an angle to prevent overloading the end gullets and also to make sure the untoothed section of the top of the blade does not hammer against the top of the log or cant when the sash is at the bottom of its travel.

Annual checks

This particular check should be in the form of a general overhaul when the machine is thoroughly cleaned and all moving parts are inspected for wear or damage. Repairs or replacements must be in strict accordance with the recommendations of the manufacturer. A careful check on all lubrication pipes for leaks or insufficient supply to the various destinations should now be carried out.

GLOSSARY
WOOD SCIENCE

annual/tree/growth rings	The portion of wood encompassing one earlywood section and one latewood section. The annual ring constitutes one growing season.	**bark**	The outer protective layer of a tree.
cambium	The thin layer of reproductive cells in wood found between the xylem, or wood, and phloem, or inner bark. Cell reproduction occurs in the cambium.	**cell**	A general term for the anatomical units of plant tissue, including wood fibers, vessel members, and other elements of diverse structure and function.
cellulose	The carbohydrate that is the principal constituent of wood and forms the framework of the wood cells.	**compression**	A measure of inward-pushing forces as a load is applied to a wood member.
compression wood	Abnormal wood formed on the lower side of branches and inclined trunks of softwood trees. Compression wood is identified by its relatively wide annual rings (usually eccentric when viewed on cross section of branch or trunk), relatively large amount of latewood (sometimes more than 50% of the width of the annual rings in which it occurs), and its lack of demarcation between earlywood and latewood in the same annual rings. Compression wood shrinks excessively longitudinally, compared with normal wood.	**coniferous/conifers**	The portion of a tree's annual ring formed early in the growing season. It is often characterized in conifers by having larger cells of lower density and is often lighter in color due to the lesser amount of wood substance present.
density	Weight per unit volume. Density of wood is influenced by rate of growth, percentage of latewood and in individual pieces, the proportion of the heartwood.	**diffuse porous dicotyledonous wood**	Hardwoods containing pores of essentially uniform size and even distribution throughout the growth ring.
earlywood	The portion of a tree's annual ring formed early in the growing season. It is often characterized in conifers by having larger cells of lower density and is often lighter in color due to the lesser amount of wood substance present.	**equilibrium moisture content**	The moisture content at which wood neither gains nor loses moisture when surrounded by air at a given relative humidity and temperature.
fiber saturation point	The stage in the drying or wetting of wood at which the cell walls are saturated and the cell cavities free from water. It applies to an individual cell or group of cells, not to whole boards. It is usually taken as approximately 30% moisture content, based on ovendry weight.	**fire retardancy**	The property of a material or assembly to withstand fire or give protection from it. As applied to elements of buildings, it is characterized by the ability to confine a fire or to continue to perform a given structural function, or both.
grain	The visible lines in wood that show the natural growth rings of the log.	**hardwood**	Timber produced from broad-leaved trees.
heartwood	The inner area of a tree trunk or log that - when the tree was growing - had stopped containing living cells and reserve materials, such as starch. The heartwood may be darker in colour than the outer sapwood though not all	**janka hardness**	Refers to the hardness rating on a scale for wood species. The rating is determined by the amount of force it takes to drive a 11.28 mm steel ball into a plank of wood 5.6388 mm in diameter.

	species show a clear difference between the two. The heartwood is often more durable than sapwood.		
knot	The remains of a branch in timber. A branch sawn off close to the trunk or shed naturally forms a sound or live knot. A broken branch stub that becomes surrounded by new growth produces a loose or dead knot in the timber.	**latewood**	Wood that is added in the latter part of the growing season within an annual ring. Latewood cells in softwoods are often smaller, denser, and darker in color than earlywood cells. Latewood cells in hardwoods may be recognized by the difference in volume occupied by vessels (pores).
lignin	The second most abundant constituent of wood, located principally in the secondary wall and the middle lamella, which is the thin cementing layer between wood cells. Chemically, it is an irregular polymer of substituted propylphenol groups, and thus, no simple chemical formula can be written for it.	**modulus of elasticity**	An imaginary stress necessary to stretch a piece of material to twice its length or compress it to half its length. Values for the individual species are given in megapascals (MPa - equivalent to N/m2), and are based on testing small clear pieces of dry wood.
modulus of rapture	Reflects the maximum load-carrying capacity of a member in bending, and is proportional to maximum moment borne by the specimen. Modulus of rupture is an accepted criterion of strength, although it is not a true stress because the formula by which it is computed is valid only to the elastic limit.	**moisture content**	The weight of water contained in wood expressed as a percentage of the weight of the oven dry wood.
parenchym	Storage tissues and consist of small, thin-walled, rectangular or brick-shaped cells. These are vertically aligned.	**pith**	The small and soft core of a tree that the wood grows around.
pits	Pits serve as passages of nutrition communication between neighboring cells.	**pores/vessels**	Tubular elements running in a vertical direction and serve to conduct water and mineral nutrients.
rays	A narrow ribbon of cells that conducts and stores food in a tree. Rays run across the grain of timber.	**reaction wood**	Wood with more or less distinctive anatomical characters, formed typically in parts of leaning or crooked stems and in branches. In hardwoods, this consists of tension wood, and in softwoods, compression wood.
resin ducts/canals	The portion of a tree's annual ring formed early in the growing season, characterized in conifers by having larger cells of lower density and is often lighter in color due to the lesser amount of wood substance present.	**ring porous dicotyledonous wood**	Hardwoods with relatively large pores concentrated in the earlywood portion of the annual ring.
sapwood	The outer area of a tree trunk or log, which in the growing tree contains living cells and reserve materials such as starch. Sapwood is generally lighter in colour than the inner heartwood, although not all species show a clear difference between the two. The sapwood is more vulnerable to attack	**semi-ring porous dicotyledonous wood**	Hardwoods with fairly evenly distributed pores whose size gradually decreases from the earlywood to latewood portion of the annual ring.

	by biological organisms but is also usually more permeable than the heartwood - this makes it easier to treat with preservatives.		
shear strength	Ability to resist internal slipping of one part upon another along the grain.	**shrinking, shrinkage**	The contraction of wood fibers caused by drying below the fiber saturation point (usually around 25-27% M.C.). Values are expressed as a percentage of the dimension of the wood when green.
softwood	This is usually obtained from pine, fir, spruce or larch (mainly conifers). Most structural timber used in the Europe is softwood.	**specific gravity**	The ratio found by dividing the weight of a substance by the weight of an equal volume of pure water.
swelling	The expansion of wood fibres due to change of moisture content.	**tension**	A measure of outward pulling forces as a load is applied to a wood member.
tension wood	Abnormal wood found in leaning trees of some hardwood species and characterized by the presence of gelatinous fibers and excessive longitudinal shrinkage. Tension wood fibers hold together tenaciously, so that sawed surfaces usually have projecting fibers and planed surfaces often are torn or have raised grain. Tension wood may cause warping.	**tracheids**	The elongated cells that constitute the greater part of the structure of the softwoods (frequently referred to as fibers). Also present in some hardwoods
xylem	Commonly referred to as wood, the region of a tree lying between the pith and the cambium.		

CONSTRUCTION AND JOINERY

awning window	A window consisting of one or more sash hinged at the top or bottom which project outward or inward from the plane of the frame. An awning rotates about its top hinge(s) and projects outward. A hopper window rotates about its bottom hinge(s) and projects inward.	**baluster**	The vertical posts which support the railing of the staircase.
balustrade	The assembly of the balusters, newel posts and handrail	**bifold door**	A door capable of being folded into two parts, as with doors that are hinged together.
bottom rail	The lower most horizontal member of a sash, door, blind or other panel assembly.	**box stair**	A stairway which is fully enclosed by walls and routed stringers on both sides.
buffing	The process of using a stand up floor buffer. The floor is abraded with 180 grit screen on the buffer. This allows for the new coat of finish to mechanically adhere to the floor. This process works with great results as long as the floor hasn't had any waxes or synthetic cleaners.	**bullnose tread**	A tread that has one or both sides finished in a radius. Often used as a starting step and often requires a curved riser beneath.
butt	A door hinge, one leaf being mortised or routed into the door frame jamb and	**by-pass sliding door**	One of two or more sliding doors that by-passes another door(s) in a door

	the other into the edge of the door. This is incorrectly called a "butt hinge" as the term "hinge" is usually applied to one which is attached to the surface of a door rather than to its edge such as a strap or T-hinge. A butt consists of the round central part (knuckle), flat portions (leaves or flaps), and the "pin" which is inserted into the knuckle. A pin can be a loose pin butt (removable) or fast (non-removable).		opening in a horizontal direction. A complete unit for such a door can be obtained consisting of two side jambs, header assembly with door track attached and necessary hardwood for hanging doors (doors may or may not be included); conserves space due to the exclusion of a required swing space.
cap	Used in an over-the-post balustrade system. The part of the fitting which widens in order to sit on a newel.	**casement window**	A window consisting of one or more sash hinged to open from the side (adjacent to the jambs), which project outward or inward from the plane of the frame in the vertical plane.
casing	Molding of varying widths and thicknesses used to trim out interior or exterior door openings.	**cladding**	The application of one material over another to provide skin or layer intended to control the infiltration of weather elements, or for aesthetic purposes.
continuous hinge	A long hinge going from the top to the bottom of the product	**cross-ply construction**	Engineered hardwood is constructed by stacking planks in alternating directions. This creates stable flooring that is less affected by moisture or changes in humidity.
dimensional stability	The ability of flooring to retain its original dimensions during the service life of the product.	**divider**	A member that divides glazing into separate vision areas. Dividers are either structural or decorative. Other common term is muntin.
dual-action window	A window consisting of a sash that tilts from the top and swings inward from the side for cleaning of the outside surface. Also referred to as a tilt-turn window.	**dual/triple glazing**	Two (three) layers of glazing material mounted in a common frame and/or sash, separated by a space.
expansion	Changes in dimension of a wood floor due to swelling and contracting as a result of moisture.	**fixed window**	A window that is designed to be non-operable and consists of a glazed frame or a non-operating sash within a frame.
floating floor	A floor that does not need to be nailed or glued to the subfloor and can be installed over most existing floors, including concrete, ceramic, vinyl, wood, and even some indoor/outdoor carpet.	**floor-to-floor height**	The total rise of a stairway. Measured from the top of the finished lower floor to the top of the finished upper floor.
flush door	A flat-faced door that may have a variety of door facings and may be hollow-core or solid-core.	**frame**	The enclosing structure of a window, door, roof window, or unit skylight which fits into or attaches to the wall or roof opening and receives glazing, sash, panels, leaves, or vents.
freestanding	A stairway which is not supported by walls. Open underneath.	**french door**	An interior or exterior door consisting of stiles, top and bottom rail and divided glass panels or lights. Often used in pairs and can be referred to as casement or terrace doors.

glazing	(n): An infill material such as glass or plastic. (v): The process of installing an infill material into a prepared opening in windows, doors, TDDs, roof windows, SSPs, or unit skylights.	**handrail**	The horizontal or rake member of a balustrade system. It sits on top of the balusters and it supported by newel posts.
hardwood	The surface coating on pre-finished flooring. Usually either a UV-cured urethane or UV-cured urethane with aluminum oxide finish.	**hung window**	A window consisting of vertically sliding sash which utilize counterbalancing devices to allow the sash to be opened to any variable position between its fully open and fully closed limits. See also Vertical sliding window.
jambs	The upright or vertical members forming the side of the frame.	**joist**	Heavy pieces of lumber, steel, or other built-up material laid on edge horizontally to form the floor and ceiling support system.
laminate	Clear wear layer protects the floor from high abrasion, stains, fading, and wear-through.	**laminate floor**	Hard surface flooring utilizing a fiberboard core and Melamine wear layer that is available in blocks, planks, and squares and can be installed as individual units.
lander	Narrow tread nosing situated above the top riser or along the upper edge of a balcony. This gives the appearance of a tread at the top of the stairway.	**landing**	A level part of a staircase (as at the end of a flight of stairs).
leaf	A part of a side-hinged door system, glazed or unglazed, surrounded by a frame. Leaves can be fixed in place (non-operable) or movable (operable).	**Lock&Fold®**	The industry's fastest and easiest type of hardwood installation system. The system locks planks together without the use of glue, nails, or staples. Can be used with both hardwood and laminate floors, depending on the product.
mullion	A vertical element that forms a division between units of a window, door, or screen, or is used decoratively.	**nail down**	A flooring installation method that uses nails to attach flooring to a subfloor.
newels	The major support posts for the balustrade system. Larger and heavier than the baluster, newels are located at the bottom and top of a staircase and at turns and critical support areas of balcony rails.	**nosing**	The portion of a tread or landing tread which protrudes beyond the face of the riser.
panel door	The panel and frame construction of the door	**parquet**	Inlaid woodwork in geometric forms, used in flooring.
patio sliding door	Exterior door, usually generous of glass, opening on the patio or terrace.	**pitch**	The slope or angle of the staircase (also referred to as rake angle).
pivot	An axis or the hardware about which a window, sash, panel, or leaf rotates.	**pivot hinge**	Hinges allowing the product to move in variable directions
pivoted window	A window consisting of a sash which pivots about an axis within the frame. The pivoting action of the window allows for easy access to clean the outside surfaces of the window. Two common types are the 180° compression seal pivoting window and the 360° pivoting window.	**pocket door**	An interior door frame to accommodate a door that slides into a partition pocket-type door frames which are often sold as a unit consisting of an outside jamb, header assembly with door track attached, split jamb pocket assembly and hardware for a hanging door.

risers	The vertical component of a stair which supports the treads.	**rosette**	Decorative finish piece, often circular or round, which mounts to a wall and receives the handrail
sanding	Sanding provides a method for smoothing an installed floor, compensating for unevenness of the subfloor. Additionally, sanding is used to renew the appearance of older floors.	**sash**	The members of a window, secondary storm product, or unit skylight that fit within a frame which are designed to accommodate the glazing.
shoe rail	Specially cut base or bottom rail which often receives the bottom end of balusters and is often installed over a knee wall	**sill**	A horizontal member at the bottom of the window frame; a masonry sill or sub-sill can be below the sill of the window unit.
starting newel	The newel used at the bottom of a stairway.	**step**	one single unit of a stair comprised of a tread and riser
stile	The upright or vertical framework pieces of a door.	**storm door**	A panel or sash door occupying the exterior door frame to provide protection from cold weather.
stringer	The inclined board(s) or structural material spanning the length of a flight that supports or holds up the treads and risers; often constructed on the sides;	**subfloor**	The structural layer intended to provide the home's floor support, which may receive floor coverings directly if the surface is appropriate, or indirectly via an underlayment if the surface is not suitable.
taber	Measure of the wear of flooring through resistance. The industry standard is 300-600 cycles of abrasion testing.	**threshold**	A wood or aluminum member, beveled or tapered on each side, and used with exterior or interior door frames. Classified as "interior" or "exterior" or "saddle".
tread	The horizontal, left-to-right board (or surface) that one steps	**winder stair**	A type of staircase that curves

VENEERS AND PLYWOODS

adjacent layer/veneer	Layers in touch, neighbouring layers.	**adhesive**	A substance capable of holding materials together by surface attachment. It is a general term and includes cements, mucilage, and paste, as well as glue.
backing/back	The lowest grade veneer which is generally only used as cross band veneer or for non-visible surfaces.	**birdseye**	Due to local sharp depressions in the annual rings, accompanied by considerable fiber distortions. Once the depressions are formed, succeeding growth rings follow the same contour for many years. Rotary veneer cuts the depressions crosswise, and shows a series of circlets called bird's eyes. It occurs only in a small percentage of Maple trees.
blister	Produced by an uneven contour of the annual rings. The veneer has the effect of being blistered. Must be cut rotary or half-round. In plywood terminology it is a localised separation caused by area of glue bond failure between plies.	**blockboard**	Core board, the core of which is made of strips of solid wood more than 7 mm wide but not wider than 30 mm, which may or may not be glued together.
bond	Adhesion by means of glue.	**buckle**	Corrugation in the veneer leaf resulting

			from different drying runs and irregular annual ring development. The veneer has to be flattened again to make the veneer saleable.
burl	Burls feature swirling grain around clusters of dormant buds, rings or eyes. Available in White Ash, Olive Ash, Carpathian Elm, Maple, Mappa, Myrtle and Walnut.	**cathedral**	A grain appearance characterized by a series of stacked "V" and inverted "V". Pattern common in plain-sliced (flat-cut) veneer.
clipping	Size adjustments after the veneer is peeled off.	**core**	Veneer between face and back.
crossbands	The core veneers that run across the panels at right angles to the face veneers	**crotch veneer**	Produced from the portion of the tree just below the point where it forks into two limbs. The grain is twisted, creating a variety of flame figures. Often resembles a well formed feather.
extender	An adhesive-type substance added to an adhesive mix to aid in glue spreading and water retention. Wheat flour is the common extender used in softwood plywood resin mixes.	**face**	The better quality surface of a plywood.
filler	Non adhesive substance added to an adhesive mix to aid in bulking and flow.E.g, a ground corn cob residue is commonly used in softwood plywood resin mixes while pecan or walnut shell flour can be used in hardwood plywood resin mixes.	**flitch**	The complete bundle of thin sheets of veneer after cutting, laid together in sequence as they were sliced or sawn.
glue	Originally, a hard gelatin obtained from hides, tendons, cartilage, bones, etc., of animals. Also, an adhesive prepared from this substance by heating with water. Through general use the term is now synonymous with the term “adhesive.”	**Glulam**	Structural Glued Laminated Timbers. Glulam is produced in varying lengths by gluing pieces of 1–2 inch thick lumber together with a resorcinol-based adhesive in the presence of a catalyst under pressure.
joint board/ lamboard	Strips of solid wood jointed or glued together	**laminated veneer lumber**	Structural composite lumber product in which wood veneers (not to exceed 0.25 in. thick) are oriented along the length of the finished beam
lathe	Generally, a machine for shaping wood, metal, or other material by means of a rotating drive that turns the piece being worked on against changeable cutting tools.	**layer**	Either one ply or two or more plies glued together with their grain direction parallel or another material.
log	The section of a tree that can be sawn or used for veneer.	**matching**	The arrangement of veneer strips of similar or varying grain patterns within a given panel or from panel to panel.
moulded/ formed/ postformed plywood	The product formed when flat plywood is reshaped into a curved configuration by steaming or plasticizing agents.	**peeling**	Process of rotating and cutting the veneer off in long continuous veneer ribbon of consistent thickness
ply	Either one single veneer or two or more veneers joined edge to edge or end to end.	**plywood**	An engineered panel, typically composed of an odd number of thin layers of wood veneers, called plies, bonded together with a rigid adhesive

			and with the grain direction of adjacent layers perpendicular to each other.
resin	(1) Solid, semisolid, or pseudo solid resin—An organic material that has an indefinite and often high molecular weight, exhibits a tendency to flow when subjected to stress, usually has a softening or melting range, and usually fractures conchoidally. (2) Liquid resin—an organic polymeric liquid that, when converted to its final state for use, becomes a resin.	**rotary cut veneer**	Veneer produced by peeling.
sander	A woodworking tool used to shape or smooth the wood surface by using a gritty surface of varying roughness.	**sliced veneer**	Veneer produced by thrusting a log or sawn flitch into a slicing machine which shears off the veneer in sheets. For decorative purposes
slicing	Process of shearing off the veneer in sheets	**spindle**	A lathe spindle is the "business end" of a lathe. Lathes are used to cut, shape and machine wood or metal, and come in a wide variety of configurations and sizes. The spindle is usually located on the left end of the lathe bed as looked at from the operator's viewpoint.
streak, mineral	Natural discolorations of the wood substance.	**tight-side**	In knife-cut veneer, the side of the sheet was farthest from the knife as the sheet was being cut. It contains no cutting checks (lathe checks).
underground burl	Burl log where the burl development is in the root and the burl is either completely or partially under the ground. These logs have to be dug out to obtain them, an operation which is generally done by hand in order not to damage high quality burls. Underground burls are Myrtle, Walnut, Maple, and Redwood Burl.	**veneer**	A thin sheet of wood, rotary cut, sliced, or sawed from a log, bolt or flitch.
x - y charging system	Laser centring system, which helps the center the log in the peeler with high accuracy		
PARTICLEBOARDS AND FIBREBOARDS			
blending	Mixing all necessary ingredients for making particleboards and fibreboards	**blow**	In plywood and particleboard especially, the development of steam pockets during hot pressing of the panel, resulting in an internal separation or rupture when pressure is released.
cold pressing	A bonding operation in which an assembly is subjected to pressure without the application of heat.	**composite**	The collective name for engineered wood-based materials or components.
defibrator	A thermomechanical pulping refiner in which the pulp material, such as wood chips, is ground in an environment of steam between a rotating grinding disc.	**dimensional stability**	A term that describes whether a section of wood or wood product will resist changes in volume with variation in moisture content (other term: movement in performance).
dry processed	The fibres are dried prior to being	**fibreboard**	A broad generic term inclusive of

	formed into a mattress that is subsequently hot-pressed. Standard process of MDF manufacture.		sheet materials of widely varying densities manufacture of refined or partially refined wood fibers. Bonding agents and other materials may be added to increase strength, resistance to moisture, fire, or decay, or to improve some other property
flakeboard	A particle panel product composed of flakes.	**forming**	The process of layering of particleboards or other material. Different layers have different properties.
HDF - High Density Fibreboard	Fibreboard in which density exceeds 800 kg/m3.	**chipboard**	A paperboard used for many purposes that may or may not have specifications for strength, color, or other characteristics. It is normally made from paper stock with a relatively low density in the thickness of 0.1524 mm and up
LDF - Low Density Fibreboard	Fibreboard in which density does not exceed 500 kg/m3.	**MDF - Medium Density Fibreboard**	A panel product manufactured from lignocellulosic fibers combined with a synthetic resin or other suitable binder. The panels are manufactured to a density of 500 kg/m3 to 800 kg/m3 by the application of heat and pressure by a process in which the interfiber bond is substantially created by the added binder.
OSB - Oriented Strandboard	A type of particle panel product composed of strand-type flakes that are purposefully aligned in directions that make a panel stronger, stiffer, and with improved dimensional properties in the alignment directions than a panel with random flake orientation.	**particleboard**	A type of construction in which the wood particles are made or classified into different sizes and placed into the preprocessed panel configuration to produce a panel with specific properties. Panels that are destined for primarily non structural uses requiring smooth faces are configured with small particles on the outside and coarser particles on the interior (core). Panels designed for structural application may have flakes aligned in orthogonal directions in various layers that mimic the structure of plywood. Three- and five-layer constructions are most common.
particles	The aggregate component of particleboard manufactured by mechanical means from wood. These include all small subdivisions of wood such as chips, curls, flakes, sawdust, shavings, slivers, strands, wafers, wood flour, and wood wool.	**pressing**	Process of bonding of different materials with the application of adhesive, heat and pressure
pulp, pulping	Commodity class of soft moist mass of wood fiber used in the manufacture of paper. Pulp is made up by reducing wood chips to fibers, either by grinding them up, or by chemical means, and then turning the fibers into	**spinning discs**	Rotating grinding disc (rotor) and a stationary disc (stator) each with radial grooves that provides the grinding surface for the chips (particles).

slurry

waferboard A particle panel product made of wafer-type flakes. Usually manufactured to possess equal properties in all directions parallel to the plane of the panel.

warping, warp Distortion in lumber causing departure from its original plane, usually developed during drying. Warp includes cup, bow, crook and twist.

wet processed The fibreboard is manufactured from wet fibres. Lignin is activated during the process as the bonding agent.

SAWMILLING AND TIMBER PRODUCTION

air dried Dried by exposure to air in a yard or shed, without artificial heat.

bark pocket An opening between annual growth rings that contains bark. Bark pockets appear as dark streaks on radial surfaces and as rounded areas on tangential surfaces.

batten Timber product which is usually squared timber, more than 40 mm wide.

beam A beam is a structural element that is capable of withstanding load primarily by resisting against bending.

board Timber product which is less than 38 mm thick, more than 80 mm wide.

bound water The water in the cell walls. It plays significant role in the further processing of the wood. It is bonded to cellulose and hemicellulose.

bow The distortion of lumber in which there is a deviation, in a direction perpendicular to the flat face, from a straight line from end-to-end of the piece

burl A hard, woody outgrowth on a tree, more or less rounded in form, usually resulting from the entwined growth of a cluster of adventitious buds. Such burls are the source of the highly figured burl veneers used for purely ornamental purposes.

butt swell A butt swell is an expansion of the lower end of the tree trunk above and beyond the usual stump flare found in all species.

cant A log that has been slabbed on one or more sides. Ordinarily, cants are intended for resawing at right angles to their widest sawn face.

cant sawing Sawing for a cant or prism.

conditioning The exposure of a material to the influence of a prescribed atmosphere for a stipulated period of time or until a stipulated relation is reached between material and atmosphere.

crook The distortion of lumber in which there is a deviation, in a direction perpendicular to the edge, from a straight line from end-to-end of the piece.

cup A distortion of a board in which there is a deviation flatwise from a straight line across the width of the board.

curvature The deviation of wood leading to reaction wood.

drying schedule A prescribed series of dry- and wet-bulb temperatures and air velocities used in drying a kiln charge of lumber or other wood products.

edging Process of cutting off the edges of the log to make a flat surface.

flitch A portion of a log sawn on two or more faces—commonly on opposite faces leaving two waney edges. When intended for resawing into lumber, it is resawn parallel to its original wide faces. Or, it may be sliced or sawn into veneer, in which case the resulting sheets of veneer laid together in the

			sequence of cutting are called a flitch. (type of cant)
free water	The water in cell lumina which is not chemically bounded.	**grade sawing**	Sawing for specific, quality timber.
grain slope	The angle of the grain in a piece of wood, as determined from a hypothetical line parallel to its length.	**check**	Longitudinal separation of the fibers in wood that do not go through the whole cross section. Checks result from tension stresses during the drying process.
chemically bond water	This type of water is part of the chemical molecules. It does not play any role in mechanical nor physical properties.	**joist**	One of a series of parallel beams used to support floor and ceiling loads and supported in turn by larger beams, girders, or bearing walls.
kiln	A chamber having controlled air-flow, temperature, and relative humidity for drying lumber. The temperature is increased as drying progresses, and the relative humidity is decreased.	**kiln dried**	Dried in a kiln with the use of artificial heat.
lath	Timber product which is less than 38 mm thick, less than 80 mm wide.	**log yard**	The short-term log holding and sorting facility usually located immediately adjacent to a sawmill.
logging	Process for timber harvesting - mainly cutting down trees.	**multiple pith**	Usually two piths in one stem.
ovality	The non-circular shape of the stem/log.	**plain/live sawing**	Plain-sawn hardwood boards are produced by cutting tangentially to a tree's growth rings, creating the "flame-shaped" or "cathedral" pattern. This method also produces the most lumber from each log, making plain-sawn lumber a cost effective design choice.
plank	Timber product which is more than 38 mm thick, width is three times bigger than thickness.	**post**	Timber with the larger dimension not more than 51mm greater than the smaller dimension and usually graded for use as a column.
radial,quarter grain sawing	Quarter-sawing means cutting a log radially (90-degree angle) to the growth rings to produce a "vertical" and uniform pattern grain. This method yields fewer and narrower boards per log than plain sawing, boosting their cost significantly. Quarter-sawn boards are popular for decorative applications such as cabinet faces or wainscoting. They will expand and contract less than boards sawn by other methods.	**resin pitch (pocket)**	An excessive local accumulation of resin or gum in the wood.
saw blade	The cuting medium of the saw. Usually from steel.	**sawmill**	A place where the log are transferred into lumber or other value added product
shake	A separation along the grain, the greater part of which occurs between the rings of annual growth. Usually considered to have occurred in the standing tree or during felling.	**stack**	Pile of wood ready for air-drying

sticker	Strips or boards used to separate the layers of lumber in a pile and thus improve air circulation.	**timber/lumber**	The product of the saw and planing mill for which manufacturing is limited to sawing, resawing, passing lengthwise through a standard planing machine, crosscutting to length, and matching.
twist	A distortion caused by the turning or winding of the edges of a board so that the four comers longer in the same plane.	**wane**	The original rounded surface of a log - with or without bark - on any face or edge of sawn timber.
wood drying/ seasoning	Removing moisture from green wood to improve its serviceability.		

WOODWORKING MACHINES AND TOOLS

back	The edge opposite the toothed edge.	**band saw**	A saw with a looped blade running around two or three wheels. Used with narrow blades for cutting freehand shapes, and with wider blades and a guide for resawing material.
carbon steel	The result of carbon being added to iron in the making of steel.	**circular saw**	A power saw that has a steel disk with cutting teeth on the periphery; rotates on a spindle.
clearance angle	The angle between the lower face of a saw blade and the material being cut.	**conveyor**	A machine which allows movement of material.
crosscutting	A cutting which runs across the board perpendicular to the grain.	**debarking**	Process of removing the bark from the logs
face	The surface of the tooth on which the chip is formed.	**feed**	The pressure exerted by the workpiece against the cutting edge of a saw blade expressed in pounds.
frame saw	A huge saw machine, very slow and space consuming.	**gullet**	The valley between the points of the teeth.
headrig	Saw machine which makes the first cut of the log.	**heel**	The end closest to the handle.
hook angle	The hook angle is the amount of forward or backward lean each tooth has. A hook angle can be thought of as the angle at which the tip enters the material. A 20 degree positive hook angle is used on rip blades to pull the wood into the blade. Standard hook angles range from 5 to 15 degrees positive. Steeper angles, from 18 to 22 degrees, are most effective for ripping and cutting softer materials. Negative hook angles, usually -5 degrees, are used to prevent self-feeding of materials and give the operator maximum control over the feed of cut.	**chipper canter**	A machine which cuts the log into a cant by chipping of the edges.
kerf	The width of a saw cut	**lathe**	A machine tool that rotates the workpiece on its axis to perform various operations
levelling	The process of eliminating irregularities (dents/bumps) in the saw blade.	**maintenance**	A process of monitoring and fixing machines and facility. Retoothing and regrinding are parts of the saw maintenance.

milling cutter	A cutting tool typically used in milling machines or machining centres to remove material by their movement within the machine or directly from the cutter's shape.	**milling machine**	Machine tool for rotating a cutter (milling cutter) to produce plane or formed surfaces on a workpiece, usually by moving the work past the cutter.
point	The tip of tooth in a saw blade.	**rake angle**	The angle between the face of a saw tooth and an imaginary line perpendicular to the baseline of the saw teeth or front of the saw, seen when viewing a saw from the side. It is generally 12 to 15 degrees on a crosscut saw, and zero to eight degrees on a rip saw.
resaw	Next saw machines, dependently on the type of cutting cut the logs, cants or even unedged timber.	**ripping**	The process of sawing a board in the direction of the grain of the board.
sander	A machine used to smooth surfaces by abrasion with sandpaper.	**saw binding**	The material can close against the sides of the saw blade, causing it to become stuck.
saw doctor	A person responsible for samillin.	**sawdust**	Waste during the sawing.
set/ clearance	The bending of teeth in a saw blade to the left and/or right of center. The setting of teeth enables a saw blade to cut straighter, to clear the chips from the kerf, and to allow the back of the band to clear the cut and not bind.	**sharpening**	Maintenance of saw blades or other tools.
spring set	The bending of teeth to right or left to allow clearance of the back of the blade through the cut.	**swage set**	Set of forcing the teeth in a line.
tipping	Improving the material properties of the tooth by adding e.g. carbide		

KEY

KEY UNIT 1

Task 1: bark - cambium - heartwood - sapwood - annual rings - grain - knots - gloss - resin canals - rays

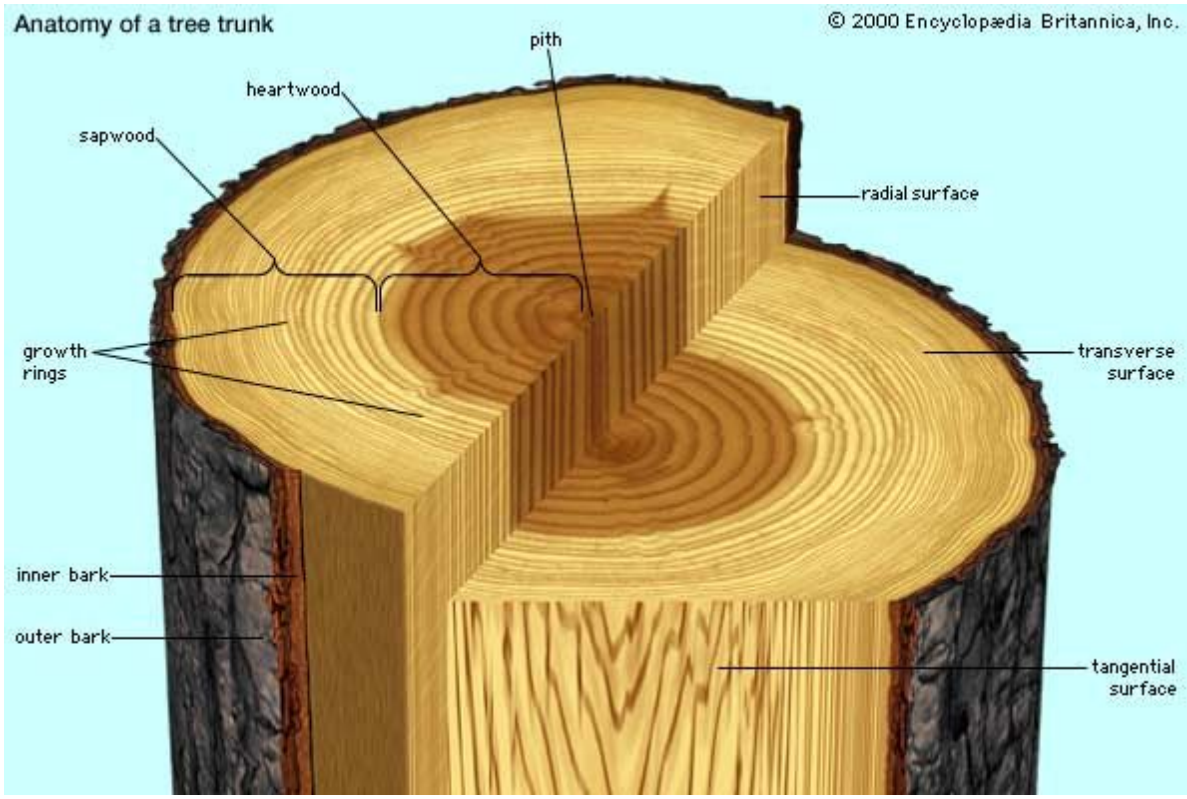
Task 3: 1 - Oak (RPD) 2 - Pine (C) 3 - Yew (C) 4 - Beech (DP) 5 - Spruce (C) 6 - Ash (RPD) 7 - Birch (DP) 8 - Plum (SRD) 9 - Walnut (SRD) 10 - Apple (DP)

Task 4: compression wood x tension wood - cellulose x lignin - latewood x earlywood - needle-leaved x broadleaf - swelling x shrinking

Task 5: Physical: swelling, shrinking, moisture content, equilibrium moisture content, density, acoustic properties, thermal properties, fire retardancy

Mechanical: shear, compression, fatigue, MOE, tension, MOR

Task 6:



KEY UNIT 2

Task 1: 1 - frame 2 - glazing 3 - sash

Task 2: From the top left: horizontal slider - casement window - awning window - hopper window - tilt-and-turn window

Task 3: A: 1 - pin, 2 - knuckle, 3 - leaves, 4 - continuous hinges, 5 - pivot hinges

B: 1 - casing, 2 - hinges, 3 - sidelite, 4 - stiles, 5 - rails, 6 - panels, 7 - mullions, 8 - threshold

Task 5: exterior doors from the left top: panel - windowed - decorative - storm - patio sliding

interior doors from the left top: panel - flush - french - pocket - bypass - bifold

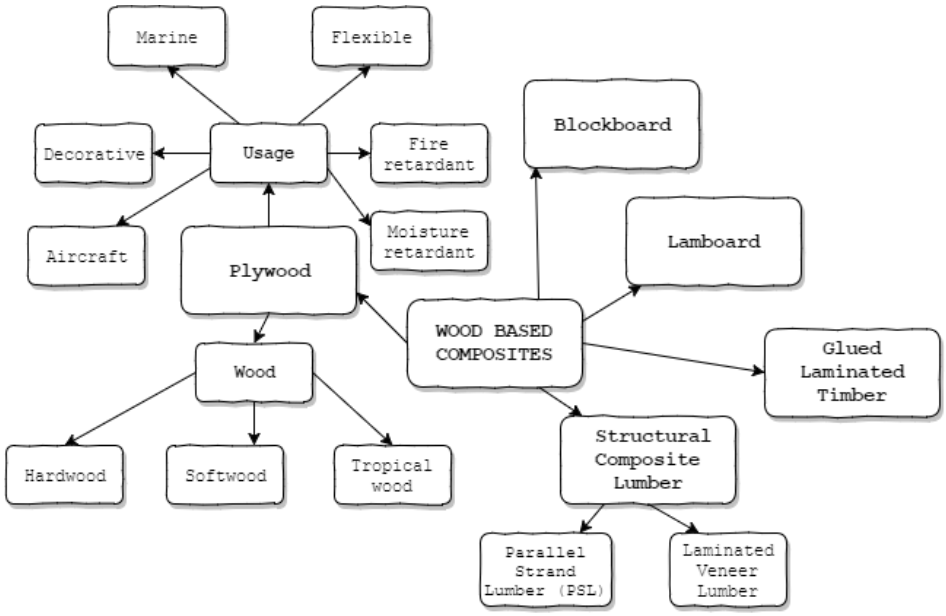
KEY UNIT 3:

Task 2: debarked, log, lathe, clipping, moisture content, jointing, sliced veneer.

Task 3: 1 - face veneer, 2 - core veneers 3 - 90 degress, 4 - back veneer, 5 - defects

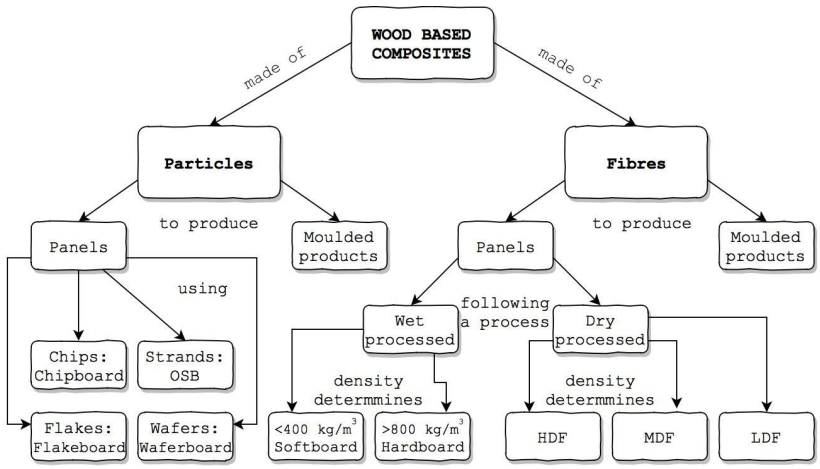
Task 4: pictures from the top: book, pleasing, slip and random matching

Task 8: 1 - blockboard, 2 - flexible/molded, 3 - LVL, 4 - joint board



KEY UNIT4

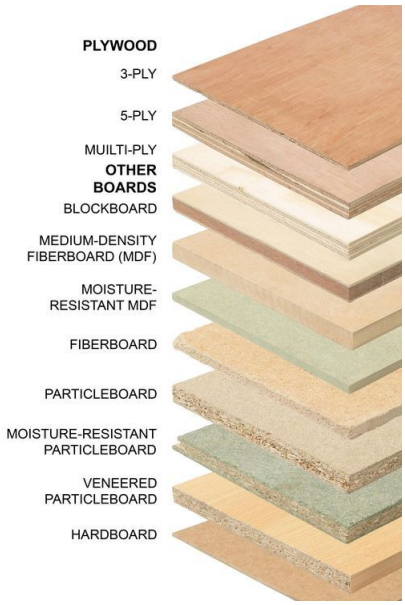
Task 1 :



Task 2:

1. a triple-pass dryer, a single-pass dry combination triple-pass/single-pass dryer, a three-section conveyor dryer 2. a continuous chain dryer 3. phenolics or isocyanates 4. 114 to 152 mm 5. conveyor 6. multiple-opening press 7. spinning disk resin applicators

Task 3:



Task 4: 1 - MDF, 2 - particleboard, 3 -OSB, 4 - plywood
Task 5: in the picture: 1 - chipper, 3 - defibrator, 4 -dryer, 6 - saw

KEY UNIT 5
Task 1: windmill - whipsaw - movable carriage - boards - technology - river - waste – safety
Task 3: 1 - cant sawing 2 - sawing for grade 3 - live sawing
Task 4: 1 - chemically bond water, 2 - bond water, 3- free water
Task 5: From the top left corner: ovality, fork shake, open bark pocket, ring shake, simple heart shake, cup shake, closed bark pocket, star heart shake, multiple pith, grain slope, burl, resin pitch, butt swell, flutes, crookedness/curvature, knots

KEY UNIT 6

Task 1: blade material, blade speed, blade tension, blade thickness, blade width, clearance angle, hook or rake angle, sharpness or tooth angle, face angle, gullet depth, gullet shape, side clearance, tooth design, tooth pitch or spacing, feed speed, face hardening, spring setting, swage profiling, tungsten tipping, stellite tipping
Task 2: picture on the left is spring set teeth
Task 3: picture on the left is more suitable for cross-cutting
Task 4: from the left corner in the lines: horizontal band saw, vertical band saw, frame saw, circular saw, chipper canter, trimmer
Task 5: for example: debarker - drum/rosser head/flail/ring, conveyor - belt/roller/chain/snail, lathe - turret/engine, milling machine - horizontal/vertical, sander - belt/cylindrical/angle/surface
Task 6: pictures from the top: angular, end-milling, plain, side, form

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