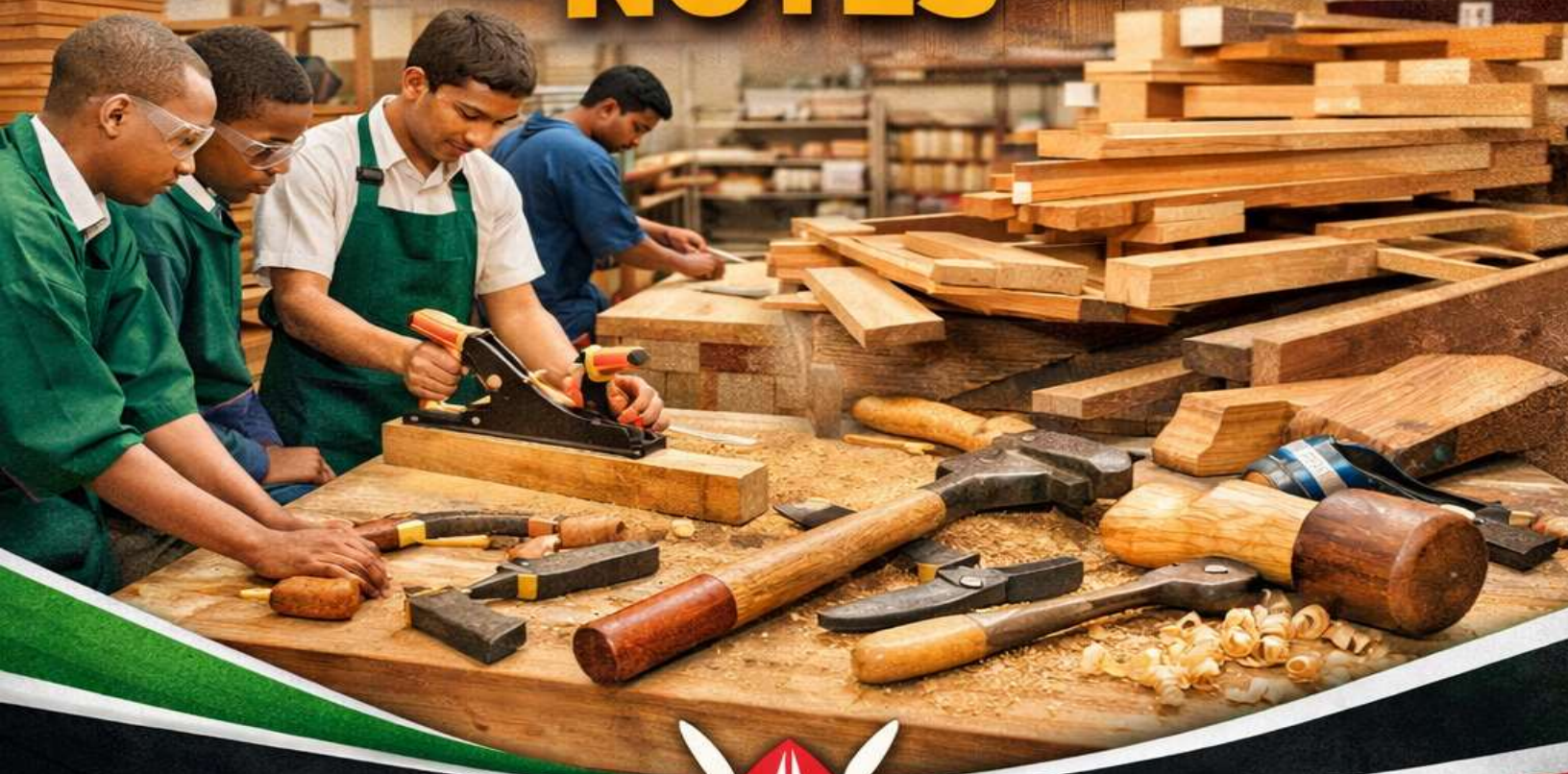


COMPETENCE BASED CURRICULUM

SENIOR SCHOOL

GRADE 10

WOOD TECHNOLOGY NOTES



1.0 Introduction to Wood Technology

Wood Technology is a practical and theoretical field of study that focuses on the use of wood as a material to create useful, decorative, and structural products. It integrates **science, technology, creativity, and practical skills** to convert wood from trees into valuable items used in homes, schools, industries, and the wider society.

Wood Technology involves:

- Understanding wood as a **natural resource**
- Processing timber into usable forms
- Designing and making wood products
- Using tools, machines, and technology safely
- Applying creativity, accuracy, and problem-solving skills

1.1 Overview of Wood Technology

1.1.1 Meaning of Wood Technology

Wood Technology refers to:

- The study of wood and its properties
- The processing of timber into useful materials
- The design and construction of wood products
- The use of tools, machines, and techniques in woodworking
- Applying **scientific and technological knowledge** in working with wood

Simple definition:

Wood Technology is the study and practice of converting wood into useful products using tools, machines, skills, and technology.

1.1.2 Development of Wood Technology as an Area of Study

(a) Historical Development of Wood Technology

i) Early / Traditional Period

- Use of stone tools to cut and shape wood
- Wood products included: shelters, canoes, spears, cooking sticks
- Skills passed orally from elders to youth

Examples:

- Wooden stools, mortars & pestles, wooden drums, carved masks, walking sticks

ii) Agricultural & Settlement Period

- Introduction of **metal tools** like axes, saws, chisels
- Wood used in farm tools, furniture, fencing, storage

Examples:

- Ox-plough handles, wooden doors, beds, granaries, animal sheds

iii) Industrial Revolution

- Introduction of **machines and sawmills**
- Mass production, standardized timber sizes

Examples:

- Machine-cut planks, factory furniture, railway sleepers, wooden crates

iv) Modern Wood Technology

- Advanced **machines, power tools, CNC, CAD**
- Sustainable forestry and engineered wood products

Examples:

- Plywood, MDF, chipboard, laminated timber, CNC-cut furniture

(b) Evolution of Wood Technology as a School Subject

- Began as **Carpentry & Joinery**
- Introduced in technical schools
- Integrated into **Competence Based Curriculum (CBC)**
- Focus on **creativity, entrepreneurship, and innovation**

1.1.3 Benefits of Studying Wood Technology

(a) Skill Development Benefits

- Develop **practical hand skills**
- Improve **hand-eye coordination**
- Learn **measurement, accuracy, and problem-solving**
- Develop **creativity, imagination, and planning**

Examples:

- Measuring and marking timber accurately
- Cutting straight or curved shapes
- Assembling joints correctly
- Designing original furniture

(b) Personal Development Benefits

- Builds **self-confidence, patience, and discipline**
- Promotes teamwork and responsibility
- Encourages safety awareness and positive work attitude

Examples:

- Completing a project from start to finish
- Working in groups in workshops
- Handling tools safely

(c) Educational Benefits

- Enhances understanding of **science** (forces, materials, structures)
- Improves **mathematics skills** (geometry, measurements)
- Encourages **technological literacy and project-based learning**

Examples:

- Calculating lengths, angles, and volume
- Understanding material strength and properties
- Interpreting working drawings

1.1.4 Careers Related to Wood Technology

(a) Artisan and Technical Careers

- Carpenter, Joiner, Cabinet maker, Furniture maker, Wood carver, Pattern maker, Flooring installer

Examples of work:

- Making tables, chairs, doors, cabinets, decorative items

(b) Industrial and Technical Careers

- Sawmill technician, Machine operator, Wood processing technician, Quality control officer

Examples:

- Operating cutting machines, supervising timber processing, inspecting wood quality

(c) Professional & Advanced Careers

- Wood technologist, Industrial designer, Furniture designer, Construction manager, Forestry technologist, Lecturer/Trainer

(d) Entrepreneurial Careers

- Furniture business owner, Timber merchant, Interior décor specialist, Wood product exporter, Workshop owner

Examples:

- School desk manufacturing, home décor production, custom furniture design

1.1.5 Role of Wood Technology in Economic Development

(a) Job Creation

- Carpenters, machine operators, designers, transporters

(b) Industrial Growth

- Supports construction and furniture manufacturing

(c) Income Generation

- Sale of wood products, export of furniture and carvings

(d) Support to Other Sectors

- Education (school furniture), health (hospital furniture), tourism (souvenirs), agriculture (farm structures)

(e) Sustainable Development

- Promotes tree planting, responsible forest use, recycling wood waste

Examples:

- Reforestation projects, engineered wood, wood recycling

1.2 Practical Activities and Projects

1.2.1 Practical Activities

1. Workshop Visits

- Observe wood types, tools, machines, and wood products
- Take notes on safety, organization, and workflow

2. Hands-on Activities

- Measuring and cutting timber
- Assembling a simple wooden stool or shelf
- Practicing joinery techniques (butt joint, lap joint, dovetail)

3. Wood Identification

- Identify common timber types: mahogany, cedar, cypress, pine
- Record properties: hardness, grain, color, durability

4. Safety Practice

- Demonstrate safe use of hand tools and machines
- Organize first aid kits in the workshop

1.2.2 Projects

1. Individual Project

- Construct a small wooden box, shelf, or stool
- Focus on **accuracy, finishing, and design**

2. Group Project

- Build a **classroom furniture set**: chairs, tables
- Apply teamwork, planning, division of labor

3. Creative Design Project

- Design and make **decorative or functional items** (frames, carvings, lamp stands)
- Encourage **innovation and entrepreneurship**

4. Sustainable Project

- Create items from **recycled timber or off-cuts**
- Promote **environmental awareness**

1.3 Summary

- Wood Technology combines **practical skills, creativity, and science**
- Focuses on **timber processing, design, construction, and safety**
- Provides **career opportunities, entrepreneurship, and economic benefits**
- Encourages **sustainable use of resources**
- Practical skills enhance **problem-solving, measurement, and teamwork**

1.2 WOOD WORKSHOP

A **wood workshop** is a designated space for woodworking activities. It provides a controlled environment for:

- Measuring, marking, and cutting timber
- Shaping, joining, and assembling wood products
- Finishing and polishing wood items
- Storage of tools, machines, and raw materials
- Ensuring safety and proper workflow

Benefits of a Wood Workshop:

- Safe working environment
- Organized storage and machine areas
- Adequate space for group practical activities
- Facilities for learning, creativity, and production
- Supports skill development and entrepreneurship

1.2.1 Meaning of a Wood Workshop

A **wood workshop** is:

- A place where wood is worked on using tools and machines
- A center for practical learning and innovation
- A space for creative design and problem-solving
- A training hub for skilled artisans and technical learners

Examples of Wood Workshops:

- School wood workshop
- Community carpentry workshop
- Furniture-making factories
- Industrial woodworking plants
- Training institutes
- Home-based hobby workshops

1.2.2 Features of a Wood Workshop

The features of a wood workshop can be grouped into **physical structure, lighting, ventilation, working areas, benches, storage, machines, and safety measures.**

(a) Physical Structural Features

Feature	Importance	Example
Strong walls	Support machines and provide durability	Reinforced concrete walls
Concrete or wooden floor	Supports weight of timber and equipment	Polished concrete floor
Wide doors	Facilitate movement of timber and furniture	Double-leaf wooden doors
Large windows	Allow natural light and ventilation	Glass windows with grills
High roof	Reduces heat and smoke accumulation	Pitched roof design
Wide working space	Supports group activities and machine operation	Open floor plan for benches
Fire exits	Ensure safety during emergencies	Clearly marked exit doors

(b) Lighting Features

Feature	Importance	Example
Natural lighting	Reduces eye strain, enhances visibility	Large sun-facing windows
Artificial lighting	Ensures work continues at night	LED bulbs, fluorescent tubes
Task lights	For precision work	Adjustable bench lamps
Overhead lights	Illuminates general workshop	Ceiling-mounted lights

(c) Ventilation Features

Feature	Importance	Example
Windows	Circulate fresh air	Cross-ventilated windows
Roof vents	Reduce heat and fumes	Ridge vents
Exhaust fans	Remove dust and smoke	Ceiling-mounted fans
Ventilation grills	Continuous airflow	Grills near machines

(d) Working Areas

Area	Purpose	Example
Measuring & marking	Precise measurement of timber	Bench with measuring tools
Cutting area	Sawing timber safely	Circular saw or handsaw section
Shaping & smoothing	Planing and sanding	Hand planes and sanders
Assembly area	Joining timber pieces	Assembly tables with vices
Finishing area	Polishing, painting, varnishing	Separate space with ventilation

(e) Work Benches

- Strong, stable, and suitable height
- Equipped with vices and smooth surfaces
- Support precision and safety

Types:

- Carpenter’s bench with front vice
- Bench with tail vice
- Portable/adjustable bench for small projects

(f) Tools and Machines Storage

- Racks, cabinets, drawers, and shelves
- Organized by type: hand tools, power tools, clamps
- Reduces accidents and saves time

Examples:

- Pegboards for hammers, saws, chisels
- Metal cabinets for electric drills
- Shelves for clamps and measuring tools

(g) Machines and Equipment

- Circular saw, band saw, planer, drill press, sander, lathe
- Support mass production, precision, and speed
- Machines require careful supervision and training

(h) Safety Features

- Fire extinguishers, first aid kits, protective clothing
- Emergency switches and safety signs
- Personal protective equipment (PPE) like goggles, gloves, helmets

Examples:

- “No Running” or “Caution: Machine in Use” signs
- Fire extinguisher near entrance
- Safety goggles while sanding or cutting

1.2.3 Layout of a Wood Workshop

Characteristics of a good layout:

- Clear movement paths
- Logical placement of machines and benches
- Easy supervision
- Safe access to exits
- Separation of noisy/polluting areas from safe zones

Types of Workshop Layouts:

1. **Process Layout:** Organized by task (cutting, shaping, finishing)
2. **Product Layout:** Organized by workflow for a specific product
3. **Fixed Position Layout:** Product remains stationary; tools and machines brought to it

Typical Workshop Layout:

- Entrance and reception
- Timber storage
- Measuring and marking area
- Cutting section
- Shaping/planing section
- Assembly and joining area
- Finishing and polishing section
- Tool and machine storage
- Safety/first aid corner

1.2.4 Reasons for Observing Safety in a Workshop

Importance:

- Prevent injuries and accidents
- Protect tools, machines, and materials
- Save lives
- Maintain cleanliness
- Improve productivity and learning outcomes

Common Accidents:

- Cuts, bruises, burns
- Electric shocks
- Eye injuries from dust or flying chips
- Respiratory problems from inhaling wood dust

Safety Measures:

- Wear PPE
- Keep tools organized
- Follow instructions and operating procedures
- Maintain clean workspaces
- Switch off machines after use

1.2.5 Importance of Workshop Features

Feature	Importance
Lighting	Clear vision, accuracy, prevents eye strain
Ventilation	Reduces dust, heat, and respiratory issues
Work benches	Support for precision work, safety
Tool storage	Organizes tools, reduces accidents
Safety features	Protect learners, prevent injuries

1.2.6 Learning Activities

Individual Activities:

- Sketch workshop layout
- Label workshop features
- Identify PPE and describe usage

Group Activities:

- Visit school or community workshop
- Identify and photograph workshop sections
- Prepare a report on tools, machines, and workflow
- Create posters on workshop safety rules

Digital Activities:

- Research modern workshop designs

- Watch tutorials on machine operations and safety
- Prepare digital presentations

1.2.7 Project Ideas

1. Mini Workshop Model:

- Use cardboard and recycled wood to model a small workshop
- Include benches, tools, machines, and storage areas

2. Safety Campaign:

- Create posters or videos highlighting PPE and safe work practices
- Conduct a workshop safety drill simulation

3. Tool Inventory Project:

- List all tools and machines in a workshop
- Describe their uses and maintenance

SUMMARY

A **wood workshop** is a critical part of learning Wood Technology. Understanding its **features, layout, and safety practices** equips learners with:

- Practical skills for measuring, cutting, joining, and finishing wood
- Knowledge to work safely and responsibly
- Preparation for careers, entrepreneurship, and sustainable use of natural resources
- Enhanced life skills such as teamwork, creativity, and problem-solving

SUB-STRAND: 1.3 HAND TOOLS AND EQUIPMENT

Hand tools and equipment are essential items used in a wood workshop to perform woodworking operations manually. They are powered by **human effort** and are used in almost every stage of wood production.

Woodworking Tasks Supported by Hand Tools

- Measuring and checking accuracy
- Marking lines, joints, and shapes
- Cutting timber to size
- Shaping and smoothing surfaces
- Making holes
- Holding workpieces firmly
- Finishing wood surfaces

Why Hand Tools Are Important

- Easy to operate and control
- Affordable and readily available
- Highly accurate for detailed work
- Promote skill development and craftsmanship
- Safer than machines when used correctly
- Suitable for learning environments

1.3.1 Meaning of Hand Tools and Equipment

Hand Tools

Hand tools are tools:

- Operated by human power
- That do not require electricity or motors
- Used directly on wood to perform tasks

Examples:

- Saws, chisels, planes, hammers, measuring tools

Equipment

Equipment refers to:

- Supporting items that help hold, support, position, or store tools and materials
- Items that improve safety, organization, and efficiency

Examples:

- Workbenches, vices, clamps, tool racks, bench hooks

HAND TOOLS IN WOOD TECHNOLOGY

Hand tools are tools operated by **human effort only**, without electricity or motors. They are used in woodworking to **measure, mark, cut, shape, bore, hold, strike, and finish wood**.

Hand tools are important because they:

- Are simple and affordable
- Develop manual skills
- Improve accuracy and control
- Enhance safety in small-scale work
- Form the foundation of all woodworking skills

CLASSIFICATION OF HAND TOOLS AND THEIR USES

1. MEASURING TOOLS

Tool	Use	Examples of Application
Steel rule	Measuring short lengths	Measuring timber thickness
Tape measure	Measuring long distances	Measuring planks and boards
Folding rule	Measuring medium lengths	Furniture making
Vernier caliper	Accurate measurement	Measuring dowel diameter
Try square	Checking right angles	Squaring timber edges
Combination square	Measuring & marking angles	Marking 45° and 90°
Sliding bevel	Transferring angles	Marking joints
Spirit level	Checking level and plumb	Installing shelves

2. MARKING OUT TOOLS

Tool	Use	Examples
Pencil	Marking lines	General marking
Marking knife	Fine marking	Joint marking
Marking gauge	Marking parallel lines	Thickness marking
Mortise gauge	Marking mortises	Mortise and tenon joints
Try square	Marking right angles	Squaring ends
Chalk line	Marking long lines	Marking boards
Scratch awl	Marking points	Starting drill holes

3. CUTTING TOOLS

Tool	Use	Examples
Rip saw	Cutting along the grain	Cutting planks
Crosscut saw	Cutting across the grain	Cutting boards
Tenon saw	Cutting joints	Tenon joints
Dovetail saw	Fine joint cutting	Dovetail joints
Coping saw	Cutting curves	Decorative work
Bow saw	Rough cutting	Cutting logs
Keyhole saw	Cutting holes	Interior cut-outs
Utility knife	Trimming	Veneer cutting

4. CHISELING TOOLS

Tool	Use	Examples
Bevel edge chisel	General cutting	Cleaning joints
Mortise chisel	Deep joints	Mortise cutting
Firmer chisel	Heavy work	Squaring joints
Paring chisel	Light finishing	Fine trimming
Gouge	Curved cuts	Carving bowls
Carving chisel	Decorative carving	Artistic work

5. PLANING TOOLS

Tool	Use	Examples
Jack plane	Rough smoothing	Leveling timber

Smoothing plane	Fine finishing	Final surface
Block plane	Trimming edges	Chamfering
Trying plane	Straightening edges	Joint preparation
Rebate plane	Cutting rebates	Frame making

6. BORING TOOLS

Tool	Use	Examples
Brace and bit	Drilling large holes	Dowels
Hand drill	Small holes	Screws
Auger bit	Deep holes	Timber joints
Bradawl	Pilot holes	Nail starting
Gimlet	Small holes	Screw holes
Countersink	Recessing screws	Flush screw heads

7. IMPACT / IMPELLING TOOLS

Tool	Use	Examples
Claw hammer	Driving & removing nails	Furniture assembly
Wooden mallet	Striking chisels	Mortise joints
Rubber mallet	Gentle striking	Assembly
Ball peen hammer	Metal striking	Fittings
Nail punch	Setting nail heads	Finishing

8. HOLDING AND CLAMPING TOOLS

Tool	Use	Examples
Bench vice	Holding work	Sawing
G-clamp	Holding joints	Gluing
F-clamp	Clamping boards	Assembly
Sash clamp	Large work	Cabinet making
Hand screw clamp	Adjustable grip	Irregular shapes
Bench stop	Prevent movement	Planing

9. SHAPING AND FINISHING TOOLS

Tool	Use	Examples
Rasp	Rough shaping	Curves
File	Smooth shaping	Edges
Spokeshave	Curved shaping	Chair legs
Scraper	Fine finishing	Smooth surfaces
Sandpaper	Final finishing	Polishing

10. SHARPENING TOOLS

Tool	Use
Oil stone	Sharpen blades
Water stone	Fine sharpening
Grinding stone	Rough sharpening
Honing guide	Correct angle
Sharpening file	Saw teeth

CARE AND MAINTENANCE OF HAND TOOLS

During Use

- Use correct tool
- Avoid misuse
- Handle carefully

After Use

- Clean tools
- Oil metal parts
- Store properly
- Sharpen cutting edges
- Repair loose handles

SAFETY RULES

- Wear goggles
- Cut away from the body
- Clamp work firmly

- Keep tools sharp
- Do not carry sharp tools carelessly

LEARNING ACTIVITIES

- Identify and name hand tools
- Classify tools by function
- Sketch and label tools
- Demonstrate correct usage
- Group discussion on safety

PROJECT WORK

Project Title: *Hand Tools Identification and Use*

Learners should:

- Collect pictures or real tools
- Describe each tool and its use
- Demonstrate safe handling
- Present findings to class

SUMMARY

Hand tools are the foundation of Wood Technology. Proper identification, correct use, safety, and maintenance ensure **quality workmanship, safety, and skill development**, preparing learners for **careers, entrepreneurship, and advanced woodworking**.

1.3.2 Identification of Hand Tools and Equipment in a Wood Workshop

Learners must be able to:

- Recognize tools by appearance
- Name tools correctly
- State their uses
- Handle tools appropriately

(a) MEASURING TOOLS

Measuring tools are used to determine length, width, thickness, depth, diameter, and angles accurately before cutting, shaping, or assembling wood.

Purpose

Used to measure:

- Length
- Width
- Thickness
- Depth
- Angles
- Levels

Examples of Measuring Tools

- Steel rule
- Tape measure
- Folding rule
- Vernier caliper
- Try square
- Combination square
- Sliding bevel
- Spirit level
- Marking gauge (distance measurement)

Uses of Measuring Tools

- Measuring timber length before cutting
- Checking width and thickness of boards
- Ensuring right angles (90°)
- Measuring angles for joints
- Checking flatness and level surfaces

Practical Examples

- Measuring timber for a stool leg
- Checking squareness of a table frame
- Measuring thickness of a door panel

TABLE: MEASURING TOOLS IN WOODWORK

TOOL NAME	DESCRIPTION	WHAT IT MEASURES	MAIN USES / APPLICATIONS
Steel Rule	Straight metal rule marked in mm and cm	Short lengths	Measuring small pieces of wood
Wooden Rule	Wooden folding or straight rule	Short lengths	General workshop measurements
Measuring Tape	Flexible steel tape in a case	Long lengths	Measuring timber, furniture sizes
Folding Rule	Hinged wooden or metal rule	Medium lengths	Accurate measurements on site
Try Square	L-shaped tool with stock and blade	90° angles	Checking squareness, marking right angles
Combination Square	Adjustable square with ruler	90° and 45° angles	Measuring, marking, checking depth
Sliding Bevel (Bevel Gauge)	Adjustable blade and stock	Any angle	Transferring angles
Protractor	Semi-circular or circular tool	Angles in degrees	Measuring and marking angles
Mitre Square	Fixed 45° or 90° square	Angled measurements	Marking mitre joints
Marking Gauge	Adjustable pin and stock	Parallel distances	Marking lines parallel to edges

Mortise Gauge	Two adjustable pins	Mortise width	Marking mortise and tenon joints
Cutting Gauge	Sharp cutter instead of pin	Fine measurements	Cutting marking lines
Depth Gauge	Rule with sliding stop	Depth of holes or grooves	Measuring depth of mortises
Calipers (Inside)	Two curved legs	Internal diameter	Measuring holes
Calipers (Outside)	Two outward legs	External diameter	Measuring thickness
Vernier Calipers	Precision measuring tool	Diameter, depth, thickness	Accurate workshop measurements
Micrometer Screw Gauge	Precision screw tool	Very small measurements	Measuring thin wood or veneer
Straight Edge	Long flat metal or wood strip	Straightness	Checking flat surfaces
Spirit Level	Bubble tube in frame	Level and plumb	Checking horizontal/vertical alignment
Plumb Bob	Weight on a string	Vertical alignment	Checking upright structures
Thickness Gauge	Adjustable gauge	Thickness	Measuring board thickness
Story Stick	Marked wooden stick	Repeated dimensions	Transferring measurements
Profile Gauge	Pins that copy shapes	Irregular shapes	Measuring curves and profiles
Radius Gauge	Curved leaves	Radius of curves	Measuring rounded edges
Angle Finder	Digital or manual	Angles	Accurate angle measurement
Rule with Depth Scale	Graduated depth markings	Depth	Measuring slots and grooves

CLASSIFICATION OF MEASURING TOOLS

1. Linear Measuring Tools

- Steel rule
- Measuring tape

- Folding rule

2. Angular Measuring Tools

- Try square
- Protractor
- Sliding bevel
- Combination square

3. Marking and Setting Tools

- Marking gauge
- Mortise gauge
- Cutting gauge

4. Precision Measuring Tools

- Vernier calipers
- Micrometer screw gauge

IMPORTANCE OF MEASURING TOOLS IN WOODWORK

- Ensure accuracy
- Reduce material wastage
- Improve quality of joints
- Enhance safety
- Achieve professional finishing

SAFETY AND CARE

- Handle carefully to avoid bending
- Clean after use
- Store in dry places
- Avoid dropping precision tools
- Use correct tool for each task

(b) MARKING OUT TOOLS

Marking tools are used to draw accurate lines, points, and shapes on wood to guide cutting, drilling, shaping, and joining.

Purpose

Used to:

- Transfer measurements onto wood
- Mark lines, shapes, joints, and holes

Examples of Marking Tools

- Pencil
- Marking knife
- Marking gauge
- Mortise gauge
- Try square
- Combination square
- Sliding bevel
- Chalk line
- Scratch awl

Uses

- Marking cutting lines
- Marking mortise and tenon joints
- Marking dowel and screw holes
- Marking angles and curves

Examples

- Marking dovetail joints
- Marking mortise depth
- Marking center points for drilling

TABLE: MARKING TOOLS IN WOODWORK

TOOL NAME	DESCRIPTION	WHAT IT MARKS	MAIN USES / APPLICATIONS
Pencil (Carpenter’s Pencil)	Flat, thick graphite pencil	Lines on wood	General marking and layout
Marking Knife	Sharp pointed blade	Fine lines	Accurate marking for joints
Scratch Awl	Sharp steel point	Fine points and lines	Marking drilling points
Brad Awl	Short pointed steel tool	Starter holes	Starting screws and nails
Marking Gauge	Single pin and sliding stock	Parallel lines	Marking edges for cutting
Mortise Gauge	Two adjustable pins	Mortise & tenon widths	Marking joint outlines
Cutting Gauge	Knife-edge cutter	Clean lines	Cutting marking lines
Panel Gauge	Long beam with cutter	Wide boards	Marking large panels
Try Square	L-shaped tool	Right-angle lines	Marking 90° angles
Combination Square	Adjustable square	90° and 45° lines	Multi-angle marking
Mitre Square	Fixed angle square	45° and 90°	Marking mitre joints
Sliding Bevel (Bevel Gauge)	Adjustable blade	Any angle	Transferring angles
Protractor	Graduated angle tool	Angles	Measuring and marking angles
Compass (Dividers)	Two pointed legs	Circles and arcs	Marking curves
Dividers	Two sharp legs	Equal spacing	Transferring measurements
Trammel Points	Adjustable points on beam	Large circles	Marking big arcs
Chalk Line	String coated with chalk	Long straight lines	Marking boards
Center Punch	Pointed steel rod	Central points	Marking drilling centres
Nail Punch (Set)	Small concave tip	Nail positions	Setting nail heads

Template / Pattern	Pre-cut shape	Repeated shapes	Marking identical parts
Profile Gauge	Sliding pins	Irregular shapes	Copying shapes
Story Stick	Marked wooden strip	Repeated dimensions	Transferring layout marks
Edge Finder	Guide tool	Edge reference	Accurate edge marking
Scriber	Hardened steel point	Fine lines	Precision marking
Rule (Used for Marking)	Straight edge with scale	Straight lines	Guiding pencil or knife

CLASSIFICATION OF MARKING TOOLS

1. Line Marking Tools

- Pencil
- Marking knife
- Marking gauge

2. Angle Marking Tools

- Try square
- Mitre square
- Sliding bevel

3. Curve and Shape Marking Tools

- Compass
- Dividers
- Trammel points

4. Point Marking Tools

- Brad awl
- Center punch

IMPORTANCE OF MARKING TOOLS

- Improve accuracy
- Guide cutting and drilling

- Reduce errors and wastage
- Ensure proper joint fitting
- Enhance workmanship quality

SAFETY AND CARE

- Handle sharp tools carefully
- Keep marking edges sharp
- Store in tool racks
- Do not use damaged tools

PRACTICAL ACTIVITIES

- Identify marking tools
- Mark out a mortise and tenon joint
- Transfer angles using bevel gauge
- Draw shapes using compass

(c) CUTTING TOOLS

Purpose

Used to cut timber:

- Across the grain
- Along the grain
- Into joints and shapes

Examples of Cutting Tools

- Cross-cut saw
- Rip saw
- Tenon saw
- Dovetail saw
- Coping saw
- Bow saw
- Keyhole saw
- Chisels (firmer, bevel edge, mortise)
- Utility knife

Uses

- Cutting boards to size
- Cutting joints such as tenon and dovetail
- Cutting curves and internal shapes
- Trimming edges

Examples

- Using a rip saw to cut along grain
- Using a tenon saw for joints
- Using a coping saw for curved designs

(d) SHARPENING TOOLS

Sharpening tools are used to restore, maintain, and improve the cutting edges of woodwork tools such as chisels, planes, knives, and saws.

Purpose

- Maintain sharp cutting edges
- Improve accuracy
- Reduce effort and accidents

Examples

- Oil stone
- Water stone
- Grinding stone
- Sharpening file
- Honing guide

Uses

- Sharpening chisels
- Sharpening plane irons
- Removing burrs from edges

Examples

- Honing a chisel before joint cutting
- Grinding a damaged blade

TABLE: SHARPENING TOOLS IN WOOD TECHNOLOGY

TOOL NAME	DESCRIPTION	TOOLS SHARPENED	MAIN USES / FUNCTIONS
Oil Stone	Natural or synthetic stone used with oil	Chisels, plane irons	General sharpening
Water Stone	Stone used with water	Chisels, plane blades	Fine sharpening
Diamond Stone	Steel plate with diamond grit	All cutting tools	Fast sharpening
Whetstone	Multi-grit stone	Knives, chisels	Edge refinement
Combination Stone	Two grits in one stone	Chisels, plane blades	Coarse and fine sharpening
Sharpening File	Hardened steel file	Saws, axes	Removing dull edges
Mill File	Flat file	Chisels, plane irons	Edge shaping
Triangular File	Three-sided file	Handsaws	Sharpening saw teeth
Round File	Circular file	Chainsaw teeth	Filing curved edges
Bench Grinder	Motorized abrasive wheel	Chisels, plane blades	Rapid material removal
Angle Grinder	Portable grinding machine	Axes, machetes	Heavy sharpening
Wet Grinder	Water-cooled grinder	Chisels, plane blades	Prevents overheating
Honing Guide	Blade-holding jig	Chisels, plane irons	Maintains correct angle
Leather Strop	Leather strip	Knives, chisels	Final polishing
Stropping Compound	Abrasive paste	Fine edges	Edge refinement
Sharpening Steel (Honing Rod)	Hardened steel rod	Knives	Edge alignment
Slip Stone	Small shaped stone	Curved tools	Gouges and carving

			tools
Carborundum Stone	Silicon carbide stone	Chisels, plane blades	Coarse sharpening
Emery Paper	Abrasive paper	Small tools	Surface smoothing
Sandpaper	Grit-coated paper	Blades	Final finishing
Grinding Wheel	Rotating abrasive disc	Metal tools	Edge shaping
Buffing Wheel	Soft rotating wheel	Polished edges	Final polish
Sharpening Jig	Tool holder	Blades	Angle control
Stone Flattening Plate	Abrasive plate	Stones	Keeping stones flat
Sharpening Kit	Set of stones & guides	Multiple tools	Complete sharpening

CLASSIFICATION OF SHARPENING TOOLS

1. Manual Sharpening Tools

- Oil stone
- Whetstone
- Files
- Slip stone
- Emery paper

2. Power Sharpening Tools

- Bench grinder
- Wet grinder
- Angle grinder

3. Honing & Polishing Tools

- Leather strop
- Honing guide
- Buffing wheel

IMPORTANCE OF SHARPENING TOOLS

- Improves cutting accuracy
- Reduces effort during work

- Prevents tool damage
- Enhances safety
- Increases tool lifespan

SHARPENING SAFETY PRECAUTIONS

- Wear eye protection
- Avoid overheating blades
- Secure tools properly
- Use correct grit sequence
- Keep fingers away from grinding wheels

PRACTICAL ACTIVITIES

- Sharpen a chisel using a whetstone
- File saw teeth using a triangular file
- Use a honing guide correctly
- Compare coarse and fine sharpening

PROJECT WORK

- Prepare a sharpening schedule
- Create a sharpening tool chart
- Demonstrate safe sharpening techniques

(e) BORING TOOLS

Purpose

Used to make holes in wood.

Examples

- Brace and bit
- Hand drill
- Auger bit
- Bradawl
- Gimlet
- Countersink bit

Uses

- Making pilot holes
- Making dowel holes
- Making screw holes
- Countersinking screws

Examples

- Making holes for hinges
- Drilling holes for dowels in furniture

(f) PLANING TOOLS

Purpose

Used to:

- Smooth wood surfaces
- Reduce thickness
- Straighten edges

Examples

- Jack plane
- Smoothing plane
- Block plane
- Trying plane
- Rebate plane

Uses

- Removing rough saw marks
- Flattening timber surfaces
- Squaring edges

(g) IMPACT / IMPELLING TOOLS

Impact (impelling) tools are tools used to strike, hit, drive, force, or shape materials in woodworking. They work by applying force through impact.

Purpose

Used to apply force.

Examples

- Wooden mallet
- Rubber mallet
- Claw hammer
- Ball-peen hammer

Uses

- Driving nails
- Removing nails
- Striking chisels

Examples

- Using a mallet to strike a chisel
- Using a claw hammer to remove nails

TABLE: IMPACT / IMPELLING TOOLS IN WOODWORK

TOOL NAME	DESCRIPTION	MAIN USES	EXAMPLES OF APPLICATIONS
Claw Hammer	Steel head with flat face and curved claw	Driving nails and removing nails	Nailing joints, removing wrongly driven nails
Ball Peen Hammer	Hammer with one flat face and one rounded end	Striking metal tools and punches	Hitting chisels, setting metal fittings
Cross Peen Hammer	Hammer with wedge-shaped peen across the handle	Shaping, starting small nails	Fine woodworking, cabinet work
Straight Peen Hammer	Peen parallel to the handle	Light striking and shaping	Detail woodwork
Wooden Mallet	Made of hardwood with rectangular or cylindrical head	Striking chisels without damage	Mortise and tenon joints
Rubber Mallet	Rubber head, soft impact	Gentle striking without marking wood	Assembling joints, fitting parts
Rawhide Mallet	Made of compressed animal hide	Non-marking striking	Fine furniture assembly
Carpenter’s Mallet	Heavy wooden mallet	Heavy chiseling work	Cutting deep joints
Soft-face Hammer	Replaceable plastic or rubber faces	Prevents surface damage	Assembly work
Sledge Hammer (Light)	Heavy hammer with long handle	Heavy impact work	Breaking timber, driving stakes
Dead Blow Hammer	Filled with shot to reduce rebound	Controlled impact	Accurate striking without bounce
Nail Punch (Nail Set)	Small steel rod with concave tip	Driving nail heads below surface	Preparing surface for finishing
Center Punch	Hardened steel with pointed tip	Marking drilling points	Marking holes before drilling
Pin Punch	Straight steel punch	Driving out small pins	Removing dowels or pins

Drift Punch	Tapered punch	Aligning holes	Aligning joints
Cold Chisel	Hardened steel cutting edge	Cutting metal parts in woodwork	Cutting nails, hinges
Wood Chisel (Bevel Edge)	Sharp steel blade with handle	Cutting and shaping wood	Carving joints
Mortise Chisel	Thick, strong chisel	Cutting deep mortises	Door and frame joints
Firmer Chisel	Rectangular blade	General chiseling	Cleaning joints
Carving Chisel	Curved blade	Decorative carving	Artistic woodwork
Gouge	Curved cutting edge	Hollowing and shaping	Bowl carving
Adze	Curved blade mounted sideways	Rough shaping of timber	Boat making
Hatchet / Hand Axe	Small axe with short handle	Rough cutting and shaping	Splitting small logs
Wooden Wedge	Tapered wooden block	Splitting wood	Log splitting
Metal Wedge	Hardened steel wedge	Heavy splitting	Firewood preparation
Tack Hammer	Small lightweight hammer	Driving small tacks	Upholstery
Panel Hammer	Lightweight hammer	Fine nailing work	Furniture assembly
Carpenter's Maul	Heavy wooden hammer	Driving wedges	Timber splitting
Chasing Hammer	Small hammer	Fine controlled striking	Detail carving
Leather Mallet	Leather-covered head	Non-damaging strikes	Polishing and assembly
Fret Hammer	Lightweight hammer	Precision striking	Model making
Joiner's Hammer	Balanced hammer	Joinery work	Cabinet making

CLASSIFICATION OF IMPACT TOOLS (FOR EXAMS)

1. Striking Tools

- Hammers
- Mallets
- Mauls

2. Driving Tools

- Nail punch
- Pin punch
- Drift punch

3. Cutting by Impact

- Chisels
- Gouges
- Adze

4. Splitting Tools

- Wedges
- Axe
- Hatchet

SAFETY PRECAUTIONS WHEN USING IMPACT TOOLS

- Wear safety goggles
- Ensure tool handles are firm
- Use correct tool for the task
- Strike squarely and accurately
- Store tools properly after use

LEARNING ACTIVITIES

- Identify impact tools in the workshop
- Match tools to their uses
- Demonstrate correct hammering techniques
- Sketch and label impact tools
- Group discussion on tool safety

PROJECT WORK

Project Title: *Identification and Use of Impact Tools in Wood Technology*

- Collect pictures or drawings of tools
- Describe each tool and its use
- Demonstrate safe handling
- Present findings to class

(h) HOLDING AND CLAMPING TOOLS

Purpose

- Hold work firmly
- Prevent movement
- Improve accuracy and safety

Examples

- Bench vice
- G-clamp
- F-clamp
- Sash clamp
- Hand screw clamp
- Bench stop

Uses

- Holding timber during sawing
- Holding joints during gluing
- Supporting long boards

(i) SHAPING AND FINISHING TOOLS

Purpose

Used to shape and finish wood surfaces.

Examples

- Wood rasp
- File
- Spokeshave
- Sandpaper (coarse, medium, fine)

- Scraper

Uses

- Shaping curves
- Rounding edges
- Smoothing surfaces before finishing

WOODWORK CUTTING TOOLS AND THEIR USES

Cutting tools are used to remove wood by slicing, sawing, or chopping in order to shape timber into required sizes and forms.

TABLE: WOOD CUTTING TOOLS IN WOOD TECHNOLOGY

TOOL NAME	TYPE (HAND / POWER)	DESCRIPTION	MAIN USES / FUNCTIONS
Hand Saw	Hand	General-purpose saw	Straight cutting of timber
Rip Saw	Hand	Large teeth	Cutting along the grain
Cross-Cut Saw	Hand	Fine angled teeth	Cutting across the grain
Panel Saw	Hand	Medium-sized saw	Cutting boards and panels
Tenon Saw	Hand	Reinforced spine	Cutting joints
Dovetail Saw	Hand	Small fine teeth	Precision joint cutting
Back Saw	Hand	Rigid metal back	Accurate straight cuts
Coping Saw	Hand	Thin blade	Curved and internal cuts
Fret Saw	Hand	Very fine blade	Decorative work
Bow Saw	Hand	Frame saw	Rough cutting
Keyhole Saw	Hand	Narrow pointed blade	Internal holes
Compass Saw	Hand	Long narrow blade	Circular cuts
Veneer Saw	Hand	Small double-edged blade	Cutting veneers
Pruning Saw	Hand	Curved blade	Cutting tree branches
Hacksaw	Hand	Fine metal blade	Cutting nails & rods

Chisel (Bevel-edge)	Hand	Sharp steel blade	Paring and shaping
Mortise Chisel	Hand	Thick blade	Cutting mortises
Firmer Chisel	Hand	Rectangular blade	General cutting
Gouge	Hand	Curved blade	Hollowing wood
Drawknife	Hand	Two-handled blade	Shaping timber
Spokeshave	Hand	Small plane-like tool	Shaping curves
Axe	Hand	Heavy cutting blade	Felling trees
Hatchet	Hand	Small axe	Rough cutting
Adze	Hand	Curved blade	Hollow shaping
Knife	Hand	Sharp blade	Trimming & carving
Plane	Hand	Flat blade tool	Cutting thin shavings
Jigsaw	Power	Reciprocating blade	Curved cutting
Circular Saw	Power	Rotating blade	Straight fast cuts
Band Saw	Power	Continuous blade	Curves & resawing
Table Saw	Power	Fixed rotating blade	Accurate straight cuts
Mitre Saw	Power	Angled cutting saw	Accurate angles
Chainsaw	Power	Motor-driven chain	Cutting logs
Scroll Saw	Power	Fine vertical blade	Intricate designs
Radial Arm Saw	Power	Sliding blade	Cross-cutting boards
Router	Power	High-speed cutter	Grooves & profiles

CLASSIFICATION OF WOOD CUTTING TOOLS

1. Sawing Tools

- Hand saw
- Rip saw
- Cross-cut saw
- Tenon saw
- Coping saw
- Jigsaw
- Circular saw

2. Chopping & Paring Tools

- Chisels

- Gouges
- Adze
- Axe

3. Shaping & Trimming Tools

- Drawknife
- Spokeshave
- Plane
- Knife

IMPORTANCE OF WOOD CUTTING TOOLS

- Enables shaping and sizing timber
- Improves accuracy and quality
- Reduces wastage
- Enhances productivity
- Essential for joinery & carpentry

SAFETY PRECAUTIONS

- Use sharp tools only
- Wear protective gear
- Secure wood firmly
- Cut away from the body
- Switch off power tools when not in use

CBC PRACTICAL ACTIVITIES

- Cut timber along and across the grain
- Demonstrate safe sawing techniques
- Compare hand saw and power saw cuts
- Identify cutting tools in the workshop

PROJECT WORK

- Make a tool identification chart
- Construct a tool storage rack
- Prepare a safety poster for cutting tools

WOODWORK BORING (DRILLING) TOOLS AND THEIR USES

Boring tools are tools used to make holes in wood for fixing, joining, decoration, and assembly.

TABLE: WOOD BORING TOOLS AND THEIR USES

TOOL NAME	TYPE (HAND / POWER)	DESCRIPTION	MAIN USES / FUNCTIONS
Brace and Bit	Hand	U-shaped brace with bit	Drilling large holes
Hand Drill	Hand	Gear-operated drill	Small to medium holes
Egg-beater Drill	Hand	Crank-operated drill	Accurate drilling
Push Drill	Hand	Spring-driven drill	Quick small holes
Bradawl	Hand	Sharp pointed tool	Starting pilot holes
Gimlet	Hand	Small screw-point tool	Small screw holes
Auger Bit	Hand	Spiral cutting bit	Deep holes
Shell Bit	Hand	Hollow cylindrical bit	Clean large holes
Spade Bit	Hand	Flat paddle-shaped bit	Fast large holes
Forstner Bit	Hand/Power	Flat-bottom hole bit	Smooth flat holes
Twist Drill Bit	Hand/Power	Spiral steel bit	General drilling
Countersink Bit	Hand/Power	Conical bit	Countersinking screws
Counterbore Bit	Hand/Power	Flat-bottom recess bit	Recessing screw heads
Power Drill	Power	Electric drilling tool	Fast drilling
Cordless Drill	Power	Battery-powered drill	Portable drilling
Pillar Drill	Power	Fixed vertical drill	Accurate repeated holes
Drill Press	Power	Bench-mounted drill	Precision drilling
Boring Machine	Power	Heavy-duty drill	Industrial boring
Taper Reamer	Hand	Tapered cutting tool	Enlarging holes
Reamer	Hand	Finishing hole tool	Smooth finishing
Hole Saw	Power	Circular cutting bit	Large circular holes
Mortising Machine	Power	Square chisel drill	Mortise holes
Dowel Drill Bit	Hand/Power	Center-point bit	Dowel holes

CLASSIFICATION OF BORING TOOLS

1. Hand Boring Tools

- Brace and bit

- Hand drill
- Egg-beater drill
- Bradawl
- Gimlet

2. Boring Bits

- Auger bit
- Twist bit
- Forstner bit
- Spade bit
- Countersink bit

3. Power Boring Tools

- Electric drill
- Cordless drill
- Pillar drill
- Mortising machine

USES OF BORING TOOLS IN WOODWORK

- Making holes for screws
- Preparing dowel joints
- Making mortise joints
- Creating decorative holes
- Preparing pilot holes

SAFETY PRECAUTIONS

- Clamp wood firmly
- Use correct drill bit size
- Keep hands away from rotating bits
- Switch off power before changing bits
- Wear eye protection

CBC PRACTICAL ACTIVITIES

- Drill pilot holes for screws

- Compare hand and power drilling
- Identify different drill bits
- Practice countersinking

PROJECT WORK

- Make a **wooden peg board**
- Construct a **dowel joint frame**
- Create a **tool identification chart**

WOODWORK PLANING TOOLS AND THEIR USES

Planing tools are used to smooth, level, straighten, and reduce the thickness of wood surfaces and edges.

TABLE: WOOD PLANING TOOLS AND THEIR USES

PLANING TOOL	TYPE	DESCRIPTION	MAIN USES / FUNCTIONS
Jack Plane	Hand	Medium-length general-purpose plane	Removing rough wood, initial smoothing
Smoothing Plane	Hand	Short plane with fine blade	Final smoothing of surfaces
Trying (Try) Plane	Hand	Long plane	Straightening and flattening long surfaces
Block Plane	Hand	Small one-handed plane	Trimming end grain and small surfaces
Fore Plane	Hand	Long heavy plane	Flattening wide boards
Rebate Plane	Hand	Plane with side blade	Cutting rebates (steps)
Plough Plane	Hand	Adjustable blade plane	Cutting grooves
Router Plane	Hand	Flat-bottom depth plane	Levelling recesses
Shoulder Plane	Hand	Narrow-blade plane	Cleaning joints and shoulders
Bullnose Plane	Hand	Short nose plane	Planing into corners
Compass Plane	Hand	Curved sole plane	Shaping curved surfaces
Spokeshave	Hand	Twin-handled plane	Shaping curves and edges
Scrub Plane	Hand	Short plane with curved blade	Rapid stock removal
Rabbet Plane	Hand	Open-side plane	Cutting grooves and rebates
Moulding Plane	Hand	Shaped sole plane	Decorative mouldings

Bench Plane	Hand	General-purpose plane	Flat surface preparation
Electric Hand Plane	Power	Motor-driven plane	Fast surface smoothing
Thickness Planer	Power	Machine planer	Uniform thickness
Surface Planer (Jointer)	Power	Flat bed planer	Flattening boards
Planer-Thicknesser	Power	Combined machine	Surface & thickness planing
Portable Power Plane	Power	Handheld electric planer	Quick surface reduction

CLASSIFICATION OF PLANING TOOLS

1. Hand Planes

- Jack plane
- Smoothing plane
- Try plane
- Block plane
- Scrub plane

2. Special-Purpose Planes

- Rebate plane
- Plough plane
- Router plane
- Compass plane
- Shoulder plane

3. Power Planing Tools

- Electric hand plane
- Thickness planer
- Surface planer

USES OF PLANING TOOLS

- Smoothing rough timber
- Reducing thickness
- Straightening warped wood

- Shaping curves
- Preparing joints

SAFETY RULES WHEN PLANING

- Secure wood firmly
- Keep blade sharp
- Plane away from body
- Switch off power before adjusting
- Wear protective gear

PRACTICAL ACTIVITIES

- Smooth a rough board
- Compare jack and smoothing planes
- Plane end grain using block plane
- Identify different planes

PROJECT WORK

- Make a **planed wooden tray**
- Construct a **small stool**
- Prepare timber for a **frame joint project**

1.3.3 Classification of Hand Tools

Hand tools are classified according to function:

1. Measuring tools
2. Marking out tools
3. Cutting tools
4. Sharpening tools
5. Boring tools
6. Planing tools
7. Impelling tools
8. Holding and clamping tools
9. Shaping and finishing tools

1.3.4 Equipment Used in a Wood Workshop

Examples of Equipment

- Workbench
- Bench hook
- Saw horse
- Portable stands
- Tool cabinet
- Tool rack
- Dust bin
- First aid kit

Uses

- Workbench: Supports work
- Bench hook: Supports wood when sawing
- Tool cabinet: Safe tool storage
- Tool rack: Organization
- Dust bin: Cleanliness

1.3.5 Safe Use of Hand Tools and Equipment

Safety Rules

- Use the correct tool for the task
- Inspect tools before use
- Wear protective clothing
- Clamp workpieces
- Cut away from the body
- Keep tools sharp
- Do not misuse tools

Safety Examples

- Wearing goggles when chiseling
- Using a mallet instead of hammer on chisels
- Clamping timber before sawing

1.3.6 Care and Maintenance of Hand Tools

Care During Use

- Use tools properly
- Avoid dropping tools
- Avoid misuse

Care After Use

- Clean tools
- Oil metal parts
- Store tools properly
- Sharpen cutting edges
- Repair damaged handles

Maintenance Examples

- Sharpening a chisel
- Oiling plane blades
- Replacing broken handles

1.3.7 Importance of Using Correct Hand Tools

- Improves accuracy

- Prevents accidents
- Saves time
- Protects tools
- Produces quality work

Examples

- Using a tenon saw for joints
- Using a try square for right angles
- Using clamps during gluing

1.3.8 Learning Activities

Individual Activities

- Identify and name tools
- Sketch and label hand tools
- Match tools to uses

Group Activities

- Tool classification chart
- Safety demonstration
- Tool maintenance practice

Digital Activities

- Research traditional vs modern hand tools
- Watch safety videos

1.3.9 Project Work

Project 1: Tool Identification Chart

- Draw and label at least 20 hand tools
- State uses and safety rules

Project 2: Tool Care Project

- Clean, oil, and store tools correctly
- Write a maintenance report

Project 3: Mini Tool Kit

- Design a basic tool kit for a carpenter
- Justify tool selection

Core Values and Life Skills

- Responsibility
- Safety awareness
- Teamwork
- Discipline
- Organization
- Problem-solving

SUMMARY

Hand tools and equipment are the **foundation of woodworking skills**. Proper identification, classification, safe use, and maintenance ensure **accuracy, safety, efficiency, and quality workmanship**. Mastery of hand tools prepares learners for **advanced woodworking, careers, entrepreneurship, and lifelong skills**.

STRAND 2: MATERIALS

SUB-STRAND 2.2: TIMBER CONVERSION AND SEASONING

Timber conversion and seasoning are critical processes in transforming raw logs into usable timber for construction, furniture making, joinery, and decorative wood products. Understanding these processes helps learners to:

- Use timber efficiently and sustainably
- Improve quality and durability of wood products
- Reduce defects such as warping, cracking, or fungal attacks
- Enhance safety in woodworking
- Appreciate modern technological advances in wood processing

2.2.1 MEANING OF TIMBER CONVERSION

Timber conversion is the process of cutting a felled tree (log) into pieces of timber with required sizes and shapes.

Reasons for Timber Conversion

- To obtain usable timber sizes for specific projects
- To reduce wastage of wood
- To improve the strength, stability, and durability of timber
- To make seasoning (drying) easier and faster
- To meet market and customer requirements
- To produce timber suitable for decorative purposes

Examples of Converted Timber Products

- Planks
- Boards
- Beams
- Posts
- Battens
- Sleepers
- Door and window frames

- Flooring boards
- Furniture blanks (for chairs, tables, cabinets)

2.2.2 METHODS OF TIMBER CONVERSION

Different sawing methods are used depending on timber species, intended use, and desired quality.

(a) THROUGH AND THROUGH SAWING (Plain Sawing)

Description: The log is cut straight through from one side to the other without rotating it.

Characteristics:

- Simple and fast method
- Produces wide boards
- Less expensive than other methods
- Maximizes timber output

Advantages:

- Saves time and labor
- Low cost
- Produces many boards
- Suitable for softwoods

Disadvantages:

- Boards may warp easily
- Less stable than quarter sawn timber
- Growth rings uneven, affecting strength

Examples of Uses:

- Construction timber
- Roofing timber
- Temporary structures (scaffolding)

- Packaging timber (pallets, crates)

Activity:

- Visit a local sawmill and observe through and through sawing. Sketch and label the process.

(b) QUARTER SAWING

Description: The log is first cut into four quarters, then each quarter is sawn into boards.

Characteristics:

- Growth rings are nearly vertical
- Produces stable and strong timber
- Shows attractive grain patterns

Advantages:

- Reduced warping and twisting
- Stronger timber
- Attractive appearance for furniture

Disadvantages:

- More wastage than plain sawing
- Slower and more expensive

Examples of Uses:

- High-quality furniture
- Flooring
- Cabinet work
- Decorative joinery

Activity:

- Collect timber samples and identify the sawing method by observing grain patterns.

(c) TANGENTIAL (RIFT) SAWING

Description: Log is cut tangentially to the growth rings.

Characteristics:

- Attractive grain patterns
- Wide boards produced

Advantages:

- Good decorative appearance
- Wide timber boards

Disadvantages:

- High chances of warping
- Less stable than quarter sawn timber

Examples of Uses:

- Furniture panels
- Decorative boards
- Interior fittings

Project Idea:

- Create a small decorative wooden panel using tangential sawn timber and apply finishing techniques.

2.2.3 MEANING OF TIMBER SEASONING

Timber seasoning is the process of reducing moisture content in timber to make it suitable for woodworking and construction.

Why Timber Must Be Seasoned:

- To reduce shrinkage and swelling
- To prevent warping and cracking
- To increase strength and load-bearing capacity
- To reduce timber weight
- To improve durability and resistance to decay
- To prevent fungal and insect attacks

2.2.4 METHODS OF TIMBER SEASONING

Timber can be seasoned using **natural** or **artificial methods**.

(a) NATURAL SEASONING (AIR SEASONING)

Description: Timber is dried using natural air circulation.

Process:

1. Timber stacked on level ground or raised platforms
2. Spacers (stickers) placed between boards to allow air circulation
3. Timber left to dry under sunlight and wind

Advantages:

- Low cost
- Easy to carry out
- No machines required

Disadvantages:

- Takes a long time (months for large timber)
- Weather-dependent
- Risk of insect or fungal attack

Examples of Uses:

- Rural construction timber
- Low-cost furniture
- Agricultural structures

Activity:

- Build a model timber stack using small wood pieces and spacers to demonstrate air seasoning.

(b) ARTIFICIAL SEASONING

Description: Uses controlled conditions or machines to dry timber quickly.

Types:

1. **Kiln Seasoning** – Timber dried in heated chambers.
 - ⊗ Advantages: Fast, controlled, uniform drying
 - ⊗ Disadvantages: Expensive, skilled operators needed
 - ⊗ Examples: Furniture timber, industrial timber
2. **Chemical Seasoning** – Timber soaked in chemicals to remove moisture.
 - ⊗ Advantages: Faster than air seasoning
 - ⊗ Disadvantages: Handling chemicals is risky
 - ⊗ Examples: Preservative-treated timber
3. **Electrical Seasoning** – Uses electric current to reduce moisture.
 - ⊗ Advantages: Very fast
 - ⊗ Disadvantages: Expensive, rarely used
 - ⊗ Examples: Laboratory timber or specialized furniture
4. **Solar Kiln Seasoning** – Uses solar energy in a small chamber.
 - ⊗ Advantages: Eco-friendly, moderate speed
 - ⊗ Disadvantages: Weather-dependent, moderate cost
 - ⊗ Examples: Eco-friendly furniture workshops

Activity:

- Compare air-seasoned timber and kiln-seasoned timber for moisture content using a moisture meter.

2.2.5 PROPER STACKING OF TIMBER DURING SEASONING

Rules for Proper Stacking:

- Use level ground or raised platforms
- Raise timber above ground (using blocks or spacers)
- Place uniform spacers between boards
- Align boards properly for vertical circulation
- Protect timber from rain or water accumulation
- Rotate boards periodically for even drying

Examples of Stacking Materials:

- Wooden stickers
- Concrete blocks
- Metal supports or platforms

Project:

- Construct a small timber stack using blocks and spacers, label parts, and explain airflow path.

2.2.6 REASONS FOR TIMBER SEASONING

- Prevent cracking and splitting
- Improve strength and stability
- Increase durability and lifespan
- Enhance visual appearance (smooth surface, reduced defects)
- Make timber easier to work (saw, plane, or join)
- Reduce weight for transportation

2.2.7 ROLE OF TECHNOLOGY IN TIMBER CONVERSION AND SEASONING

In Conversion:

- Sawmill machines allow faster and precise cutting

- Reduces physical effort and human error
- Machines include:
 - ⊙ Band saw machines
 - ⊙ Circular saw machines
 - ⊙ Log handling equipment

In Seasoning:

- Controlled drying prevents defects
- Machines ensure uniform moisture content
- Examples:
 - ⊙ Kiln dryers
 - ⊙ Moisture meters
 - ⊙ Automated monitoring systems

Activity:

- Visit a sawmill or furniture factory and list all machines used for conversion and seasoning.

2.2.8 SAFETY ENHANCEMENT THROUGH TECHNOLOGY

Safety Benefits:

- Reduces manual lifting and handling
- Machines have protective guards and emergency stops
- Automated systems ensure uniform, predictable processing

Examples:

- Machine guards on saws
- Emergency stop buttons
- Automated feed systems for logs

Activity:

- Demonstrate safety rules while working with timber and machines in a workshop setting.

2.2.9 LEARNING ACTIVITIES

- Brainstorm and list all methods of timber conversion
- Research and present a report on timber seasoning methods
- Group discussion on importance of seasoning
- Construct timber stacking models using small wood pieces
- Field visit to sawmills to observe conversion and seasoning
- Compare air-seasoned vs kiln-seasoned timber properties
- Measure moisture content of different timber samples

2.2.10 CORE VALUES AND LIFE SKILLS DEVELOPED

- Responsibility and accountability in timber use
- Environmental conservation (sustainable wood harvesting)
- Safety awareness in workshops
- Teamwork during group projects
- Critical thinking for solving timber defects

PROJECT IDEA / ASSIGNMENT

Title: “From Log to Furniture: Timber Conversion and Seasoning Study”

Instructions:

1. Select a small log or timber sample
2. Demonstrate conversion into boards or planks
3. Stack timber properly for air seasoning
4. Record moisture content weekly
5. Identify defects and suggest improvements
6. Prepare a report with sketches, photographs, and conclusions

STRAND 2: MATERIALS

SUB-STRAND 2.3: ADHESIVES

Definition:

Adhesives are substances used to bond or join two or more materials together by surface attachment. In wood technology, adhesives are primarily used to join pieces of wood permanently or temporarily without the need for nails or screws.

Importance of Adhesives in Wood Technology:

- Provide strong and durable joints
- Improve the appearance of joints and surfaces
- Reduce the need for nails, screws, or mechanical fasteners
- Allow bonding of different types of materials (wood-metal, wood-plastic)
- Enhance durability and longevity of wood products
- Facilitate complex designs like curved laminations or veneering
- Reduce production time in furniture and joinery

Examples of Wood Products Bonded Using Adhesives:

- Laminated doors and table tops
- Veneered plywood
- Furniture joints (mortise and tenon, dovetail, finger joints)
- Decorative panels
- Laminated beams and flooring

2.3.1 MEANING OF ADHESIVES

An adhesive is:

- A bonding substance or material
- A chemical or natural compound
- Applied between surfaces to hold them together
- Used to join materials permanently or temporarily

2.3.2 TYPES OF ADHESIVES USED IN WOOD TECHNOLOGY

Adhesives are classified based on origin, composition, and intended use.

(a) NATURAL ADHESIVES

Definition: Adhesives obtained from natural sources.

Examples:

- Animal glue
- Hide glue
- Bone glue
- Casein glue (milk protein glue)
- Starch-based glue

Characteristics:

- Biodegradable and environmentally friendly
- Less resistant to moisture
- Non-toxic in most cases
- Slow setting time

Uses:

- Traditional woodworking and furniture
- Bookbinding and paper-based crafts
- Small craft projects
- Restoration of antique furniture

Activity:

- Prepare a small batch of casein glue and test it on wood samples. Compare bonding strength with synthetic glue.

(b) SYNTHETIC ADHESIVES

Definition: Chemically manufactured adhesives.

Examples:

- Polyvinyl acetate (PVA) glue
- Epoxy resin
- Urea-formaldehyde resin
- Phenol-formaldehyde resin
- Contact adhesives
- Polyurethane adhesives

Characteristics:

- Strong and durable
- Quick-setting (depending on type)
- Moisture resistant (some types)
- Can bond wood to other materials

Uses:

- Furniture making
- Joinery work
- Laminating boards and panels
- Industrial wood products

Activity:

- Apply PVA glue to two wood pieces, clamp for 24 hours, and test strength by pulling.

(c) INTERNAL USE ADHESIVES

Definition: Adhesives suitable for indoor applications.

Examples:

- PVA glue
- Animal glue

- Casein glue

Characteristics:

- Non-waterproof or low moisture resistance
- Safe for indoor use
- Easy to clean and handle

Uses:

- Indoor furniture
- Cabinet work
- Veneered panels

(d) EXTERNAL USE ADHESIVES

Definition: Adhesives suitable for outdoor conditions.

Examples:

- Epoxy resin
- Phenol-formaldehyde resin
- Polyurethane adhesives

Characteristics:

- Water and weather resistant
- Strong bonding
- Durable under harsh conditions

Uses:

- Outdoor furniture
- Garden benches
- Laminated beams exposed to weather
- Boats and marine woodworking

2.3.3 CLASSIFICATION OF ADHESIVES IN WOOD TECHNOLOGY

- **Natural adhesives** – made from animal or plant sources
- **Synthetic adhesives** – chemically manufactured
- **Thermoplastic adhesives** – soften with heat, harden on cooling (hot glue)
- **Thermosetting adhesives** – chemical reaction forms permanent bond
- **Internal use adhesives** – for indoor projects
- **External use adhesives** – for outdoor projects

2.3.4 CHARACTERISTICS OF GOOD WOOD ADHESIVES

General Characteristics:

- Strong bonding strength
- Quick and controllable setting time
- Easy to apply
- Good penetration into wood surfaces
- Durable and long-lasting

Internal Use:

- Low moisture resistance
- Non-toxic
- Easy cleaning

Examples: PVA glue, Animal glue

External Use:

- High moisture resistance
- Heat and UV resistant
- Long durability
- Strong bond under stress

Examples: Epoxy, Polyurethane

2.3.5 USES OF ADHESIVES IN WOOD TECHNOLOGY

Uses:

- Joining wood to wood (furniture joints, panels)
- Bonding wood to metal (fixtures, reinforcement)
- Bonding wood to plastic (laminates, coatings)
- Laminating boards for thickness or strength
- Veneering for decorative surfaces
- Curved lamination in chair backs or table edges

Examples of Applications:

- Dovetail, mortise-and-tenon, finger joints
- Fixing veneers on plywood
- Laminating table tops or cabinets
- Bonding decorative panels
- Making laminated beams for construction

Activity:

- Make a small veneered panel using adhesive and compare results of different adhesives.

2.3.6 PROCEDURE FOR USING ADHESIVES

Step-by-Step Procedure:

1. Prepare surfaces (sand, remove dust)
2. Clean surfaces to remove grease or moisture
3. Apply adhesive evenly using brush, roller, or spatula
4. Join surfaces carefully, aligning properly
5. Apply uniform pressure using clamps, weights, or presses
6. Allow sufficient setting/curing time

Tools Used:

- Brushes for spread

- Rollers for even coating
- Clamps for pressure
- Spatulas for spreading paste
- Weights for flat surfaces

Activity:

- Glue two small timber pieces using different adhesives and record setting time and bond strength.

2.3.7 IMPORTANCE OF ADHESIVES

Importance:

- Produces strong and durable joints
- Improves surface appearance
- Reduces use of expensive fasteners
- Allows creation of complex designs
- Reduces labor and increases efficiency

Examples:

- Strong furniture joints (tables, chairs)
- Smooth and seamless table tops
- Laminated panels for doors and cabinets
- Decorative boards and veneers

2.3.8 SAFETY PRECAUTIONS WHEN USING ADHESIVES

Personal Safety:

- Wear gloves to avoid skin contact
- Work in ventilated areas
- Avoid inhalation of fumes
- Wear safety goggles if splashing likely

Storage Safety:

- Store in labeled containers
- Keep away from children and heat sources

Disposal Safety:

- Do not pour adhesives into drains
- Dispose of empty containers safely
- Follow manufacturer's instructions

Activity:

- Conduct a safety audit of adhesives in the workshop. Identify hazards and recommend improvements.

2.3.10 PROJECT / ASSIGNMENT IDEAS

Project 1: "Furniture Joint Bonding Study"

- Make three small furniture joints (dovetail, mortise-and-tenon, finger joint)
- Use different adhesives (PVA, epoxy, animal glue)
- Compare bond strength and appearance
- Record findings in a project report with photos and diagrams

Project 2: "Veneer Application and Adhesive Testing"

- Apply veneer to a plywood sample using PVA and contact adhesive
- Compare adhesion quality, curing time, and surface finish
- Present results in a table and discuss advantages of each adhesive

SUB-STRAND 3.1: PREPARATION OF WOOD

INTRODUCTION TO WOOD PREPARATION

Definition:

Wood preparation is the process of making timber ready for use in wood products by ensuring it is accurate, smooth, safe, and suitable for joining, finishing, and assembly.

Importance of Proper Wood Preparation:

- Ensures **accuracy** in measurements and joints
- Improves **strength** of wood products
- Enhances **appearance** and finishes
- Increases **durability** of furniture and structures
- Improves **safety** during woodworking
- Reduces wastage of timber and materials

Consequences of Poor Preparation:

- Weak or faulty joints
- Uneven or rough surfaces
- Timber wastage
- Unsafe wood products
- Time loss during assembly

3.1(a) SELECTION OF APPROPRIATE TOOLS AND EQUIPMENT

Meaning:

- **Tools:** Hand or power devices used to perform woodworking operations.
- **Equipment:** Supporting items that hold, guide, or measure timber accurately.

Factors to Consider When Selecting Tools:

- Type of wood (hardwood vs softwood)
- Size and thickness of timber
- Type of operation (cutting, shaping, boring)
- Accuracy required

- Safety for the user
- Availability of tools
- Skill level of the user

COMMON TOOLS AND EQUIPMENT USED IN WOOD PREPARATION

1. Handsaw

- Cuts timber along or across the grain
- Types: Rip saw (with the grain), Cross-cut saw (across the grain)
- Examples of use: Cutting planks, shelves, table parts, stools, door boards, rough timber

2. Tenon Saw

- Small saw with stiff back for fine cuts
- Used mainly for joints
- Examples: Cutting tenons, mortises, dovetails, shoulders, small timber pieces

3. Jack Plane

- Smooths and flattens wood surfaces
- Removes thin shavings
- Adjustable blade
- Examples: Smoothing rough boards, flattening faces, reducing thickness, straightening edges

4. Try Square

- Checks squareness (90° angles)
- Ensures accurate marking and cutting
- Examples: Checking corners, marking shoulder lines, face/edge alignment

5. Marking Gauge

- Marks parallel lines along wood
- Examples: Marking thickness, widths, joint depths, rebates, grooves

6. Bench Hook

- Holds timber during cutting
- Prevents slipping
- Examples: Supporting wood while sawing, safer cutting of small pieces

7. Other Supporting Tools

- **Chisel:** Cutting joints
- **Mallet:** Striking chisels
- **Clamps:** Holding wood firmly
- **Workbench:** Supporting timber during operations
- **Tape measure:** Accurate measurement
- **Pencil:** Marking lines
- **Ruler/Straightedge:** Straight marking
- **Sandpaper:** Smoothing surfaces
- **Brace and bit / Hand drill:** Drilling holes

Activity:

- Identify all tools in a workshop and classify them according to function (cutting, shaping, measuring, holding).

3.1(b) PROCESSES INVOLVED IN WOOD PREPARATION

Definition:

Wood preparation involves **truing up stock** and processing timber to the required dimensions and shapes for making wood products.

TRUING UP THE STOCK

Truing up means making timber **flat, straight, square, and to the correct size.**

Steps in Truing Up Stock

1. Face Side

- First surface prepared and used as reference

- Procedure:
 - ⊗ Place timber on workbench
 - ⊗ Plane along the grain
 - ⊗ Check flatness with straight edge
 - ⊗ Mark face side symbol (✓)
- Examples: Tabletops, door panels, shelves, stool seats, cabinet sides

2. Face Edge

- Edge at right angle to face side
- Procedure:
 - ⊗ Place face side against bench
 - ⊗ Plane edge
 - ⊗ Check squareness with try square
 - ⊗ Mark face edge symbol (✓)
- Examples: Frame members, rails and stiles, drawer sides, legs

3. Width / Thickness

- Timber reduced to required width and thickness
- Procedure:
 - ⊗ Mark with marking gauge
 - ⊗ Plane to marked lines
 - ⊗ Ensure uniform thickness
- Examples: Shelves, panels, rails, legs, drawer components

4. Length

- Timber cut to final length
- Procedure:
 - ⊗ Measure required length
 - ⊗ Mark using try square
 - ⊗ Cut using handsaw or tenon saw
- Examples: Table legs, rails, stiles, drawer sides, supports

Activity:

- Students practice truing up a small timber piece, marking and planing according to steps above.

3.1(c) OPERATIONS CARRIED OUT ON PREPARED WOOD

1. Chamfering – Cutting off sharp edges at an angle

- Examples: Table edges, stool legs, shelves, door edges

2. Beveling – Cutting wood at a sloping angle

- Examples: Picture frames, shelves, furniture edges, decorative panels

3. Rebating – Cutting a step along the edge

- Examples: Window frames, door frames, back panels, drawer bottoms

4. Grooving – Cutting a narrow channel

- Examples: Sliding doors, drawer bottoms, cabinet shelves, panel fittings

5. Housing – Slot cut across the grain

- Examples: Shelves, bookcases, cupboards, partitions

6. Mitring – Joining wood at an angle (usually 45°)

- Examples: Picture frames, window/door frames, decorative mouldings

7. Shaping – Giving wood decorative forms

- Examples: Curved chair legs, ornamental panels, artistic carvings, furniture edges

8. Boring Holes – Making holes in wood

- Examples: Fixing screws, dowels, hinges, handles, peg joints

Activity:

- Students perform at least 3 operations (chamfering, grooving, boring) on small timber pieces and document the results.

3.1(d) IMPORTANCE OF WOOD PREPARATION

Why Preparation is Important:

- Ensures **accuracy** in dimensions and joints
- Improves **strength** of wood products
- Enhances **beauty and finish**
- Reduces **wastage of timber**
- Increases **safety** during use
- Saves **time** during assembly
- Ensures **durability** of products
- Improves **market value**

Examples of Products Requiring Good Preparation:

- Tables, chairs, beds
- Cabinets, shelves, cupboards
- Doors, windows, stools, desks
- Decorative panels and mouldings

SAFETY PRECAUTIONS DURING WOOD PREPARATION

- Wear protective clothing (apron, gloves, goggles)
- Use tools correctly and safely
- Keep tools sharp for better control
- Clamp timber firmly
- Avoid loose clothing and jewelry
- Keep the workspace clean and organized
- Store tools properly after use
- Follow teacher's or supervisor's instructions

PROJECT IDEA

Project 1: "From Raw Timber to Finished Component"

- Select a small timber piece
- True up stock (face, edge, width, thickness, length)
- Perform at least 3 operations (rebating, grooving, chamfering)

- Assemble into a simple product (small shelf, box, frame)
- Document process with sketches, photos, and step-by-step procedures

Project 2: “Accuracy in Wood Preparation”

- Prepare 3 timber pieces of different sizes
- Measure and plane accurately to dimensions
- Compare outcomes with classmates
- Discuss importance of accuracy and mistakes

SUB-STRAND 3.2: WOODWORKING JOINTS

INTRODUCTION TO WOODWORKING JOINTS

Definition:

Woodworking joints are **methods of connecting two or more pieces of timber** to form a strong, durable, and functional structure.

Importance of Joints:

- Provide **strength** to wood products
- Increase **stability** and resistance to bending or twisting
- Improve **appearance** through neat and tight connections
- Enhance **durability** of furniture and fittings
- Allow **complex structures** like cabinets, doors, and chairs
- Reduce the need for nails and screws
- Accommodate timber expansion and contraction

Applications of Woodworking Joints:

- Furniture: chairs, tables, beds, cabinets
- Doors and windows
- Cabinets, shelves, and cupboards
- Frames and decorative mouldings

3.2(a) CLASSIFICATION OF WOODWORKING JOINTS

Woodworking joints can be classified into **three main categories**:

1. LENGTHENING JOINTS

Purpose: Extend the length of timber.

Types:

1. **Butt Joint** – End-to-end joining of timber
 - Simple joint, usually reinforced with nails, screws, or dowels
 - **Examples:** Light frames, small shelves, temporary supports, short beams
2. **Scarf Joint** – Angled overlapping ends
 - Provides longer timber pieces, increases surface area for glue
 - **Examples:** Door frames, roof rafters, long beams, wall studs
3. **Half-Lap Joint** – Half thickness removed from both ends and joined
 - Provides moderate strength and neat appearance
 - **Examples:** Furniture frames, picture frames, panel frames, cabinet rails
4. **Finger Joint** – Multiple interlocking fingers, often glued
 - Strong and decorative
 - **Examples:** Laminated boards, flooring, table tops, skirting boards

2. WIDENING JOINTS

Purpose: Increase width of timber by joining boards side by side

Types:

1. **Edge-to-Edge Joint** – Flat sides joined
 - Reinforced with glue or dowels
 - **Examples:** Table tops, door panels, decorative panels
2. **Tongue and Groove Joint** – Interlocking edges

- Strong, hides edges, commonly used for flooring
- **Examples:** Floorboards, wall panels, ceilings, panel doors

3. **Dowel Joint** – Cylindrical wooden pins join edges

- Provides alignment and strength
- **Examples:** Cabinet panels, drawer fronts, laminated boards

4. **Spline Joint** – Thin strip inserted into grooves on edges

- Strengthens edges and prevents warping
- **Examples:** Laminated panels, drawer panels, cabinet doors, wide tabletops

3. **FRAMING JOINTS**

Purpose: Assemble timber into frames for structural support

Types:

1. **Mortise and Tenon Joint** – Tenon fits into mortise

- Strongest and most traditional joint
- **Examples:** Chairs, beds, doors, window frames, cabinet frames

2. **Dovetail Joint** – Interlocking wedge-shaped fingers

- Decorative and strong, resists pulling apart
- **Examples:** Drawers, boxes, jewelry boxes, tool chests

3. **Halving Joint (Cross Halving)** – Half thickness removed on both pieces

- Good for shelving supports, moderate strength
- **Examples:** Cabinet frames, chair backs, shelf brackets

4. **Mitre Joint** – Angled joint, usually 45°

- Decorative corners
- **Examples:** Picture frames, cabinet corners, decorative mouldings

3.2(b) PREPARATION OF WOODWORKING JOINTS

Steps in Preparing Joints:

1. **Select Appropriate Timber** – Free from defects, straight-grained, appropriate thickness
2. **Mark Timber Accurately** – Using try square, marking gauge, pencil
3. **Cut Joints Carefully** – Using tenon saw, handsaw, chisel, router
4. **Check Fit** – Joint should fit snugly without gaps
5. **Smooth Surfaces** – Plane or sand surfaces for clean assembly
6. **Dry Assemble** – Test fit before final fixing
7. **Bond or Fix** – Use adhesives (PVA, epoxy, animal glue) or fasteners

Practical Examples:

- Mortise and tenon joint for chair legs
- Dovetail joint for drawer sides
- Finger joint for table top extension
- Tongue and groove joint for floorboards

3.2(c) FASTENERS USED IN WOODWORKING JOINTS

Fasteners Strengthen Joints and improve durability.

Common Fasteners and Uses:

1. **Nails** – Temporary or permanent joining; light furniture, frames, boxes
2. **Screws** – Strong, easy to dismantle; cabinets, doors, chairs
3. **Wooden Dowels** – Cylindrical pins; edge joining, drawer panels, laminated boards
4. **Bolts and Nuts** – Heavy structures; beds, large tables, workshop benches
5. **Adhesives (Glue)** – PVA, epoxy, animal glue; veneering, laminating, furniture joints
6. **Brackets / Corner Irons** – Extra strength; shelf supports, cabinet corners, frame reinforcements

Activity:

- Students identify fasteners in the workshop and match them with joint types
- Practice assembling a simple joint using nails, screws, or glue

3.2(d) ROLE AND IMPORTANCE OF WOODWORKING JOINTS

Benefits:

- Provide **strength and stability** to wood products
- Enable **complex structures** like cabinets and chairs
- Improve **appearance** through neat joints
- Increase **durability**
- Reduce use of nails/screws, saving cost
- Allow for **timber expansion/contraction** without damage

Examples of Applications:

- Chair frames – Mortise and tenon
- Drawers – Dovetail
- Table top extension – Finger joint
- Cabinet doors – Edge-to-edge joint
- Floorboards – Tongue and groove

3.2(e) LEARNER ACTIVITIES

- Discuss types of joints in groups and explain purpose
- Sketch different joint types (lengthening, widening, framing)
- Prepare mortise and tenon, dovetail, finger, and tongue & groove joints in the workshop
- Identify fasteners suitable for each joint
- Observe joint preparation in a local workshop
- Watch instructional videos and create a report
- Record steps in a logbook with sketches

3.2(f) SAFETY PRECAUTIONS DURING JOINT PREPARATION

- Wear **gloves and goggles**
- Clamp timber securely before cutting
- Use **sharp tools** to avoid slips
- Keep fingers away from cutting edges
- Work in a **clean and organized workspace**
- Avoid rushing; focus on **accuracy and safety**

3.2(g) CORE VALUES AND LIFE SKILLS DEVELOPED

- Precision and accuracy
- Patience and perseverance
- Teamwork and collaboration
- Responsibility and accountability
- Problem-solving skills
- Appreciation for craftsmanship
- Environmental care (efficient timber use)

PROJECT IDEAS

Project 1: “Construct a Small Table Using Multiple Joint Types”

- Materials: Timber pieces, glue, dowels, screws
- Joints: Mortise and tenon (legs), dovetail (drawer), finger joint (table top)
- Steps: Measure → Mark → Cut → Dry assemble → Fix → Finish

Project 2: “Create a Mini Cabinet with Frame and Panel Construction”

- Use mortise and tenon for frame
- Use edge-to-edge for panels
- Reinforce with brackets or screws
- Document each step with sketches and photos

Project 3: “Joint Strength Testing”

- Prepare three identical joints (butt, half-lap, dovetail)
- Apply force to test durability
- Record which joint holds best under pressure

EXAMPLES OF COMMON JOINT APPLICATIONS

Joint Type	Product Example	Fasteners Used
Mortise & Tenon	Chair, bed, door frame	Glue, wooden pegs
Dovetail	Drawer, jewelry box	Glue
Finger Joint	Laminated table top	Glue
Tongue & Groove	Floorboards, wall panels	Glue, nails

Scarf Joint	Roof rafters, long beams	Nails, bolts
Half-Lap	Cabinet frame, picture frame	Glue, screws
Mitre	Picture frames, cabinet corners	Glue, brackets
Edge-to-Edge	Panel boards, doors	Glue, dowels
Dowels	Boards, drawer fronts	Glue + dowels
Brackets	Shelf supports	Screws + brackets

SUB-STRAND 3.3: SURFACE PREPARATION

INTRODUCTION TO SURFACE PREPARATION

Definition:

Surface preparation is the process of **making a wood surface smooth, clean, and ready to receive a finish**, such as varnish, paint, wax, or polish.

Importance:

- Smooth and even finish
- Proper adhesion of coatings
- Removal of defects (knots, splinters, scratches, old finishes)
- Professional and aesthetic appearance
- Improves durability and resistance to moisture, insects, and wear

Common Applications:

- Furniture: tables, chairs, cabinets, shelves
- Doors, windows, and frames
- Decorative panels and mouldings
- Flooring and handrails

3.3(a) REASONS FOR FINISHING A WOOD PRODUCT

Finishing a wood product ensures:

1. **Appearance** – smooth, polished, and attractive surface
 - ☉ Example: Dining table tops, office desks, shelves
2. **Durability** – protection against moisture, fungi, and termites
 - ☉ Example: Outdoor furniture, window frames
3. **Strength** – reduces splitting, cracking, and surface wear

⊙ Example: Cabinet doors, wooden doors

4. **Smoothness** – removes roughness, splinters, and tool marks

⊙ Example: Wooden toys, chair legs

5. **Ease of Cleaning** – surface becomes easy to wipe

⊙ Example: Kitchen cabinets, floorboards

6. **Water and Stain Resistance** – prevents absorption of liquids

⊙ Example: Table tops, bathroom doors

7. **Enhancement of Grain** – natural beauty of wood is highlighted

⊙ Example: Decorative panels, tabletops

8. **Hygiene** – smooth, sealed surfaces prevent dust accumulation

⊙ Example: Wooden cutting boards, toy surfaces

3.3(b) MATERIALS AND TOOLS FOR SURFACE PREPARATION

Common Materials

- **Sandpaper** – coarse (80 grit), medium (120 grit), fine (240–400 grit)
- **Scraper** – removes old finishes and high spots
- **Files / Rasps** – shape and smooth edges
- **Cloths / Brushes** – dust removal and finish application
- **Water / Wet Cloth** – raises grain for smoother sanding
- **Hot Iron** – raises grain on plywood or softwood

Examples of Use:

- Sandpaper: smooth table tops, shelves, cabinet doors
- Scraper: remove old paint from chair legs, doors
- Files: shape legs of chairs, decorative panels
- Cloth: clean dust before varnish or paint
- Brush: apply clear varnish, oil, or polish

Common Tools

- Hand plane – for flattening surfaces
- Sanding block – better grip, even pressure
- Scraper / cabinet scraper – removes rough areas
- Steel file / wood file / rasp – for curves and edges
- Soft brush / cloth – dust removal, polish application

- Power sander (orbital or belt) – for large surfaces

Practical Examples:

- Hand sanding cupboard door edges
- Scraping high spots on drawer panels
- Using file to smooth chair legs
- Cleaning surfaces before varnish or paint

3.3(c) STEP-BY-STEP PROCEDURE TO PREPARE WOOD SURFACES

1. **Inspect Timber** – check for knots, cracks, splits, or defects
2. **Truing Up Surfaces** – plane or sand rough timber to uniform thickness
3. **Raise Grain (Optional)** – lightly wet surface, let dry, then sand
4. **Scraping** – remove high spots or residual glue
5. **Sanding** – start with coarse, move to medium, finish with fine
6. **Filling Imperfections** – use wood filler for cracks, knots, or holes
7. **Cleaning** – remove dust using soft cloth or brush
8. **Apply Clear Varnish** – brush following wood grain
9. **Allow to Dry** – according to manufacturer instructions
10. **Light Sanding Between Coats** – ensures smooth final finish
11. **Final Coat** – for shine, protection, and smooth texture

Practical Examples:

- Sanding and varnishing a bookshelf
- Preparing a dining table top
- Polishing cupboard doors
- Coating window frames and door panels
- Finishing floorboards

3.3(d) METHODS OF SURFACE PREPARATION

1. **Scraping** – removes rough spots or old finishes
 - ⊗ Example: Scraping chair legs before varnishing
2. **Raising the Grain** – wet surface, sand after drying
 - ⊗ Example: Plywood panels before varnish
3. **Hand Sanding** – using sandpaper or sanding block

⊗ Example: Cabinet doors, table tops, chair legs

4. **Machine Sanding** – for large surfaces

⊗ Example: Workshop benches, large doors, floorboards

5. **Filling Imperfections** – wood filler or putty

⊗ Example: Cracks in door panels, wooden boxes, picture frames

6. **Polishing / Buffing** – after final coat

⊗ Example: Chair arms, decorative panels, handrails

3.3(e) **IMPORTANCE OF PREPARING WOOD SURFACES**

- Ensures **adhesion of finish**
- Produces **smooth and even finish**
- Enhances **natural beauty** of timber
- Reduces **absorption of finish**, saves materials
- Improves **product durability**
- Reduces **surface defects** (roughness, splinters)
- Produces **marketable, professional-quality products**
- Improves **hygiene and ease of cleaning**

Practical Examples:

- Smooth table tops for dining areas
- Polished cupboard doors
- Protective finish on outdoor furniture
- Wooden toys with non-toxic varnish
- Decorative panels with clear finish
- Flooring surfaces for easy cleaning
- Handrails with smooth protective coating

3.3(f) **LEARNER ACTIVITIES**

- Group discussion on reasons for finishing wood products
- Identify tools and materials used for surface preparation
- Practice sanding, scraping, and cleaning timber
- Apply clear varnish on wooden samples
- Observe surface preparation in a nearby workshop
- Draw and label all tools and materials

- Compare results of hand sanding vs. machine sanding

Activity Example:

- Students sand and varnish a small shelf using three different sandpaper grades and observe the differences in smoothness and shine

3.3(g) SAFETY PRECAUTIONS DURING SURFACE PREPARATION

- Wear gloves and goggles
- Work in well-ventilated area
- Avoid inhaling wood dust
- Keep tools sharp for easier work
- Clamp timber to avoid slipping
- Avoid contact of varnish or chemicals with skin
- Dispose of varnish and cloths safely
- Keep workspace clean to prevent accidents

3.3(i) PROJECT IDEAS

1. Varnished Wooden Shelf

- ⊙ Materials: Timber plank, sandpaper, scraper, brush, clear varnish
- ⊙ Steps: Inspect → Sand → Fill cracks → Clean → Apply varnish → Dry → Light sanding → Final coat

2. Finished Dining Table Top

- ⊙ Compare hand sanding vs. machine sanding
- ⊙ Apply two coats of clear varnish
- ⊙ Observe smoothness, shine, and protection

3. Wooden Toys / Decorative Panel

- ⊙ Practice surface preparation for small projects
- ⊙ Apply non-toxic varnish for safety

4. Surface Finish Comparison Experiment

- ⊙ Prepare three samples using different methods: hand sanding, machine sanding, scraping
- ⊙ Apply varnish and evaluate smoothness, shine, and adhesion

3.3(j) EXAMPLES OF SURFACE PREPARATION APPLICATIONS

Timber Product	Surface Preparation Method	Finish Applied
Dining Table	Sanding → Scraping → Varnish	Clear varnish
Cabinet Doors	Sanding → Filler → Varnish	Clear varnish
Chair Legs	File → Sand → Varnish	Clear varnish
Window Frames	Scraping → Sand → Coat	Clear varnish
Door Panels	Sand → Raise Grain → Varnish	Clear varnish
Shelves	Sanding → Clean → Varnish	Clear varnish
Floorboards	Machine sanding → Varnish	Clear varnish
Wooden Toys	Sand → Smooth → Non-toxic varnish	Non-toxic clear varnish
Handrails	Sand → Varnish	Protective clear coat
Decorative Panels	Scraping → Sanding → Varnish	Clear varnish

SUB-STRAND 3.4: PROJECT ACTIVITY – FURNITURE ITEM

INTRODUCTION TO PROJECT ACTIVITY

Definition:

Project activity involves **applying theoretical knowledge and practical skills** learned in wood technology to construct a **finished furniture item**.

Importance:

- Develops **practical woodworking skills**
- Enhances **creativity and design thinking**
- Builds **confidence and problem-solving ability**
- Produces **useful and functional items**
- Encourages **appreciation of craftsmanship**
- Prepares learners for **real-life woodworking and career opportunities**

Examples of Furniture Projects:

- Stool – small seating furniture
- Bench – seating for halls or gardens
- Coffee Table – functional living room table
- Chair – with back support and legs
- Shoe Rack – storage furniture

- Bedside Cabinet – bedroom furniture
- Book Rack – storage/display for books
- Magazine Stand – living room accessory
- TV Stand – living room furniture

3.4(a) CONSTRUCTION OF A FURNITURE ITEM

Step-by-Step Procedure

Step 1: Planning the Project

- Choose a furniture item based on skill level and materials available
- Draw a **simple sketch with dimensions**
- Decide **timber type, tools, and finishes** needed
- Consider functionality, aesthetics, and safety

Example:

- Stool: Height 450 mm, Seat 300×300 mm, Legs 450 mm
- Coffee Table: Length 1200 mm, Width 600 mm, Height 450 mm

Step 2: Selecting Materials

- Choose **good quality timber**: hardwood or softwood depending on durability required
- Ensure timber is:
 - ⦿ Straight-grained
 - ⦿ Free of cracks, knots, and defects
 - ⦿ Dry and seasoned

Examples of Timber by Project:

Furniture Item	Recommended Timber
Stool	Pine, Mahogany
Bench	Teak, Mahogany
Coffee Table	Pine, Oak
Chair	Mahogany, Cedar
Shoe Rack	Pine
Bedside Cabinet	Teak, Mahogany

Book Rack	Pine, MDF
TV Stand	Oak, Mahogany
Magazine Stand	Pine, Mahogany

Step 3: Selecting Tools

Measuring Tools: Tape measure, try square, ruler, marking gauge

Marking Tools: Pencil, compass, marking knife

Cutting Tools: Handsaw, tenon saw, chisel, coping saw

Shaping Tools: Jack plane, file, rasp, spokeshave

Assembly Tools: Clamps, mallet, hammer, screwdriver

Finishing Tools: Sandpaper (coarse → medium → fine), scraper, brush, cloth

Example:

- Using a **tenon saw** to cut mortise and tenon joints for chair legs
- Using **rasp** to shape stool legs
- Sanding a table top with **progressive sandpaper grades**

Step 4: Preparing Materials

- Cut timber to required lengths, widths, and thickness
- Plane surfaces to make them flat and smooth
- Mark joints accurately using try square and marking gauge
- Cut joints carefully (mortise & tenon, dovetail, finger joints, dowel joints)
- Smooth edges using file or sandpaper

Example:

- Cutting dovetail joints for bedside cabinet drawer
- Smoothing coffee table legs with file and sandpaper

Step 5: Assembly

- **Dry Assembly:** Fit pieces together without glue to check alignment
- **Trial Assembly:** Clamp pieces to test stability and accuracy
- **Final Assembly:**
 - ⦿ Apply wood glue or adhesive
 - ⦿ Clamp firmly to ensure tight joints

© Use nails, screws, dowels, or brackets for extra strength

Example:

- Chair frame: mortise & tenon joints glued and clamped
- Book rack: edge-to-edge boards with dowels glued and clamped

Step 6: Surface Preparation

- Sand progressively (coarse → medium → fine)
- Scrape high spots if necessary
- Clean dust using soft cloth or brush
- Fill small cracks or holes using wood filler
- Apply **finish**: clear varnish, paint, polish, or wax

Examples:

- Varnishing stool seat
- Polishing coffee table top
- Painting shoe rack for decorative effect

3.4(b) APPRECIATION OF SKILLS LEARNED

Skills Developed:

1. Accurate measurement and marking
2. Cutting and shaping timber
3. Preparing precise joints
4. Assembling wood into functional items
5. Surface preparation and finishing
6. Using clamps, adhesives, and fasteners
7. Time management during project completion
8. Working safely with hand tools
9. Problem-solving during assembly
10. Creativity in design

Practical Examples:

- Using **try square** to mark angles for stool legs

- Cutting **mortise and tenon** joints for chair frame
- Sanding coffee table surface for smooth finish
- Applying glue to bench frame and clamping
- Shaping decorative edges for bedside cabinet
- Assembling shelves in book rack with dowels

3.4(c) EXAMPLES OF PROJECT FURNITURE ITEMS

Furniture Item	Timber Used	Joint Used	Surface Preparation	Finish
Stool	Pine	Mortise & Tenon	Sanding, scraping	Clear varnish
Bench	Teak	Half-lap	Sanding, filler	Varnish or polish
Coffee Table	Oak	Finger joint	Hand sanding, scraping	Clear varnish
Chair	Mahogany	Mortise & Tenon	Scraping, sanding	Clear varnish
Shoe Rack	Pine	Dowel joint	Sanding	Clear varnish or paint
Bedside Cabinet	Teak	Dovetail joint	Sanding & scraping	Varnish
Book Rack	Pine	Edge-to-edge & Dowel	Sanding	Clear varnish or polish
TV Stand	Oak	Half-lap, Mitre	Sanding, scraping	Clear varnish
Magazine Stand	Pine	Dowel & Finger Joint	Sanding	Paint or varnish

3.4(d) LEARNER ACTIVITIES

1. Plan and design furniture project (sketch with measurements)
2. Select appropriate timber for the chosen project
3. Measure and mark timber accurately
4. Cut timber to required sizes
5. Prepare and cut joints accurately
6. Assemble using dry trial, then glue or fasteners
7. Sand, scrape, and finish surfaces
8. Present finished product for evaluation or critique
9. Document the process in a workbook (materials, steps, challenges)
10. Compare results of hand tools vs. machine tools (if available)

Group Activity:

- Divide learners into groups; each group constructs one furniture item
- Present finished products for class critique and discussion

3.4(e) SAFETY PRECAUTIONS

- Wear protective clothing: gloves, apron, goggles
- Clamp timber before cutting or planing
- Keep fingers away from cutting edges
- Use sharp tools for safer cutting
- Work in well-lit and ventilated area
- Keep workspace clean to prevent accidents
- Store tools safely after use
- Follow teacher/workshop supervisor instructions

3.4(f) IMPORTANCE OF PROJECT ACTIVITY

- Develops **practical woodworking skills**
- Enhances **creativity and design ability**
- Teaches **problem-solving, planning, and time management**
- Produces **functional, durable, and aesthetically pleasing furniture**
- Prepares learners for **future careers in wood technology**
- Encourages **independence and confidence**
- Promotes **teamwork and collaboration** if project is group-based

SUMMARY

- Project activity **consolidates all skills** in timber preparation, jointing, surface finishing, and assembly
- Completing a furniture item teaches **measurement, cutting, jointing, assembly, surface preparation, and finishing**
- Learners gain **confidence, practical knowledge, creativity, and appreciation for craftsmanship**
- Practical experience ensures **production of professional, durable, and aesthetically pleasing wood products**

PROJECT EXTENSION IDEAS

- Build **stackable shelves** using edge-to-edge joints
- Create **multi-purpose stools** with storage
- Design **foldable coffee tables**
- Construct **decorative wall panels** with surface finish techniques
- Make **custom book racks** with finger joints and varnish finish

STRAND 4: RELATED DRAWING

SUB-STRAND 4.1: DRAWING AND SKETCHING

INTRODUCTION TO DRAWING AND SKETCHING

Definition:

- Drawing is the **visual representation of an object, concept, or idea** to guide construction or production.

In Wood Technology:

- Helps visualize furniture and timber products
- Guides accurate measurement and cutting
- Reduces material wastage
- Ensures precise assembly and joints
- Provides professional presentation for clients or teachers

Benefits:

- Enhances creativity
- Improves technical communication
- Reduces errors in production
- Aids problem-solving during design

Types of Drawings in Wood Technology:

1. **Oblique Projection:** One face in true shape; receding lines drawn at an angle (usually 45°)
2. **Isometric Projection:** Shows three faces equally foreshortened; useful for technical illustration

- 3. **Perspective Drawing:** Shows depth as it appears to the eye (one-point, two-point)
- 4. **Orthographic Projection:** 2D views (front, side, plan) from 3D objects; essential for workshop guidance
- 5. **Freehand Sketching:** Quick, informal representation for ideas and brainstorming

4.1(a) TYPES OF PICTORIAL DRAWINGS

1. Oblique Drawing

- Shows one face in true shape; other lines recede at angle (usually 45°)
- **Advantages:** Quick, simple, easy for small objects
- **Examples:**
 - ⊙ Side view of a stool
 - ⊙ Front of a chair with visible seat
 - ⊙ Small cabinet or shoe rack
- **Activity:** Sketch an oblique view of a **stool** using 45° receding lines

2. Isometric Drawing

- Three faces equally foreshortened
- Axes at 120° between each other
- Useful for technical and workshop drawings
- **Examples:**
 - ⊙ Coffee table (top, legs, drawer)
 - ⊙ Chair frame (legs, seat, back)
 - ⊙ Bedside cabinet with drawers
 - ⊙ Book rack showing vertical and horizontal shelves
- **Activity:** Draw an isometric view of a **small bookshelf** with 3 shelves

3. Perspective Drawing

- Shows objects as they appear to the eye
- **Types:** One-point, two-point, three-point perspective
- Useful for client presentations or marketing
- **Examples:**
 - ⊙ Living room furniture arrangement

- ⊙ Library book rack

- ⊙ Wardrobe corner

- **Activity:** Create a **one-point perspective sketch** of a coffee table with a drawer

4. Orthographic Drawing

- Produces **2D projections of a 3D object**
- Includes **plan view, front elevation, side elevation**
- Essential for workshop or construction guidance
- **Examples:**
 - ⊙ Stool (plan, front, side views)
 - ⊙ Bench orthographic views
 - ⊙ Bedside cabinet elevations
- **Activity:** Convert the isometric sketch of a book rack into **front, side, and top views**

5. Freehand Sketching

- Quick, informal representation
- Useful for **brainstorming and initial designs**
- Should include:
 - ⊙ Basic proportions
 - ⊙ Shape and layout
 - ⊙ Key features (shelves, drawers, decorative edges)
- **Examples:**
 - ⊙ Stool with curved legs
 - ⊙ Chair with armrests
 - ⊙ Coffee table with storage drawer
 - ⊙ Book rack with multiple shelves
 - ⊙ Bedside cabinet with sliding drawer
- **Activity:** Freehand sketch a **shoe rack with 3 shelves** including spacing

4.1(b) DRAWING ISOMETRIC PROJECTION

Steps to Draw an Isometric View

1. Draw three axes (x, y, z) at **120° angles**
2. Draw **length, width, and height** along the axes

3. Connect points to form edges of object
4. Add details: shelves, legs, drawers, decorative features
5. Darken final edges for clarity
6. Label dimensions and features

Examples:

- Coffee table: top, legs, drawer
- Stool: seat, legs, support bars
- Book rack: vertical supports, horizontal shelves

Activity: Draw an **isometric sketch of a bedside cabinet** showing 2 drawers

4.1(c) DRAW ORTHOGRAPHIC VIEWS FROM ISOMETRIC DRAWING

Steps

1. Identify front, side, and top faces from the isometric drawing
2. Project lines orthogonally to each face
3. Draw accurate **2D representation** for each view
4. Include dimensions, labels, and notes
5. Check proportions and alignment

Examples:

- Bedside cabinet: front, side, and plan views
- Small chair: plan, elevation, side
- Shoe rack: front, side, plan

Activity: Convert an **isometric sketch of a coffee table** into orthographic views

4.1(d) FREEHAND SKETCHING

- Quick, informal drawing for idea generation
- Must include: proportions, layout, main features
- Does not require instruments but should be neat
- **Examples:**
 - ⊗ Stool with curved legs
 - ⊗ Chair with back support and armrests

- ⊙ Coffee table with drawer
- ⊙ Book rack with multiple shelves
- ⊙ Bedside cabinet with sliding drawers
- ⊙ Decorative wall-mounted shelf

Activity: Freehand sketch 3 different designs of a magazine stand, including shelves and supports

4.1(e) IMPORTANCE OF DRAWING IN WOOD TECHNOLOGY

1. Facilitates clear communication of ideas
2. Helps in accurate measurement and cutting
3. Minimizes errors and material wastage
4. Assists in planning assembly and joints
5. Encourages creativity and innovation
6. Serves as reference for project evaluation
7. Useful for market presentation and client approval
8. Enables visualizing complex furniture before production

Practical Examples:

- Workshops using isometric and orthographic drawings for production
- Cabinet makers using perspective sketches for clients
- Students sketching freehand designs before starting projects
- Designers producing multiple sketches for chair designs
- Book rack sketch for school library storage planning

TOOLS AND MATERIALS FOR DRAWING

- Drawing board / flat surface
- T-square, set squares
- Compass, divider
- Ruler / scale
- Pencils (HB, 2B, 4B)
- Eraser, sharpener
- Digital devices for reference or CAD software

Examples:

- HB pencil for sketching stool on board
- Set squares for accurate orthographic projection
- Ruler for measuring coffee table dimensions
- Digital reference images for designing shelves

LEARNER ACTIVITIES

1. Identify and classify different types of pictorial drawings
2. Draw **isometric projections** of selected furniture items
3. Convert **isometric drawing into orthographic views**
4. Produce **freehand sketches** of furniture designs
5. Compare sketches with real objects
6. Present drawings for peer critique
7. Use drawings to plan a **mini workshop project**

Group Activity:

- Divide learners into teams; each team sketches a furniture item in **isometric and orthographic views** and presents to the class

SAFETY PRECAUTIONS

- Keep pencils, compasses, and rulers safely when not in use
- Avoid sharp edges of instruments
- Maintain clean and organized drawing area
- Handle tools carefully to prevent injury
- Avoid leaning on drawing boards to prevent falls

SUMMARY

- Drawing and sketching are **critical skills** in wood technology
- Types include **isometric, oblique, perspective, orthographic, and freehand sketches**
- Drawings help in **planning, design, construction, and finishing**
- Mastery of drawing skills improves **accuracy, creativity, efficiency, and project quality**

EXAMPLES OF APPLICATIONS

Drawing Type	Item Example	Purpose
Isometric	Coffee table	Visualize 3D shape
Orthographic	Stool	Workshop cutting guide
Perspective	Book rack	Show depth for client
Oblique	Chair	Quick production visualization
Freehand	Shoe rack	Brainstorm initial ideas
Isometric	Bench	Planning joint positions
Orthographic	Bedside cabinet	Dimensioning for cutting
Freehand	Decorative shelf	Explore design variations
Perspective	Cabinet	Client presentation
Isometric	Wall-mounted shelf	Assembly planning

PROJECT ACTIVITIES AND EXTENSIONS

- Sketch **multi-functional furniture**: stool with storage
- Draw **stackable shelves** using isometric and orthographic views
- Freehand design **decorative panels for cabinets**
- Perspective sketches of **room furniture layout**
- Create **digital sketches** using CAD or tablet