



Furniture Making

Level II

Learning Guide #1

Unit of Competence: Set-up and Operate Woodwork
Machines

Module Title: Setting-up and Operating Woodworking
Machines

LG Code: IND FMK2 M02 0919 LO1-LG-01

TTLM Code IND FMK2 M02 TTLM 0919V1

LO1: Prepare for work



Instruction Sheet

Learning Guide #1

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- 1.1 Determining work instructions according to job requirements
 - 1.1.1. Design
 - 1.1.2. Quality
 - 1.1.3. Materials
 - 1.1.4. Quantities
 - 1.1.5. Equipment's
- 1.2. Cutting list
- 1.3. Job specifications.
- 1.4. Workplace health and safety
- 1.5. Characteristics of materials and uses
- 1.6. Select tools and equipment
- 1.7. Procedures for minimizing waste material

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to:**

- Perform work instructions to determine job requirements
- Read and interpret cutting list and job specifications
- Observe workplace health and safety requirements
- Select and inspect quality material for machining
- Identify and check Joining machines, cutting tools and jigs
- Determine procedures to minimize waste material Check Safety equipment

Learning Instructions:

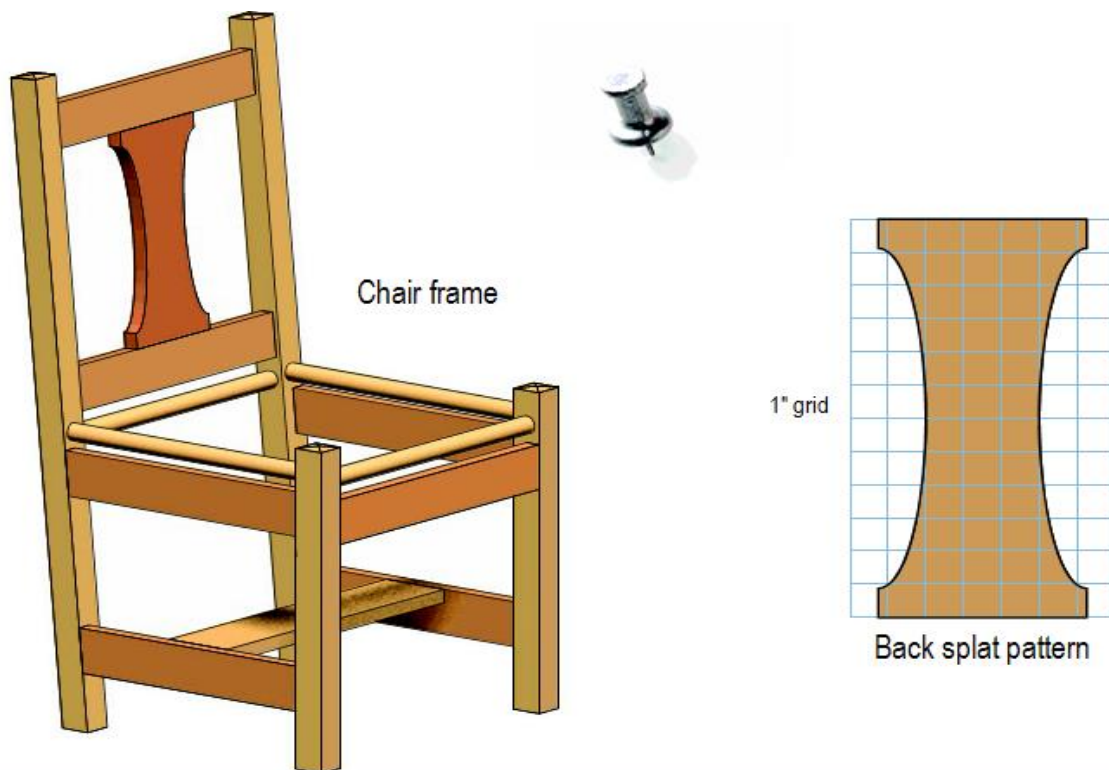
1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in **page -7, 10, 15 and 19** respectively.
5. Do the “LAP test” in **page – 10 and 21** (if you are ready).

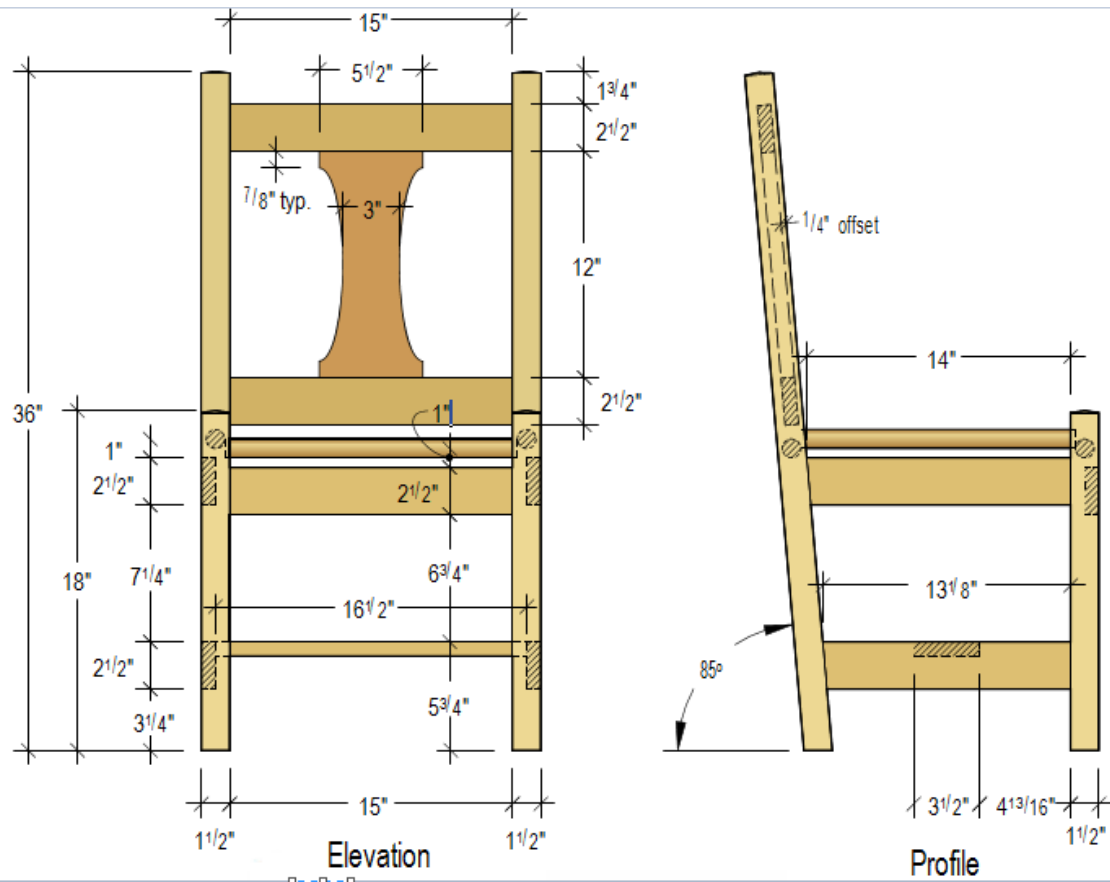
Information Sheet-1

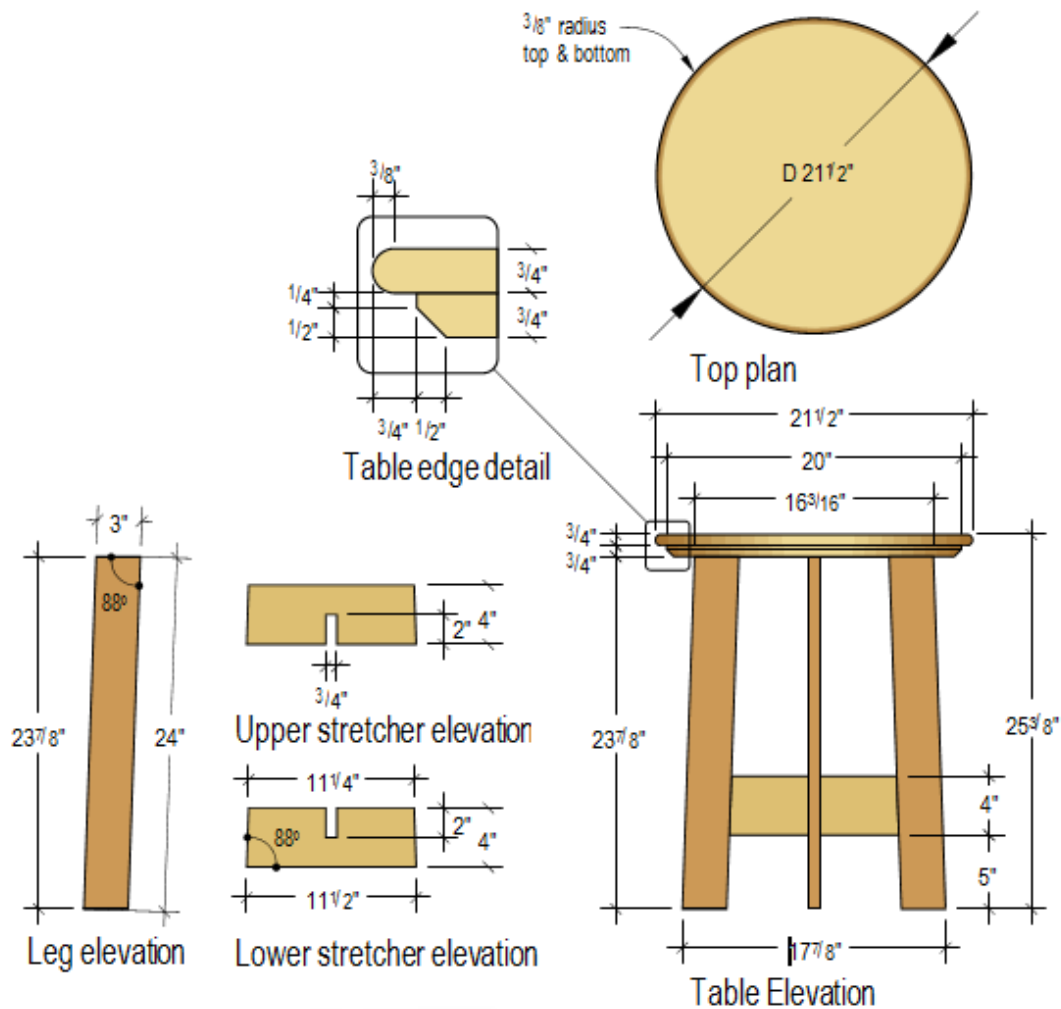
Determining work instructions according to job requirements

1.1.1. Design

- People are not likely to have the same ideas, likes or dislikes for a particular furniture design.
- It is almost impossible to give specific rules that will insure good design in a piece of furniture. However, furniture must be well designed and beautiful if it is to be *useful*, *attractive* and *convenient*.
- The taste or feeling for good design can be acquired by observing quality in all manufactured products and by adhering to certain fundamentals.
- There are many things to consider when designing a product. The end result must, of course, satisfy the customer.
- To do this the designer must consider the purpose, strength, size, shape, proportion, appearance, time (the time spent in designing is well worth the effort. This helps to avoid mistakes and saves time in the long run), and cost of the product.







1.1.2. Quality

- Quality is ultimately measured by how well the product meets the requirements and expectations of the consumer.
- Quality may be specified by the designer or the person that uses it.
- The standards or specification requirements, address lumber grades, plywood grades, wood and manufactured panel casework, plastics covered casework, countertops, doors, finishing, and assembly.
- Quality also involves productivity. When work falls short of the goals, corrective action must be taken. Reports and schedules are made to assist in monitoring work activities.

1.1.3. Materials

- There are many materials available for producing cabinets and fine furniture.
- These should be considered carefully throughout the design and production process.
- Materials you might consider include lumber, veneer, plastic, manufactured panel products, plywood, particleboard, plastic laminates, and glass.



- To assemble these materials, you will also choose among adhesives, mechanical fasteners, or joinery.
- Finishing materials are coating that provide color and protection to the wood.
- What material(s) will be suitable or available for realization?
- What properties should the material (s) used possess?
- Will the material(s) need any special treatment?
- What type of finish will be required

1.1.4.Quantities

- The manufacturing organization should produce the products in right number.
- If they are produced in excess of demand the capital will block up in the form of inventory and if the quantity is produced in short of demand, leads to shortage of products

Bill of Materials

- listing of all of the raw materials, parts, subassemblies, and assemblies needed to produce one unit of a product
- Basically, a bill of material (BOM) is a complete list of the components making up an object or assembly.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Match column A with column B. Select the letter of the correct answer from column B & write your answer on the provided space **in front of the number in column A**

If you wish to change your answer place an x mark on your previous answer and write your preferred answer

Column A	Column B
----- Ultimately measured by how well the product meets the requirements and expectations of the consumer. (2 points)	Quantities
-----The manufacturing organization should produce the products in right number (2 points)	Bill of material
----- listing of all of the raw materials, parts, subassemblies, and assemblies (2points)	Design
----- <i>Useful, attractive and convenient.</i> (2points)	Quality

Note: Satisfactory rating – 8 points

Unsatisfactory - below 8 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information Sheet-2	Reading and interpreting cutting lists
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- What is cutting list? A cutting list shows how to cut a given set of parts from set of available stock.
- Now that we have designed the cabinet, we have to figure out how much wood we will need to make it.
- Each parts of your project require a certain amount of wood which has thickness, width and length.
- When you designed the project, you figure out what all of the parts were and what their dimensions have to be.
- So you basically create a list all of these parts, listing where they go in final assemble as well as their names, thickness, width, length and what kind of wood you want to use to make them.
- From the cut list you can determine know how much wood you need to buy, you can estimate how much the material will cost and once you know what it will cost.

Operation Sheet 1	Cutting list
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Developing a Cutting Schedule:

Once you have completed your working drawings, you will need to determine the final cut-size of each piece. First, create a table with six columns labeled as follows:

Key	Parts	Pcs.	Size	Material	Cut from

Step-1 Key: Begin by assigning each piece of your project a letter (A, B, C, etc.). Use the letter to label each part on your rough layout as shown on the illustration to the right.

Step-2 Parts: Next, name the piece (Back, front, top, leg, etc.)

Step-3 Pieces: If the part to be cut is duplicated, number the amount of pieces you will need to cut. For instance, if you are making a dining room table, you will need 4 legs. If you are making a nightstand, you will need two sides. Since these parts are the exact same size, you need only write the part once and label the amount of pieces.

Step-4 Size: Determine the exact size of your final piece after you cut it. Record the dimension. This will tell you the size to cut your wood.

Step-5 Material: List the type of material you will use (oak, pine, redwood, etc.). This is particularly important if you are using more than one type of lumber.

Step-6 Cut from: List the lumber in its store-bought size from which you will cut the part (1x4x8; 3/4" plywood; 2x6x4; etc.). This will tell you from which piece of store bought lumber to cut.

A cutting list is a tabulated list showing information about the materials required for the job.

It shows you things like:

When finished, your cutting schedule will look something like this:



Key	Parts	Pcs.	Size	Material	Cut From (buy) *see Notes
A	Top	1	3/4 x 26-3/4 x 47-7/8" (OA)	Pine	4/8, 1 x 4
B	Edging, ends top	2	3/4 x 1 x 27-3/4"	Pine	All edging from 1/5, 1 x 6
C	Edging, front top	1	3/4 x 1 x 49-7/8"	Pine	"
D	Legs	4	2 x 2 x 28-1/2"	Pine	1/5, 8/4 x 6
E	Top rails, front and rear	2	3/4 x 1-1/2 x 47-1/8"	Pine	All rails from 1/7, 1 x 4
F	Top rails, ends	2	3/4 x 1-1/2 x 24-3/4"	Pine	"
G	Rear stretcher	1	1-3/4 x 1-5/8 x 47-1/8"	Pine	All stretchers cut from 1/7, 8/4 x 8" board
H	End stretchers	2	1-3/4 x 1-5/8 x 24-3/4"	Pine	"
I	Dividers	3	3/4 x 4-1/4 x 26-1/2"	Pine	1/8, 1 x 6
J	Cleat	1	3/4 x 1-1/2 x 22-3/4"	Pine	Scrap box
K	Drawer shelf	1	3/4 x 12-1/4 x 26-1/4"	Pine	1/5, 1 x 8
Drawer					
L	Drawer sides	2	1/2 x 2-5/8 x 12-1/2"	Pine	1/5, 1 x 4
M	Drawer back	1	1/2 x 1-7/8 x 10-5/8"	Pine	1/1, 1 x 4
N	Drawer front	1	3/4 x 4-3/16 x 12-1/4"	Pine	1/18, 1 x 6
O	Drawer bottom	1	1/4 x 10-1/16 x 11-15/16"	Plywood	1 sq. ft.
Keyboard Platform					
P	Keyboard platform	1	3/4 x 14-5/8 x 30-7/8"	Pine	1/5, 1 x 4
Q**	Hand rest	1	3/4 x 2 x 30-7/8"	Pine	1/1, 1 x 4
R	Stop blocks	2	3/4 x 3/4 x 3-1/2"	Pine	1/18, 1 x 6

Specification

Having considered all this factors and having decided what to do, a statement is then made embodying the major conclusions regarding functions, limitations, etc. This statement is referred to as a design specification. For example; the container must be:

- Able to hold reasonable amount of rubbish safely.
- Very stable and raged.
- Easy to move about.
- Easy to operate by foot (i.e. the lid).
- Easy to construct with available materials.
- Attractive and inexpensive.



Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define what is cutting list? (2.5 points)
2. Develop chart for cut list? (5 points)
3. What are difference between a bill of materials and cutting list? (2.5points)

Note: Satisfactory rating – 10 points

Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within ½ hour.

Task 1: Using Job specifications, set-out rods and plans for determine the job requirements, including cutting list, dimension, design, quality materials and processes

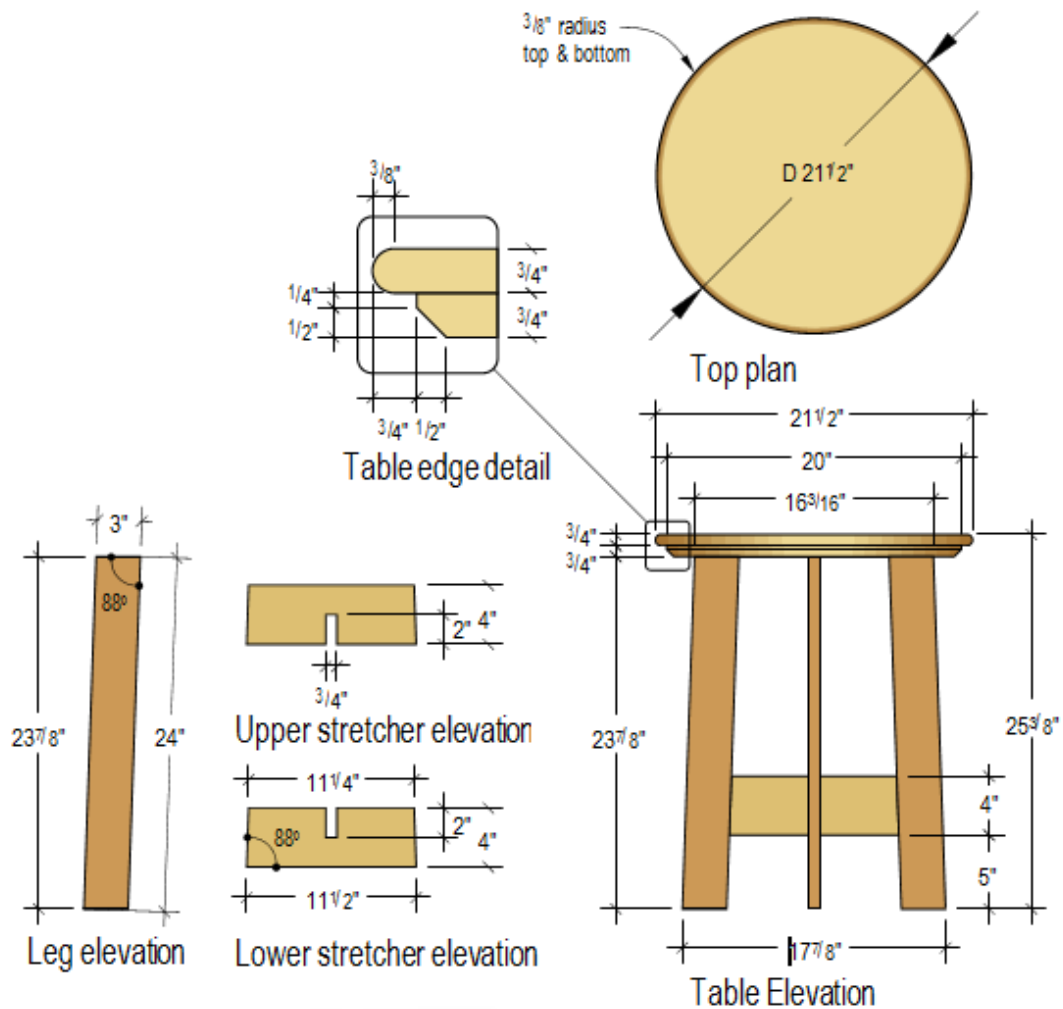
Task 2: Check Cutting list and set out in accordance with workplace procedures and the plans and specification

Task 3: Identify Components and described using common workplace terminology

Task 4: Establish Sizes and tolerance of components and documents in accordance with workplace procedures

Task 5: Identify Dimensional allowances for further processing and documented

Task 6: Interpret Cutting list and accordance with job requirements





Information Sheet-3

Observing workplace health and safety requirements

- **Safety** is the first essential requirement and every personnel must learn the safety measures even before he starts working on a machine or on equipment's.
- **Safety** is an attitude, a form of mind of worker. If the attitude of worker towards safety is good and he is safety conscious, then he himself will develop the safe working habits. Before you can use equipment and tools or attempt practical work in a workshop you must understand basic safety rules.
- These rules will help keep you and others safe in the workshop.

Safety is a precaution to avoid accident.

Care is a technique of properly handling tools, equipment's & materials.

To protect ourselves from the accidents of hand tools & machines in the workshop it's better to consider the following three safety care.

Personal protective equipment

When working on or with the machine, the following must be strictly observed:
Persons with long hair who are not wearing a hairnet are not permitted to work on or with the machine!

It is prohibited to wear gloves while working on or with the machine!

When working on or with the machine, the following must always be worn by personnel:



Protective clothes

Sturdy, tight-fitting clothing (tear-resistant, no wide sleeves)



Protective footwear that protect the feet from heavy falling objects and prevent sliding on slippery floors



Hearing protection

To protect against loss of hearing

General Safety Rules:

General safety rule is very important to reduce the accident while you working in workshop. Some of them are listed below,

- ☛ **Always dress properly:** - Dress properly for your work. While you must wear your aprons are provided so that you can work on the machines. Remove any jeweler, neckties, chains, bracelets, and rings. Roll up your sleeves and tie any hair back in a ponytail before beginning any work



- ☛ **Follow directions:**-understanding the procedures of using by hand tools & machines.
- ☛ **Keep the shop clean:** - Put your tools back where they belong when you are finished. Keep the floor clear of debris and sawdust the floor should be clear of scrap blocks, excessive material, and sawdust. Keep projects, sawhorses, and other equipment and materials you are using out of travel lanes. Wipe up any spilled liquids immediately.
- ☛ **Learn to use the tools correctly**
 - -Understanding using of hand tools in proper ways.
- ☛ **Avoid house play**
- ☛ **Report all accidents**
- ☛ **Practice lending a cheerful helping hand when requested by someone.**

Be thoughtful and helpful toward other students in the class. Caution them if they are violating a safety rule. This is one of the most important rules in that all of you have responsibility for each other's safety and well-being in the class.

House Keeping

Keeping of work shop clean & store the tools in proper place is to ensure our body & tools from the accidents of machine while working & breakage of tools respectively. The workshop is kept in different ways .Some of themes are:

- Work benches should be free & clean of clutter.
- Tools & equipment's should be safely stored.
- Keep the floor clean & clear.
- Immediately wipe of spilled liquids which can create a slippery surface.

Fire prevention

- When using power tools it is the responsibility of the student to be aware of a tool getting hot. If this happens immediately turn it off, unplug it, and report it to the teacher.
- If a tool emits a "burning smell" inform the instructor immediately.
- Any finishing materials should not be used near an open flame.
- This would also include thinners and paints.
- Rags that have absorbed any amount of linseed oil, solvents, stains, paints, or any other finishing products must be disposed in an approved covered metal container as a precaution against spontaneous combustion.
- Report to the instructor any odor of gas. Gas can not only cause a fire or an explosion, it can also make people ill.
- When unplugging an electrical cord, always do so by the plug itself and not by the cord. This causes damage to the wires and can eventually be the cause of a fire.



The Ten Commandments of Machine Safety

1. **Pay Attention:** Not paying attention is the number one cause of accidents. Think. Think. Think. Keep your mind on your work. Give your work your undivided attention. Do not look around, talk to others, or use a machine without rehearsing the cut in your mind first.
2. **Keep Machine Guards In Place** at all times. Guards are there to protect you. If a guard has been removed tell the teacher so that he/she may put it back on before you begin.
3. **Do Not Over Reach:** Never reach across or over a moving blade.
4. **Know The Fly Zone:** Know where the wood is going to go, kick back, or fly if you lose control of it, and do not stand in that area. For example: A drill press will spin the wood clockwise, so the long side of the material should be to the left. A table saw will throw the wood backward, so stand to the side.
5. **Proper Tool Use:** Only use a tool for what it is made for. Understand grain direction, rip-cuts, cross-cuts, blade direction, and proper blade installation. Turn off a tool when you are finished and wait for it to come to a complete stop before leaving. Blades are often felt before they are heard.
6. **Proper Wood Size:** Many accidents occur simply because a person attempts to cut a piece of wood that is too small or too big. Smaller pieces of lumber are easily grabbed by the blade and the hand holding the wood quickly follows. Because lumber that is too large must be forced into the blade, the extra force required can cause slipping, thrusting, or sudden release. Body parts then lunge forward into the blade. Oversized lumber is under control of the blade, not your hands.
7. **Special Set-Up Approval:** A special cut requires guards to be removed, and if not done correctly will cause serious injury. Always inform the teacher of any special set-up you are thinking on attempting.
8. **Proper Hand Placement:** Always hold the wood firmly. Never cross your arms. Do not push wood hard towards the blade. Do not force wood. You may slip and fall into the blade.
9. **Keep Fingers Clear:** Keep your fingers clear of blades, rotating parts, pinch points, and electrical plugs by maintaining a clearance of 2 to 4 inches. To assure your safety and the safety of others, only cut wood that is a minimum of 12" long and 3" wide (the 12/3 rule). You must inform the instructor before cutting any piece smaller than the 12/3 rule.
10. **Keep Work against the Fence and On the Table:** Wood should be firmly against the fence and the table before cutting. The blades and cutters are designed to drive/throw/press the wood against the fence and table. In other words, if you don't have wood there, the blade will put it there for you, along with your hand.



Self-Check -3

Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define safety? (2 points)
2. List personal protective equipment's? (2 points)
3. List Ten Commandments of machine safety (6 points)

Note: Satisfactory rating – 10 points

Unsatisfactory - below 10points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet-4

Characteristics of materials and uses

Wood selection:

- a. Only material furnished or approved by the instructor is to be used.
- b. All material is to be inspected for knots and nails before using. These may fly off during cutting and cause bodily injury or damage the machine.
- c. Do not use green lumber in any milling process. Green lumber is wood that has not been thoroughly dried. It is wet on the inside and contains tree sap. This type of wood will change over time (warp, bow, twist, etc.) as well as grow mold.

Plywood

Plywood layers (called veneers) are glued together. Each layer is called a ply. When gluing the plies together, the grain pattern of each alternating layer is placed at a right angle to the layer before it. This adds to the strength.

There are usually an odd number of plies so that the sheet is balanced—this reduces warping.

Advantages:

1. Allows you to keep the wood look of a project.
2. Can be stained Is strong and resistant to distortions
4. Cheaper than wood planks

Disadvantages:

1. Splinters when router
2. Exposed edges show veneers
3. Feathers, sheaves, or splits when screw fasteners are used or when hinges are applied

MDF

MDF is an engineered wood product formed by breaking down hardwood or softwood “left-overs” (the wood material left behind after milling) into wood fibers. These left-overs are combined with wax and a resin binder, which are then formed in panels by applying high temperature and pressure. MDF is more condensed and more compressed than plywood. Edges, therefore, may be routed cleanly and sanded with little effort. Entire projects can be made from MDF, the tops, the shelves, the face frames, the drawer fronts, and more.

Advantages:

1. Edges are easily routed and sanded.
2. Easily painted
3. Minimal sanding
4. Can use for the entire project
5. Cheaper than wood

Disadvantages:

1. Cannot be stained
2. Does not look like wood



Particleboard, sometimes called pressboard or chipboard, is an engineered wood product manufactured from wood particles, such as wood chips, sawmill shavings, or even saw dust. These materials are combined with a synthetic resin or some other suitable binder and pressed together, forming what we call a composite material.

Advantages:

1. Cheap.
2. Good underlayment for vinyl or tile backer board
3. Holds screws in place
4. Good for shelves spanning 30" or more

Disadvantages:

1. Chips when route ring
2. Prone to expansion and discoloration due to moisture
3. Does not look like wood

Ethiopian Timber

Local Name	Uses of Wood
Eucalyptus	Housing construction, caulking material
Wanza	Simple furniture
Eucalyptus	Building construction, poles, piles, flooring, bridge
Zigba	Furniture, construction, door, window
Pine	Furniture and cabinet making, frames in building construction
Tid	Construction, poles, flooring
Tikur inchet	Construction, Framing
Kerero	Furniture, flooring, construction
Girar	Construction



	Structure/ Material	Types	Use	Width
Plywood	3 or more layers of veneer, glued at 90 degrees to one another (cross banding) Bonding: Interior/ exterior Marine Structural	Decorative plywood	Paneling	3 – 30 mm
		Three-ply board	Drawer bottom, cabinet box	
		Multi-ply	Veneered furniture	
		Four/ six ply	Structural work	
	Drawer side plywood	Drawer sides	12 mm	
Blockboard	Outside layers of veneer Core is constructed from strips of solid wood	3 layer	Shelving, worktops Not good to veneer	12 – 44 mm
Laminboard	Blockboard structure, strips of solid wood only 5 – 8 mm wide	3 layer	Furniture applications, good for veneering	12 – 44 mm
		5 layer		
Particle Board	Consists of wooden particles, glued together Different particle sizes and glues Relatively brittle, lower tensile strength	Chipboards:	Furniture applications Can be veneered, not painted	6-40 mm
		Single layer chipboard		
		3-layer chipboard		
		Graded density chipboard	With surface ready	
		Decorative chipboard	Greater tensile strength Structural work	
		Oriented strand board		
Flake or wafer board				
Fibre Boards	Wood reduced to basic fibre elements Various density and adhesives Homogeneous and sable	Hardboards:	Cabinet backs, furniture	1.5 – 12 mm
		Standard	Mesh pattern at back	
		Tempered	Water resistant glue	
		Duo faced	No mesh pattern at back	
		Decorative	Perforated, lacquered	
		Medium boards:	Pinboards and wall paneling	6 – 12 mm
		Low density		
		High density		
Medium density fibreboard (MDF)	Synthetic resin adhesive Smooth surface, edges Can be veneered, painted, moulded	6 – 32 mm		

**Self-Check -4****Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Match column A with column B. Select the letter of the correct answer from column B & write your answer on the provided space **in front of the number in column A**

If you wish to change your answer place an x mark on your previous answer and write your preferred answer

Column A	Column B
----- pressboard or chipboard, is an engineered wood product manufactured from wood particles (2 points)	Plywood
----- engineered wood product formed by breaking down hardwood or softwood “left-overs” (the wood material left behind after milling) into wood fibers. (2 points)	MDF
----- layers (called veneers) are glued together (2points)	Particleboard

Note: Satisfactory rating – 6 points

Unsatisfactory - below 6points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Information sheet-5	Select tools and equipment
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Tools

- Tools can be divided into two main groups: hand tools and power tools.
- Hand tools are operated by the physical strength of the user.
- Power tools require an external source of power such as electricity or compressed air to operate.
- Each of these groups can also be divided into sub groups.

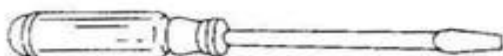
Operation Sheet 1	Use hand and power tool safely
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Steps 1- select the right tool and equipment for the job

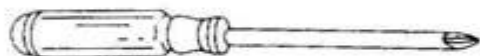
Steps 2- keep tools in good condition

Steps 3- use tools and Equipment the correct way

Steps 4- keep tools in a safe place



Medium screwdriver



#2 Phillips screwdriver



Straight edge



Adjustable wrench



Combination square



13mm Wrench

- Combination wrench
- Hex key
- Framing square
- Medium size flat blade screw driver

Waste Disposal and Recycling

1. Be responsible for cleaning up workstations, tools and the shops.
2. Sort waste by category as required using approved containers.
3. Sort recyclable liquids and solids into proper approved storage container.



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 3 hours.

Task 1: Interpret work order and locate and apply relevant information

Task 2: Apply safe handling requirements for equipment, products and materials, including use of personal protective equipment

Task 3: Read and interpret cutting lists and job specifications

Task 4: Identified materials used in the work process



Further reading material

- **Advanced Woodworking VALLEY OAKS CHARTER SCHOOL**
- Wood working text book
- Woodworkers' Guide to Sharpening, by John English, Fox Chapel Publishing, 2008
- Illustrated Guide to Sharpening, by Thomas Lie-Nielsen, Taunton Press, 2004
- Sharpening, by Nick Engler, Rodale Press, 1994
- The Complete Guide to Sharpening, by Leonard Lee, Taunton Press, 1995
- How To Sharpen Every Blade in Your Woodshop, by Don Geary, Betterway Book machinery component maintenance and repair