JS3 FIRST TERM NOTES ,2026/2027 NOTES

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WEEK 1

Definitions and Facts:

- **Motion** is the change in the position of an object from one place to another with respect to time.
- **A machine** is an assembly of several mechanisms, or elements arranged to transmit power or motion for doing work.
- Machine elements such as **gears, belts, chains, pulleys, cams and cranks** transmit and convert motion from one machine part to another.

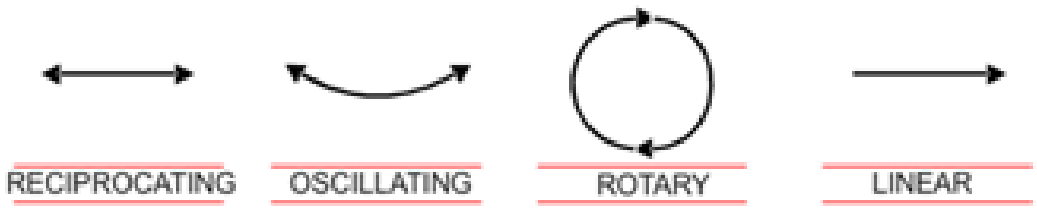
What is Responsible for the Motion of Objects?

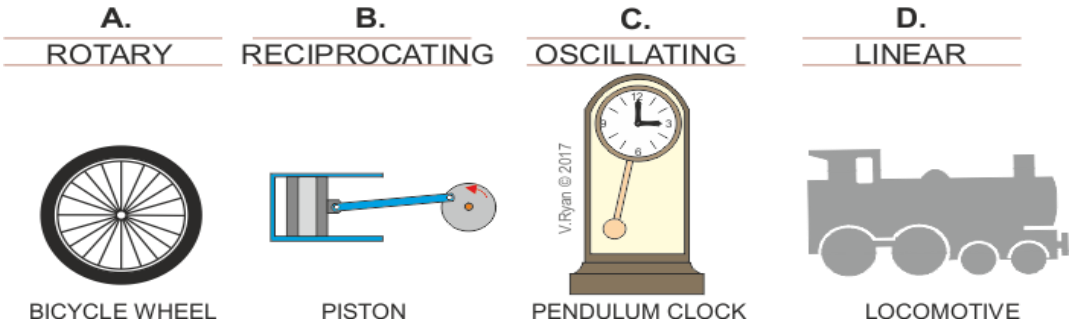
Objects do not move on their own unless acted upon by a **force**. A force is *a push or a pull* that causes an object to *start moving*, *stop moving*, *change direction* or *change speed*.

Types of Motion in Mechanical Systems

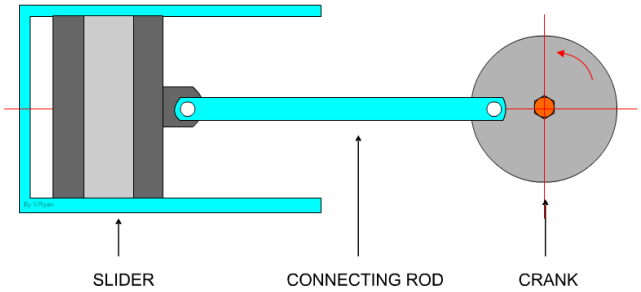
1. **Linear (Translatory) Motion:** is the movement of an object along a straight path. **Real-world Examples:** Elevator (Lift), Sliding window, Drawer, Conveyor belt, Printer carriage, etc.
2. **Rotary Motion:** is the movement of an object around a fixed axis. **Real-world Examples:** Ceiling fan, Bicycle wheel, Grinding machine, Electric motor shaft, Pulley, etc.
3. **Reciprocating Motion:** is repeated movement backward and forward along the same straight line. **Real-world Examples:** Engine piston, Bicycle pump, Syringe plunger, Sewing machine needle, etc.
4. **Oscillating Motion:** is repeated movement to and fro about a fixed point. **Real-world Examples:** Clock pendulum, Playground swing, Windshield wiper, Rocking chair, etc.

Schematics of the motion types





Note: many mechanisms, or machine elements take one type of motion as input motion, and give out the same or a different type as output.



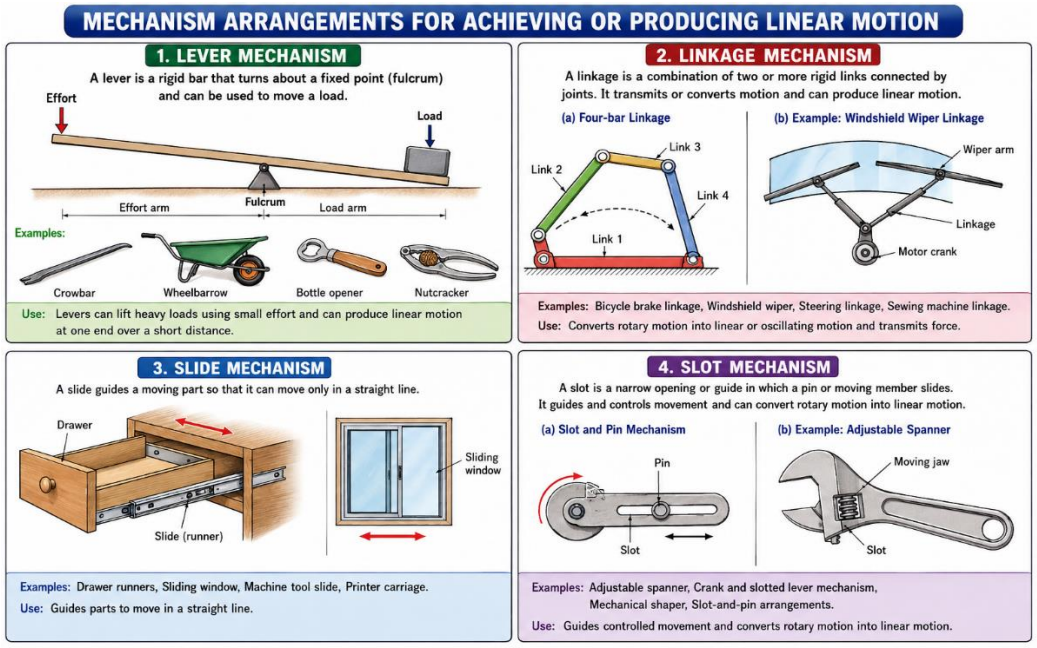
Review Exercise

1. Define motion.
2. Explain what is responsible for the motion of objects.
3. Mention four forms of motion in mechanical systems.
4. State two examples of each.
5. Differentiate between:

   a. Rotary motion and reciprocating motion.

   b. Linear motion and oscillating motion.

Mechanisms for achieving Linear Motion in Machines



❑ **The following are some examples of mechanisms for producing linear motion:**

a. Levers
b. Linkages
c. Slides and
d. Slots

A. Levers

Levers use *mechanical advantage* to make lifting or applying pressure easier. All *levers* are made of a bar and a *pivot*, called a *fulcrum*. Levers have three main parts:

- *effort* - the amount of force applied by the user, also referred to as the *input*
- fulcrum - where the lever pivots
- *load* - the weight that needs to be moved, also referred to as the output

Mechanical advantage is the amount of help you get using a machine in comparison to doing something with just human effort, and it is created by levers.

It is measured by dividing the load by the effort applied to moving it, both measured in Newtons (N) - this could also be described as the output (load) divided by the input (effort).

Key fact
Mechanical Advantage = load (N) ÷ effort (N)

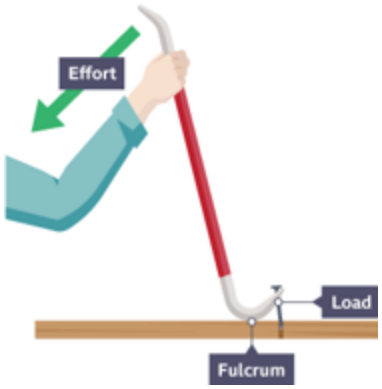
Classes of lever

There are three different types of levers. They are chosen for their ability to produce the most mechanical advantage for a particular task. These classes of lever arrange the effort, fulcrum and load in a different order:

First order	Effort	Fulcrum	Load
Second order	Effort	Load	Fulcrum
Third order	Fulcrum	Effort	Load

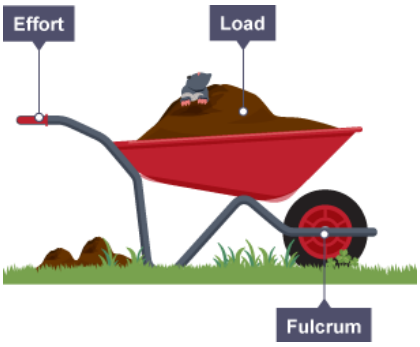
1. First Order Levers

First order *levers* (Class 1) place the fulcrum between the effort and the load. An example would be a seesaw, which places the fulcrum in the centre and allows equally weighted children to lift each other up.



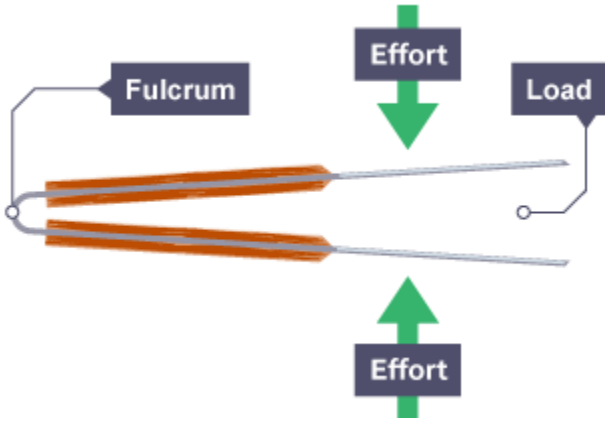
2. Second Order Levers

Second order levers (Class 2) place the fulcrum at one end of the lever and the effort at the other, with the load in the centre. The closer together the fulcrum and load are, the easier it is to lift the load. Examples include wheelbarrows, nutcrackers and some bottle openers.



3. Third Order Levers

Third order levers (Class 3) place the effort between the fulcrum and the load. If the effort and the fulcrum are further apart, it becomes easier to lift. A third order lever **does not** have the mechanical *advantage of first order levers or second order levers* so are less common. They are generally used for moving small or delicate items. Examples include tweezers or fishing rods**.**



B. Linkages: are a combination of levers for the purpose of:

a. Changing the direction of motion

b. Transmitting or converting the type of motion

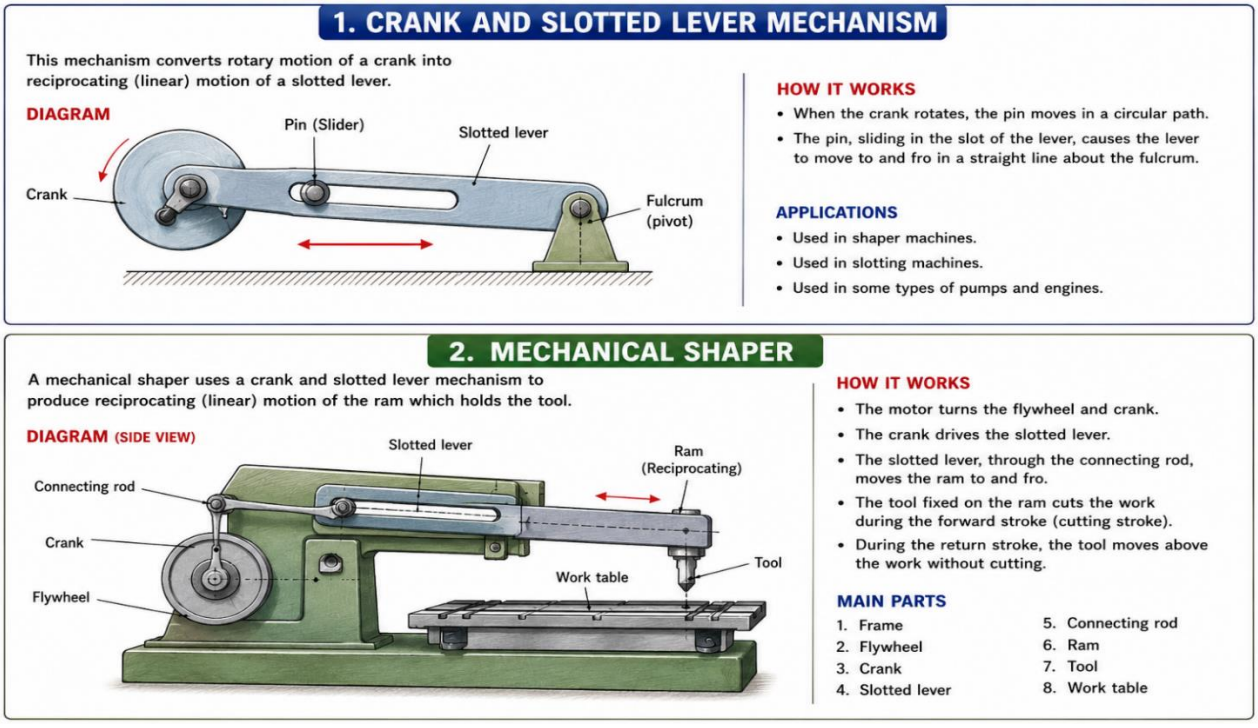
c. Changing the timing of moving parts (by varying the size of the applied force).

Some types of linkages include:

S/N.	TYPES	Principle of Operation	Real word Examples
i.	**Reverse-motion**	***changes the direction of the input motion***	**Scissor lift, foldable cloth rack, etc.**
ii.	**Parallel-motion**	***Keeps/maintains the direction of the output the same as the input***	**Cantilever tool boxes,**
iii.	**Bell-crank**	***changes the direction of motion* or *transmits it round a corner (i.e. 90°)***	**Bicycle brake system,**
iv.	**Treadle**	**changes one type of motion into another,**	**Sewing machine, windshield wiper, power hacksaw, etc.**

C. **Slides:** A slide guides a moving part so that it travels only in a straight line**.** A slide is a rigidly supported object over which another one can move. It consists of rod and a ring. **Real world examples: sliding windows,** drawer runners, sliding window, machine tool slide, printer carriage **etc.**

D. Slots: A slot is *a narrow opening or guide* through which a pin or moving member travels to control motion**.** It consists of a rod and a roller ball constrained to move in and out of a shaped hole**.** Slots guide movement and often convert rotary motion into linear or reciprocating motion**. Real world examples:** curtain rails, mortise locks, adjustable spanner, slot-and-pin mechanism, crank and slotted lever mechanism, mechanical shape**, etc.**

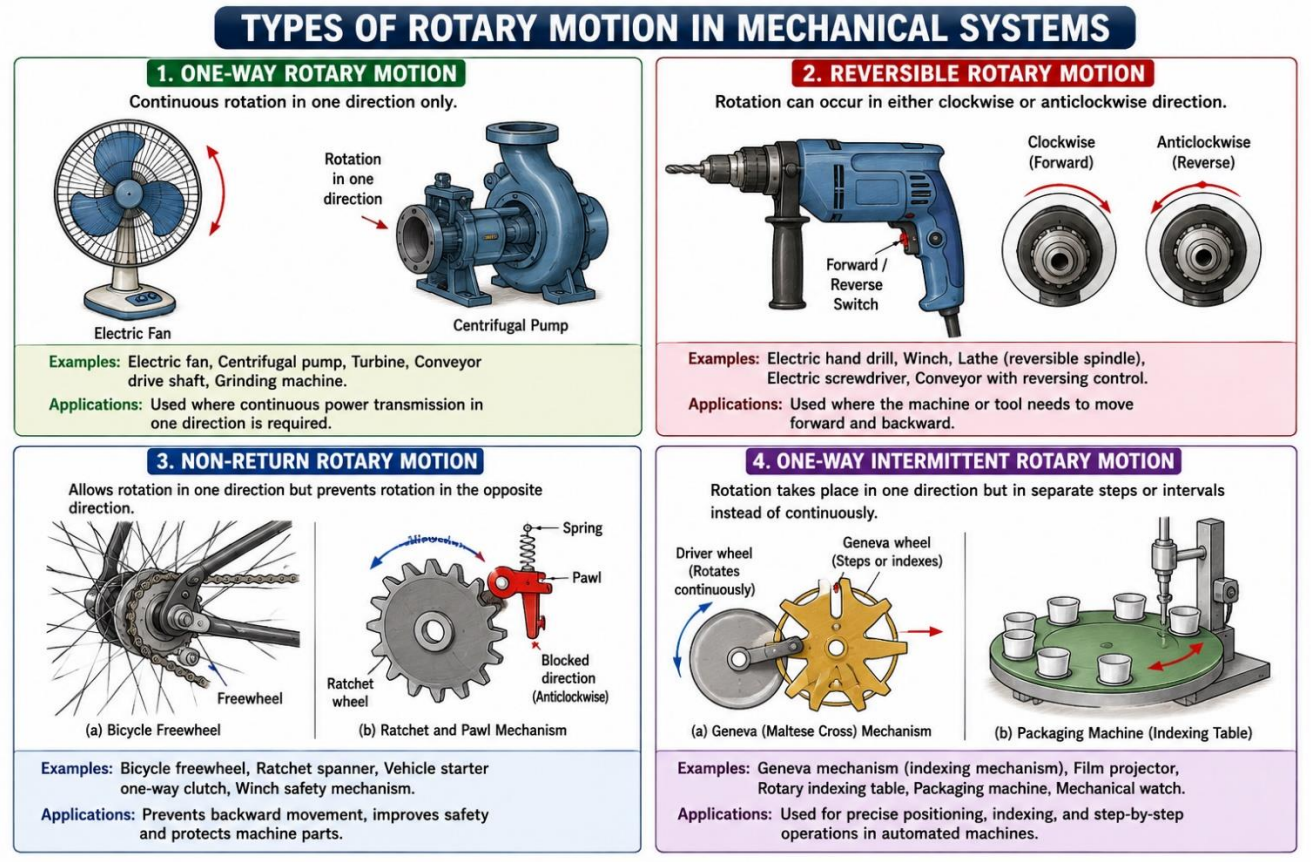


- **Review Exercise**

1. **Define the following:**
   - **a.** Mechanism
   - **b.** Linear motion
2. Explain how each of the following produces linear motion and state two applications each:
   - I. Lever
   - II. Linkage
   - III. Slide
   - IV. Slot

WEEK 2

Types of Rotary Motion in Machines



i. **<u>One-way rotary motion</u>:** is the type of rotation *that is either strictly clockwise or strictly anti-clockwise*. A reversal of direction could lead to a damage to the machine while in motion. E.g. *conveyor drive shaft, ceiling fan blade, centrifugal water pump, turbine blades, electric grinding machine*, etc.

ii. **<u>Reversible rotary motion</u>:** is the type of rotation that can occur in both <u>clock wise and anti-clockwise directions.</u> Examples are: electric drill, door knobs, tap-head control system, etc.

iii. **<u>One-way intermittent rotary motion</u>:** is rotation in one direction but occurring in separate steps or intervals rather than continuously. Real world examples: *rotary indexing table, packaging machine, mechanical watch mechanism watch, etc.*

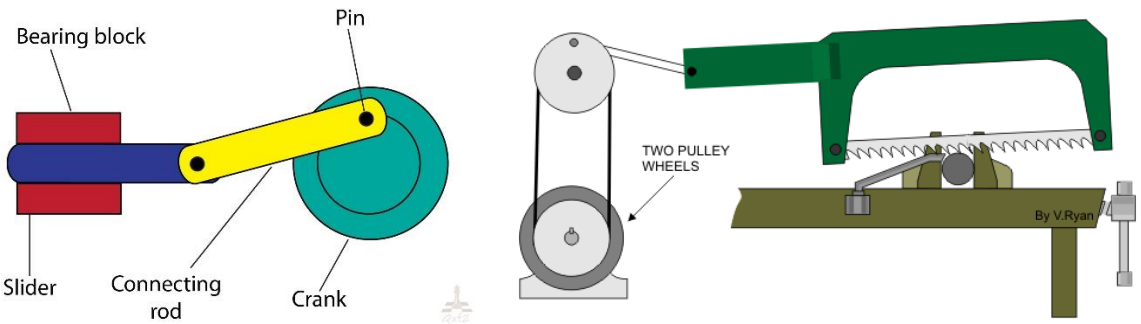
iv. **<u>Non-return rotary motion</u>:** this type allows rotation in *one direction* but **prevents** movement in the *opposite direction*. E.g. bicycle freewheel, ratchet spanner, vehicle starter one-way clutch, winch safety mechanism, corkscrews, kitchen tin cutters, , etc**.**

- **<u>Conversion of Rotary to other forms of Motion and vice versa</u>.**

  Motion conversion is the process *of changing one form of motion into another* to enable a machine perform a specific function.

- The following mechanisms are capable of motion conversions:

1. Slider–Crank Mechanism



Function

Converts: Rotary motion → Reciprocating motion or

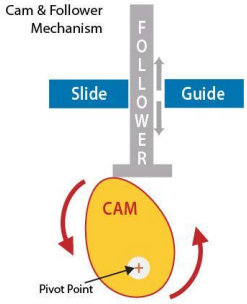
- Reciprocating motion → Rotary motion

Examples: Internal combustion engine**,** Bicycle pump**,** Compressor**,** Steam engine

Working Principle

A rotating crank moves a connecting rod, causing the slider (piston) to move back and forth.

2. Cam and Follower



Function

Converts: Rotary motion → Reciprocating or Oscillating motion

Examples: Engine valves**,** Automatic machines**,** Mechanical toys**,** Printing machines

Working Principle

The rotating cam pushes the follower upward and allows it to return under spring force or gravity.

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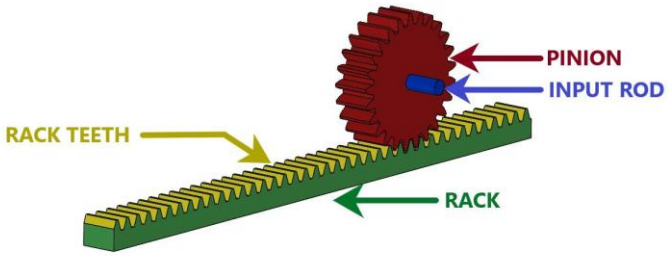
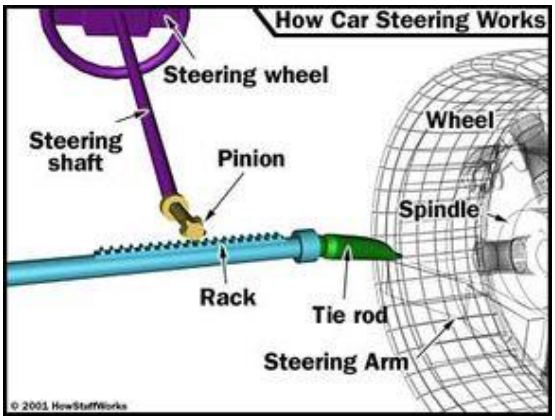
3. Rack and Pinion





Function

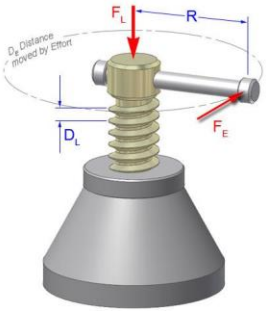
Converts: Rotary motion ↔ Linear motion

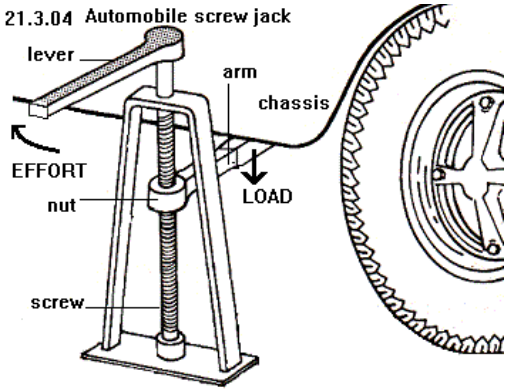
Examples: Vehicle steering system**,** Sliding gates**,** Machine tools**,** Railway point control, etc.

Working Principle

The rotating pinion gear drives the straight rack to produce linear motion, or the rack drives the pinion to produce rotary motion.

4. Screw-and-nut Mechanism





Function

Converts: Rotary motion ↔ Linear motion

Examples: Screw jack**,** Bench vice**,** Car jack**,** Lead screw of a lathe, etc.

Working Principle

Turning the screw causes the nut or load to move in a straight line because of the screw thread.

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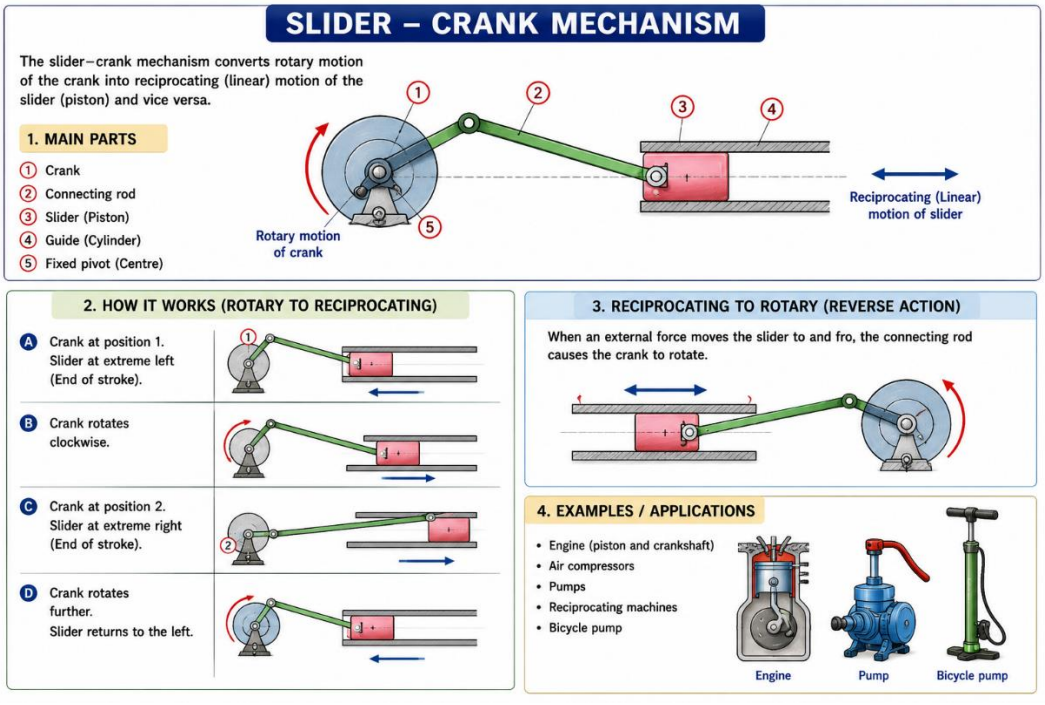
5. Crank and Lever Mechanism



Function

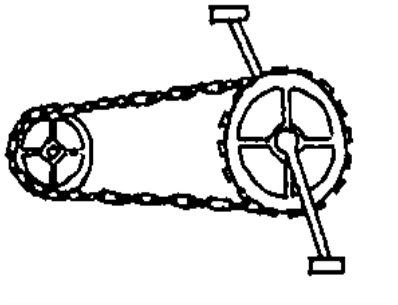
Converts: Rotary motion → Oscillating motion

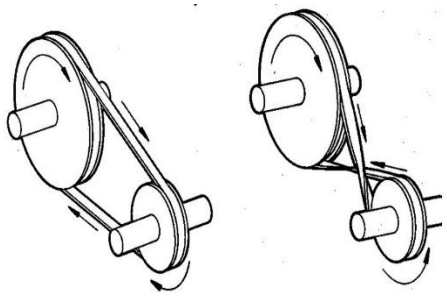
Examples: Windshield wiper**,** Pump handle**,** Mechanical shaper**,** Rocker mechanisms, etc.

Working Principle

The rotating crank drives a lever through a connecting rod, causing the lever to swing to and fro.

Other mechanisms include***: belt-and – pulley***, ***chain – and – pulley*** and ***wheel – and – axle.***





Summary Table

Mechanism	**Motion Converted**	**Practical Applications**
Slider–Crank	Rotary ↔ Reciprocating	Engine, Compressor
Cam and Follower	Rotary → Reciprocating/Oscillating	Engine valves
Rack and Pinion	Rotary ↔ Linear	Steering system
Screw- and -nut Mechanism	Rotary ↔ Linear	Screw jack, Vice
Crank and Lever	Rotary → Oscillating	Windshield wiper

Review Exercise

1. Define motion conversion.
2. Explain how the following mechanisms work:

- Slider–crank
- Cam and follower
- Rack and pinion
- Screw mechanism
- Crank and lever

3. State one practical application of each mechanism.
4. Differentiate between:

a. Rack and pinion and screw mechanism.

b. Slider–crank and cam-and-follower mechanism.

APPLICATION OF ROTARY MOTION IN BRAKES AND CLUTCHES

Friction

Friction is a force that opposes motion between two surfaces in contact.

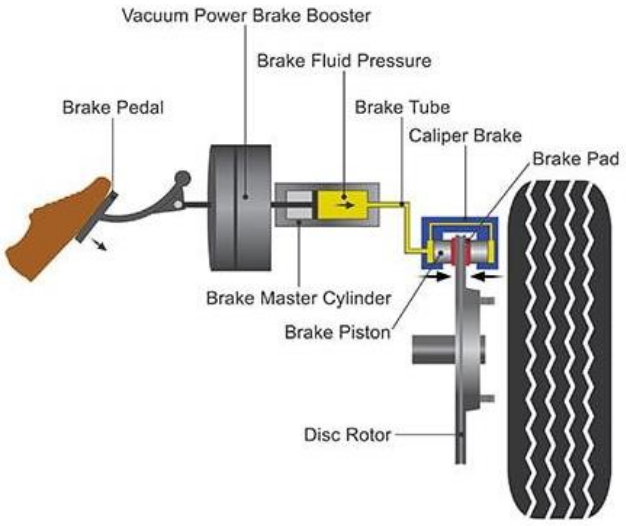
Effect of Friction

- ✓ Slows rotating parts.
- ✓ Stops rotary motion.
- ✓ Converts kinetic energy into heat.
- ✓ Improves safety.

Main Brake Components

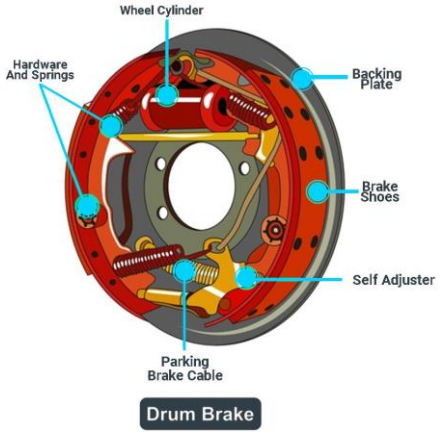
- Brake Pedal
- Master Cylinder
- Brake Fluid
- Brake Pipes
- Brake Caliper
- Brake Pads
- Brake Disc
- Brake Drum and Brake Shoes

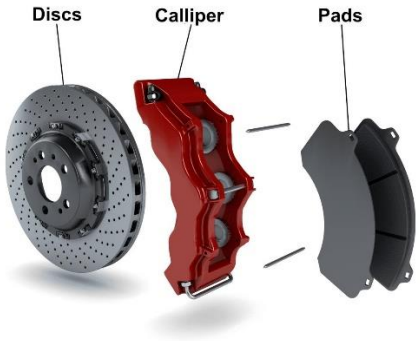
Hydraulic Disc Brake System



How Brakes Work

Driver presses brake pedal → Master cylinder builds pressure → Brake fluid transmits pressure → Brake pads/shoes press against disc/drum → Friction slows the wheel → Vehicle stops.





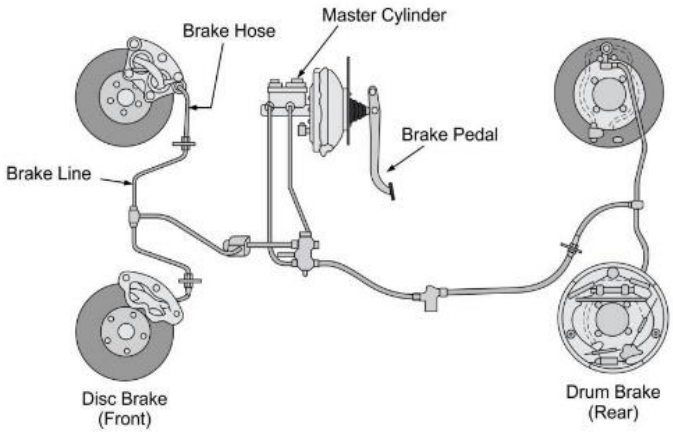
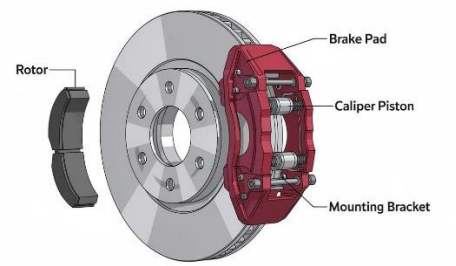


Figure 20 - Hydraulic brake system.

Clutch

A clutch mechanical device connects and disconnects the engine from the gearbox, allowing smooth starting, stopping and gear changing.

Unlike brakes, which stop rotary motion, the clutch *controls the transmission of rotary motion* from the engine to the wheels.



Written Exercise

1. Define friction.
2. Explain the effect of friction in controlling rotary motion.
3. Mention any four components of the vehicle brake transmission system.
4. Explain the function of each component listed.
5. Describe, with the aid of a flow chart, how a hydraulic brake system operates.

WEEK 3 -5

METAL -JOINING METHODS: SOLDERING AND BRAZING

BEHAVIOURAL OBJECTIVES (SMART)

At the end of the lesson, learners should be able to:

1. **Mention soldering and brazing as metal joining methods.**
2. **Correctly identify at least six soldering tools and materials.**
3. **State one use of each identified tool or material.**
4. **Arrange the steps involved in soldering operations in the correct sequence.**
5. **Mention at least six safety precautions to observe during soldering.**

DEFINITIONS

- Metal joining methods are techniques used to permanently or temporarily connect two or more metal parts so they function as a single unit.

  1. **Temporary method**: this is used for the *parts that can be separated later*. E.g. the use of mechanical fasteners like rivets, screws, bolts and nuts, etc

  2. **Permanent method**: this is used for *the metal parts that cannot be separated easily*. E.g. soldering, brazing, welding, etc.

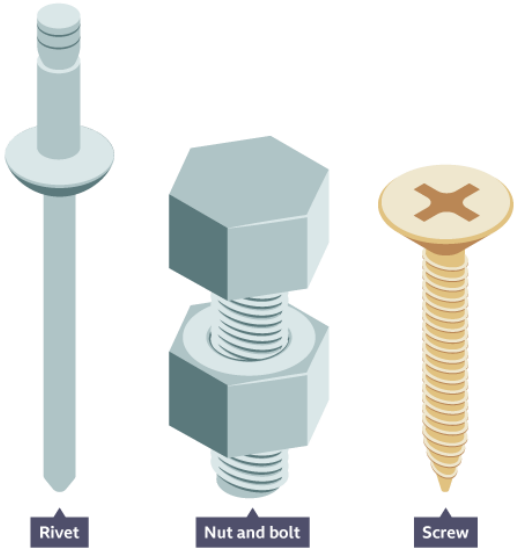


Fig. a. Riveting

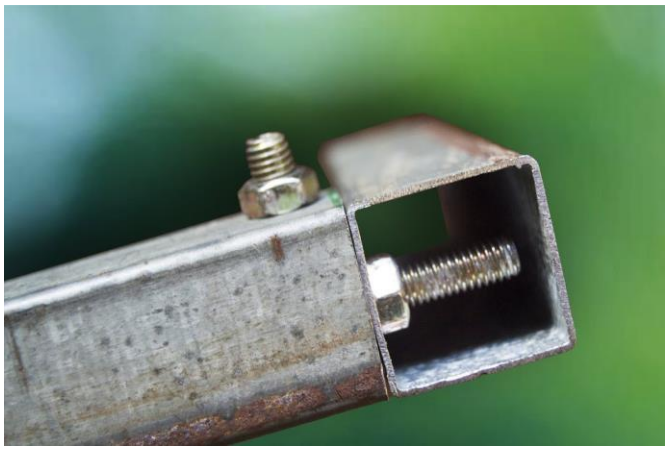


Fig. b. Bolting & Nutting

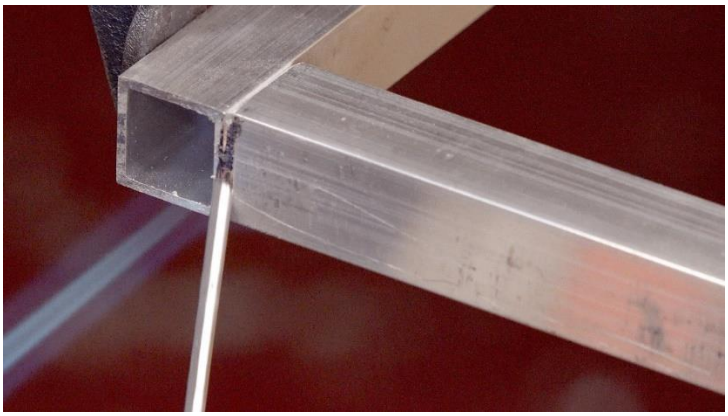


Fig. c. Soldering & Brazing

Fig. d. Screwing

SOLDERING

Definition:

Soldering is a method of joining metals using a filler metal (solder) that melts below 450°C, without melting the parent or base metals.

One condition for choosing a filler metal is that its melting point should be lower than that of the individual base (or adjoining) metals.

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Tools

- Soldering Iron
- Soldering Stand
- Side Cutter
- Long-nose Pliers
- Wire Stripper
- Tweezers

- Desoldering Pump

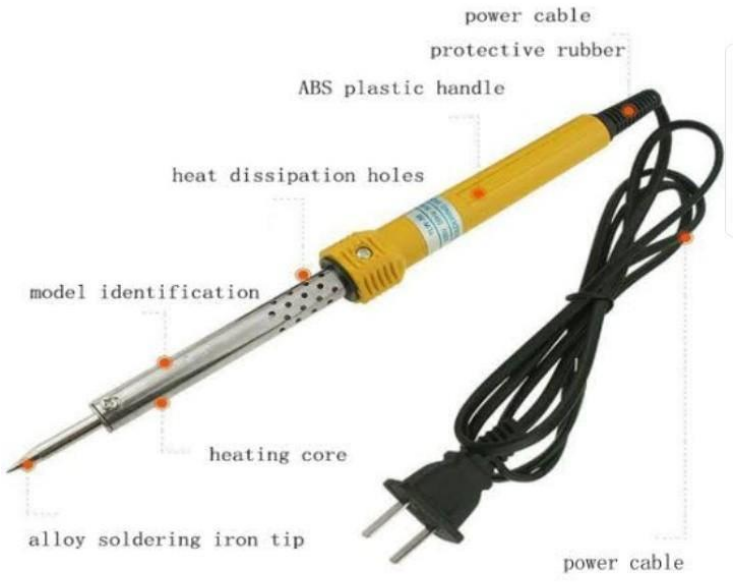
Materials

- Solder Wire
- Flux
- Copper Wire
- Printed Circuit Board (PCB)
- Electronic Components

Types of Soldering

i. **Soft Soldering**: Its features are:

   i. involves the use of soft solders, usually made of **tin** and **lead** alloys
   ii. has a melting range of 180°C to 370°C.
   iii. It is applied in lighter and softer metal like electrical and electronic work.
   Real World Applications: Electronic circuit boards, Electrical wire connections, Radios, Televisions, Computers, etc.



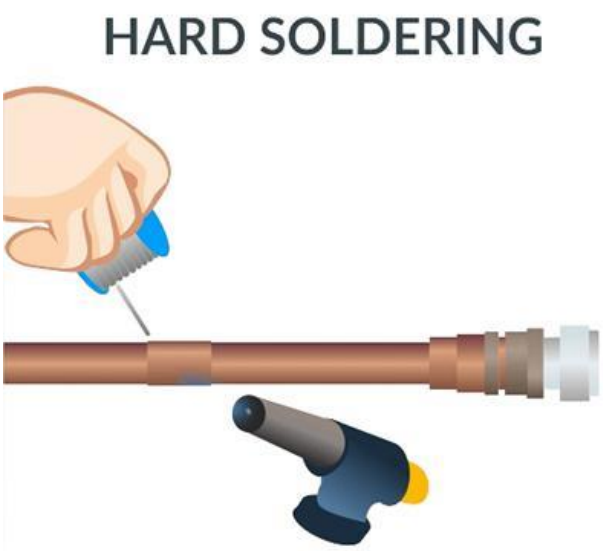
ii. **Hard Soldering**: its features are:

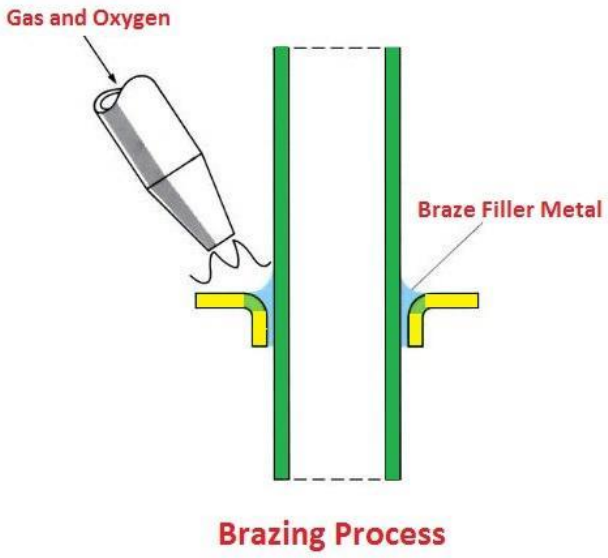
i. is done by using higher-melting point solder such as alloys of copper, zinc and silver.

ii. the temperature ranges from 730°C to 900°C.

iii. its types are silver soldering and brazing.

Real World Applications: Air-conditioning /Refrigeration pipe, Jewellery, Precision engineering components, Small metal fabrications, etc.

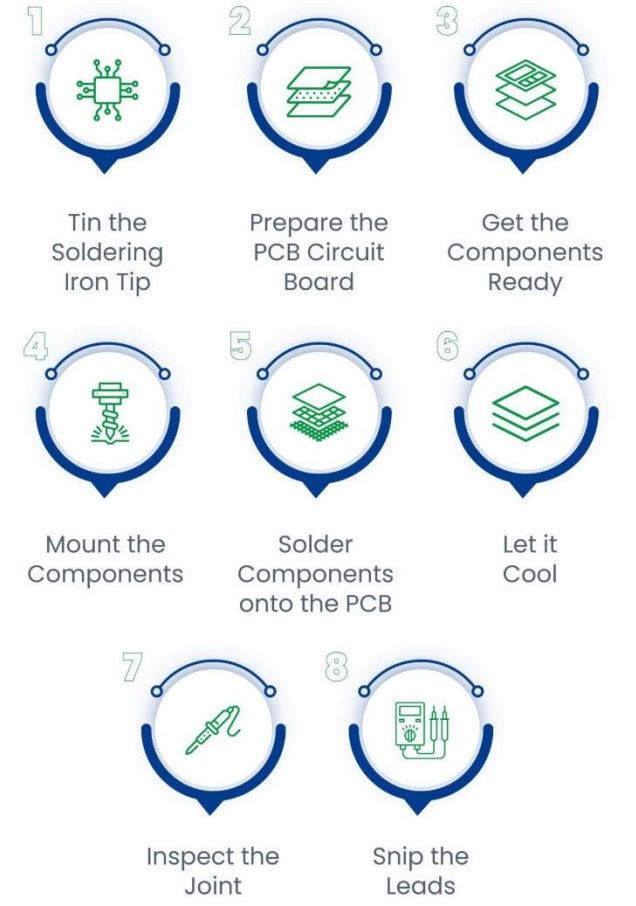


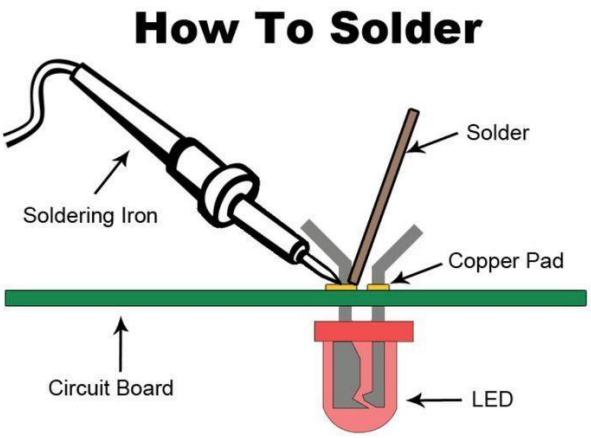


Basic Soldering Operations

a. Prepare work area.
b. Heat soldering iron.
c. Clean iron tip.
d. Clean joint surfaces.
e. Apply flux.
f. Heat the joint.

g. Apply solder.
h. Allow the joint to cool.
i. Inspect the joint.
j. Switch off equipment and clean up.





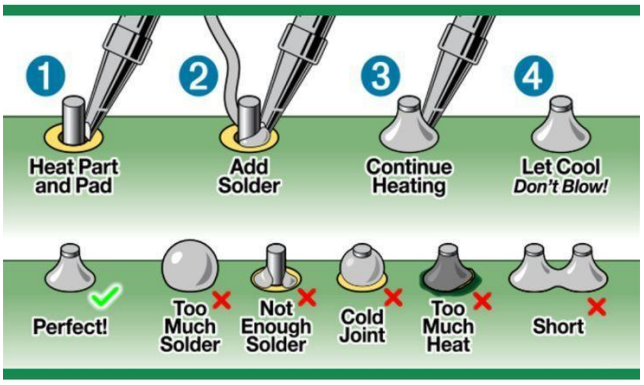


Fig.a An Electronic Technician

Advantages of Soldering.

i. Low operating temperature
ii. Low electric power is required.
iii. Neat joints
iv. Easy to perform
v. Suitable for electronics
vi. Moderate skill of the operator is required.

Disadvantages

i. Weak joints
ii. Not suitable for heavy-duty work
iii. Unsuitable for high-temperature applications
iv. Poor technique produces unreliable joints

Brazing

Brazing is a metal-joining process that uses a filler metal with a melting point above 450°C, producing stronger joints than soldering.

Types/Methods of Brazing

S/N.	TYPE OF BRAZING	HEAT SOURCE	KEY FEATURES
1.	**Torch Brazing**	**Gas torch: Gas flame containing Oxygen + Acetylene gas**	**Versatile, portable, allows localized heating of the joint area.**
2.	**Furnace Brazing**	**Sealed furnace chamber.**	**Provides uniform heat distribution for large or complex assemblies; ideal for high-volume production.**
3.	**Induction Brazing:**	**Induction coil, through Electromagnetic Induction. The resistance of the work piece generates the heat internally when placed between an induction coil of high frequency alternating current.**	**Rapid, precise, localized heating generated by a high frequency alternating current and a coil.**
4.	**Infrared Brazing**	**Infrared Lamps, through a form of non-contact heating where**	**Non-contacting heating, focused or precise heating, radiation energy**

		the energy absorbed by the material is converted into heat.	**transfer, ideal for joining dissimilar metals, etc.**

WEEK 6 & 7

CAREER PROSPECT AND CAREER PROSPECT IN TECHNOLOGY

- A career is a job, series of closely related jobs or other engagements, which is your primary or basic form of employment and from which you earn your living in adult life.
- Career may be life-long, and if not, at least take several of your productive years. When you choose a career, you may change jobs whenever you think it's necessary. Regardless, however, your job will still be in that basic career area except you choose to pursue an entirely different career. The longer you stay on a particular career, the better experienced you become in that field.

  Career Prospect

  This refers to the chance or probability of succeeding in the future in one's chosen profession. Usually this requires some periods of training and skill acquisitions.

- The opportunities for growth, advancement and success in a chosen profession.
- **Job Opportunities:** Employment positions available in a particular field or occupation.

Factors to Consider Before Choosing Career

i. The different fields in a particular career, i.e. job prospect
ii. Natural and developed abilities.
iii. Interest and drive
iv. The educational route/professional training required to study each field in the selected career.
v. Professional advice (from guidance & counselling unit)

Technology Related Careers

- There are so many careers which are related to technology. Any career which involves jobs requiring the practical application of scientific principles *in the conversion of materials*; *use of tools and machines* as well as *the productive engagement of the forces of nature* is related to technology in one way or the other.
- Occupations in the field of technology requires skills ranging from the lowest (artisans, craftsmen, master craftsmen, technicians, etc.) to the highest (technologist, engineers, etc.)
    - ✓ Career opportunities that exist in the fields of technology are:
    - ✓ Careers opportunities in Engineering fields of technology.
    - ✓ Career opportunities in Agriculture and agricultural related fields of technology.
    - ✓ Careers in applied Environmental sciences and their related areas.
    - ✓ Careers in Information Technology, etc.

Some of these include:

a. Engineering and construction
b. Medicine
c. Pharmacy
d. Agricultural Engineering/Technology
e. Business and Commerce
f. Information and Communication Technology
g. Software Engineering
h. Computer Programming, etc.

Note: The following careers are **not** related to technology:

- Law,
- Philosophy,
- Psychology,
- Language,

- Religion, and other aspects of humanities.

• Technology Careers and Their Responsibilities

S/N.	Career	Major Responsibilities
1.	Mechanical Engineer	Designs, manufactures and maintains machines.
2.	Civil Engineer	Designs and supervises roads, bridges and buildings.
3.	Electrical Engineer	Designs and maintains electrical systems.
4.	Electronics Engineer	Develops and repairs electronic equipment.
5.	Computer Engineer	Designs and maintains computer hardware and systems.
6.	Architect	Designs buildings and prepares building plans.
7.	Quantity Surveyor	Estimates construction costs and manages project finances.
8.	Building Technologist	Supervises building construction and ensures quality standards.
9.	Automobile Technician	Repairs and maintains motor vehicles.
10	Welder and Fabricator	Joins and fabricates metal components.
11	Plumber	Installs and repairs water supply and drainage systems.
12	Electrician	Installs and maintains electrical wiring and equipment.
13	Solar Energy Technician	Installs and maintains solar photovoltaic systems.
14	ICT Technician	Installs and maintains computers and communication networks.

Engineering as a Career

- To become a professional engineer, one will have to pass through the secondary school, (conventional or technical) to the university and then proceed to a professional institution, like COREN for training and get certified in order to practice engineering as a career.
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Educational Pathways

I. Technical Colleges
II. PolytechnicS
III. Colleges of Education (Technical)
IV. Universities
V. Vocational Training Centres
VI. Apprenticeship Programmes

Some Engineering & Technology Associations/Professional Bodies

- ❑ Nigerian Society of Engineers (NSE)
- ❑ National Association of Technological Engineers (NATE)
- ❑ Nigerian Institute of Engineering Technician (NIET)
- ❑ Nigerian Association of Engineering Craftsmen (NAEC)

- ❑ Association of Consulting Engineers of Nigeria (ACEN)
- ❑ Council for The Regulation of Engineering in Nigeria [COREN]
- ❑ Chartered Association of Building Engineers (CABE)
- ❑ Architects Registration Council of Nigeria (ARCON), etc.

WEEK 8 & 9

WOOD WORK & METAL WORK PROJECTS

A **project** is a practical activity in which learners plan, construct and finish a useful article using appropriate tools, materials and skills.
Project work helps learners apply classroom knowledge to practical situations.

- The stages involved in constructing or completing woodwork projects are:
- **Design Stage**: involves considerations like cost involved, types of joints, usage of the project, etc.
- **Working Drawing stage**: it is required to first get the simple drawings, i.e. the pictorial views (i.e. a 3-D drawing) of the article and the working drawing (i.e. the 2-D drawing) of the article. The drawing will show the shapes, parts and sections of the articles which will make construction and preparation of the cutting list easy.
  The cutting list is made up of the correct materials needed for the construction of the article to prevent wastages or inadequacies of the materials for the project at hand.
- **Fabrication Stage**: involves putting together both the working drawing and the specifications to produce the project.

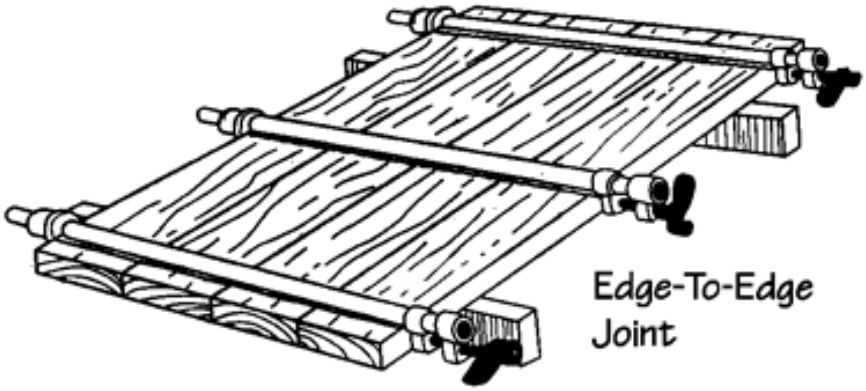
Woodwork Projects	**Metalwork Projects**
• Pencil box • Book stand • Tool tray • Footstool • Picture frame	• Dustpan • Garden trowel • Metal tray • Funnel • Coat hook

Wood Joints

A wood joint is the method of connecting two or more pieces of wood together to produce a stronger, more durable and useful structure.

- The use of simple joints is essential in assembling and fastening two or more pieces of wood together.
- **Note:**
  i. The wood joint to select for each kind of construction depends to some extent on the need for: strength, appearance, the difficulty of fabrication and the equipment available.
  ii. The art and skill of fastening and assembling two or more pieces of wood together by joints is called **"joinery".**
  iii. Wood joints are classified into three (3) main groups:

A. **Widening Joints:** These are used to produce wider boards by joining a number of narrow boards together, 'edge – to edge', to increase the overall length. They are used for table tops, desktops, cabinet sides, etc. E.g. tongue-and-groove, rebate, etc.



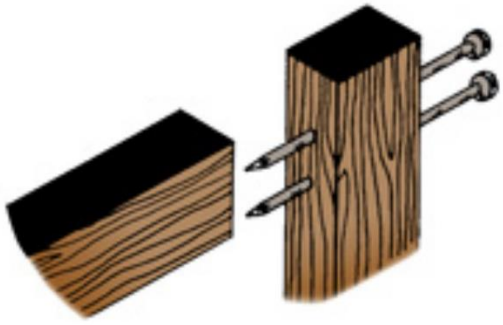
B. **Angle or Box Joints:** These joints are used to fix together faces of wood pieces to form right angles (90^o), i.e. in a box-like manner. E.g. butt, halving (or half lap), dovetail, comb (or finger), housing joints, etc.
Most joints are permanently fastened together with glue and sometimes screws or nail.

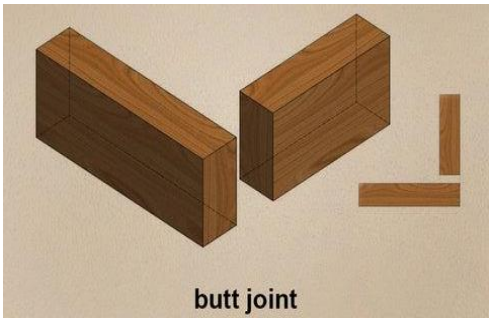
C. Framing Joints: These joints are used in decorative moulding and frame-like constructions where the wood pieces are joined 'end-to-edge', with their *edges at right angles*. They are used as picture frames, in panel doors, tables and chairs, etc. e.g. dowelled, mortise-and-tenon, corner halving, bridle, mitre joints, etc.

<u>Examples of Common Wood Joints</u>

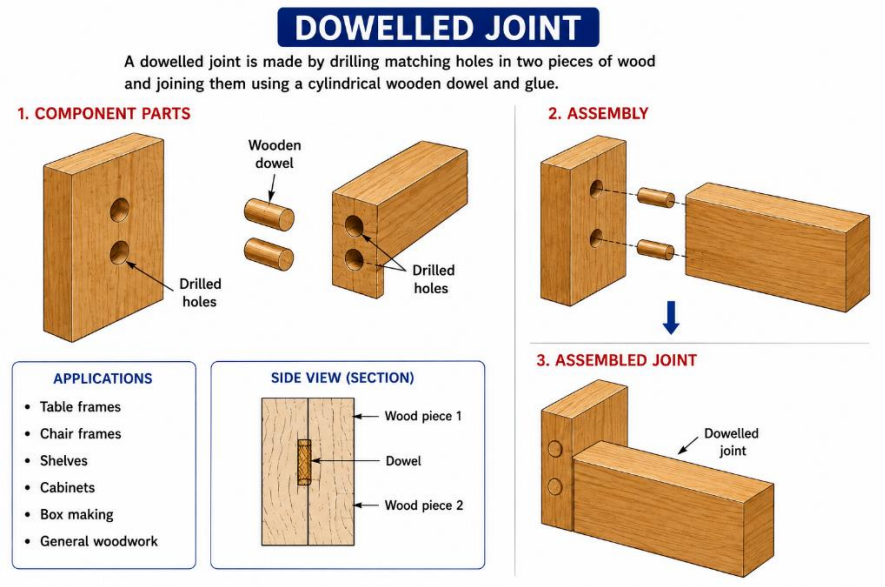
- **1. Butt Joint:** have the edges squared, put together and held together by means of glue with fasteners like nails, to strengthen the joints. Butt joint is a very weak joint. It is used in table tops, packing cases, etc.

  Note: 'plain' butt joints are the weakest joints which requires to be strengthened.



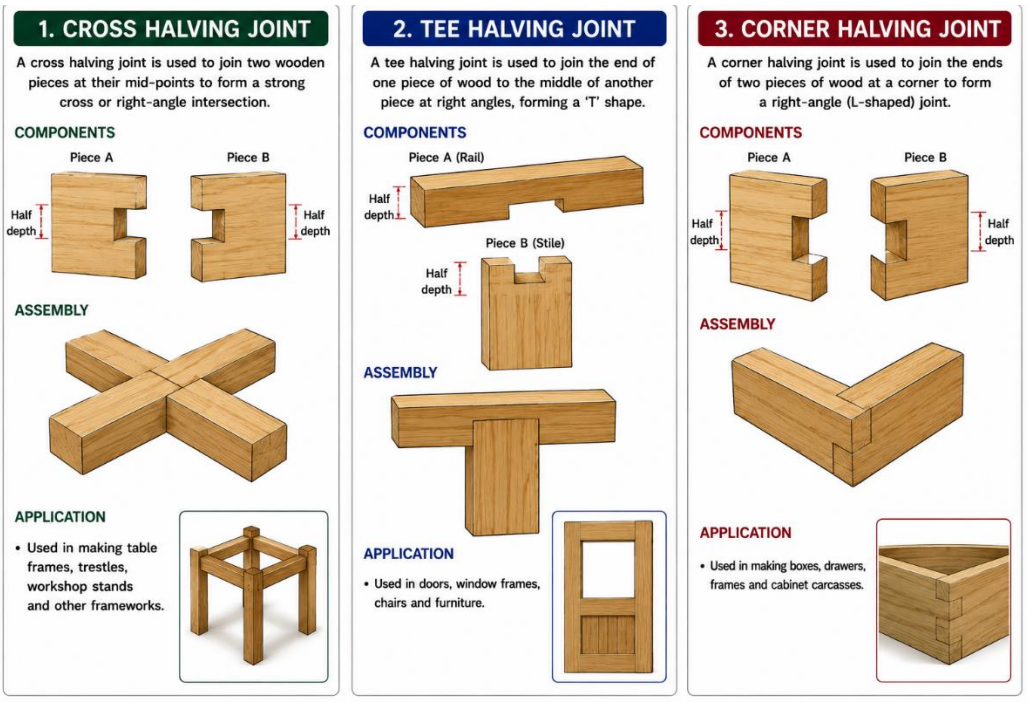


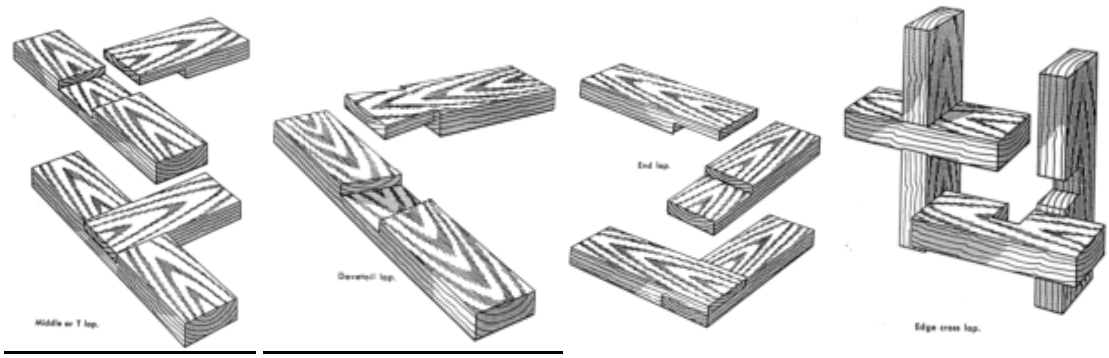
- 2. **Dowelled Joint**: is similar to the butt joint, but it is made stronger by addition of dowels(pegs), glued and inserted into holes in each edge and the board cramped up. It is used for table tops, where a stronger joint than plain butt is required.



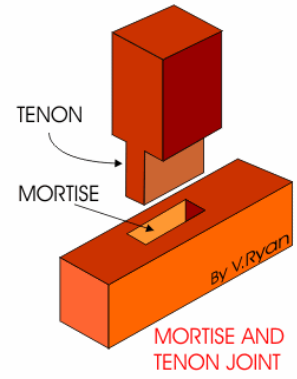
■ 3. **Halving or half-lap Joint**: is a joint where two pieces of wood are joined together to meet or cross each other. They are halved in their width and thickness, so that the assembled pieces of wood surfaces flush (i.e fit properly) after being assembled. E.g. of halving joints are: corner halving, cross-halving and tee-halving joints.

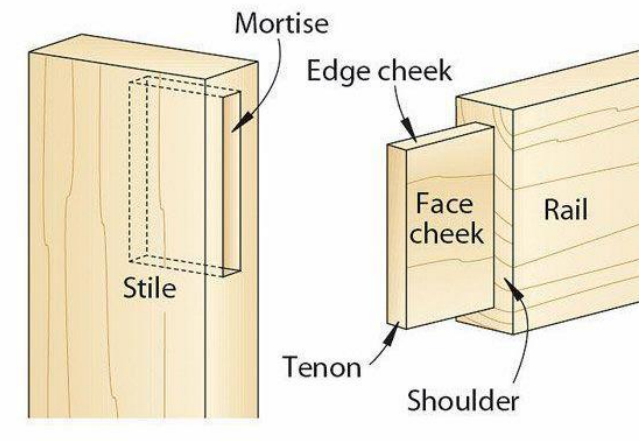
It is used for legs of furniture, in doors, furniture frames and braces. This is joint is strong.



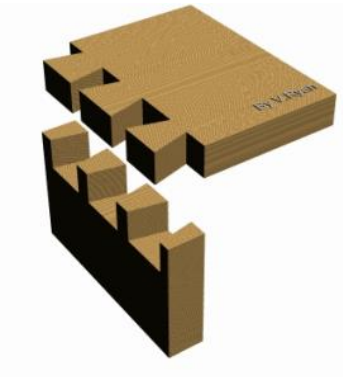


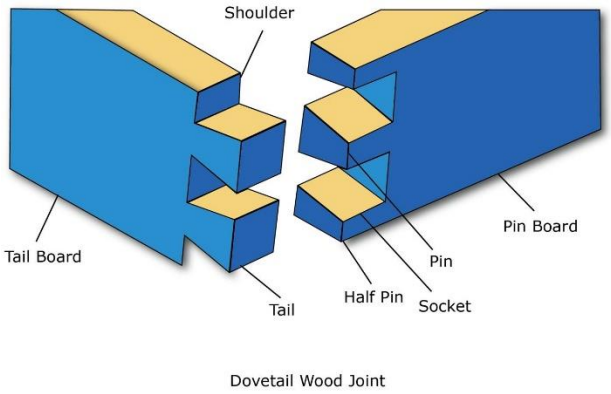
- **4. Mortise and Tenon Joint**: is one of the common joints used for joining the rails and legs of tables, chairs, etc. It consists of a piece of wood with a rectangular hole (called mortise) in it, while the other piece of wood has a protruding portion (called tenon) at its end. Both are designed to fit each other. They are used for rails and legs of tables





- 5. **Dovetail Joint**: is a very strong joint used at corners, edges and other points where wood pieces join at an angle. It consists of a number of projections called pins on one side, which are cut to fit pin holes on each side of the dovetails. This is used in box construction such as drawers, jewellery boxes, cabinets and other pieces of furniture where strength is required.

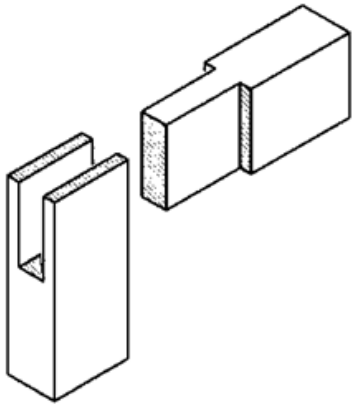


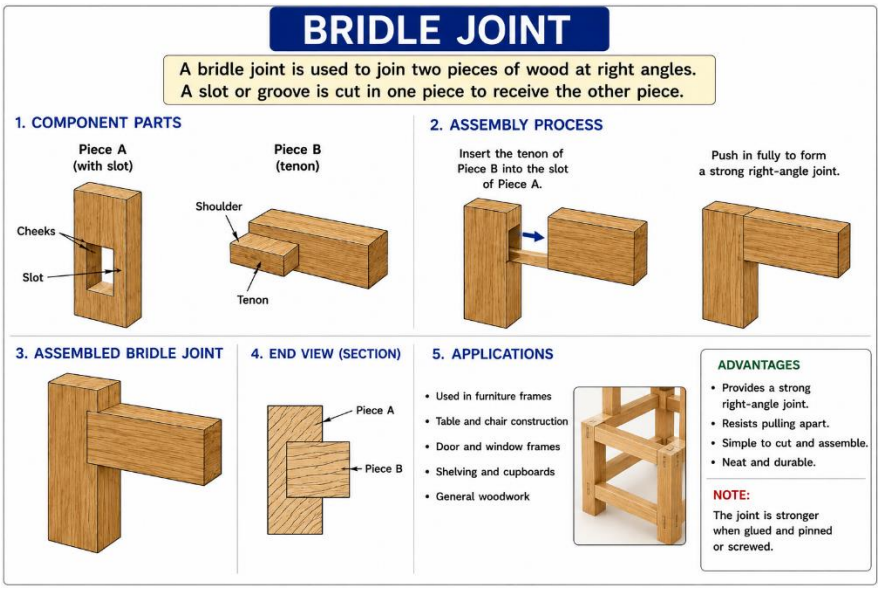


Dovetail Wood Joint

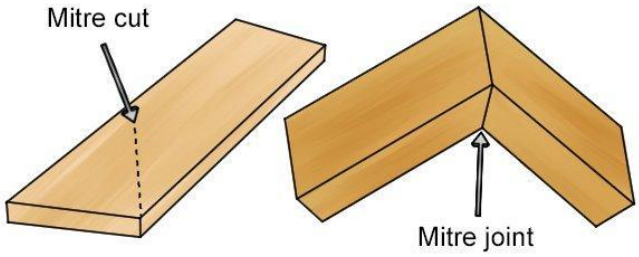
- **6. Bridle Joint:** can be used instead of mortise and tenon joint. One wooden piece *has some materials removed from its inner section* while the other *has some materials removed from its outer sections*.

Both are to be fixed together. It is used for making picture frames, padded chair seats, mirror frames, etc.

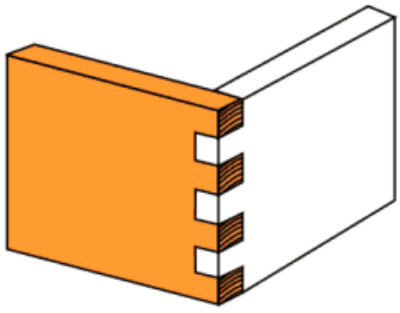




- **7. Mitre Joint:** is a joint where the joining pieces are cut at a 45-degree angle and joined to form a right angle; butted and held together by nails, screws or glue. It is used in picture frames, architraves, etc.

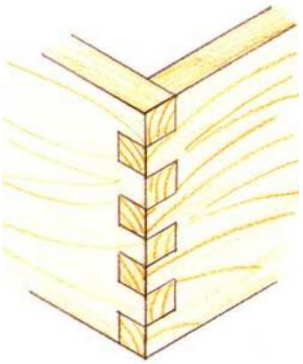


- 8. **Finger Joint**: it is ideal for box construction and is suitable for use with natural wood such as pine and mahogany or even manmade boards such as plywood and MDF. The joint is strong especially when used with a quality glue.

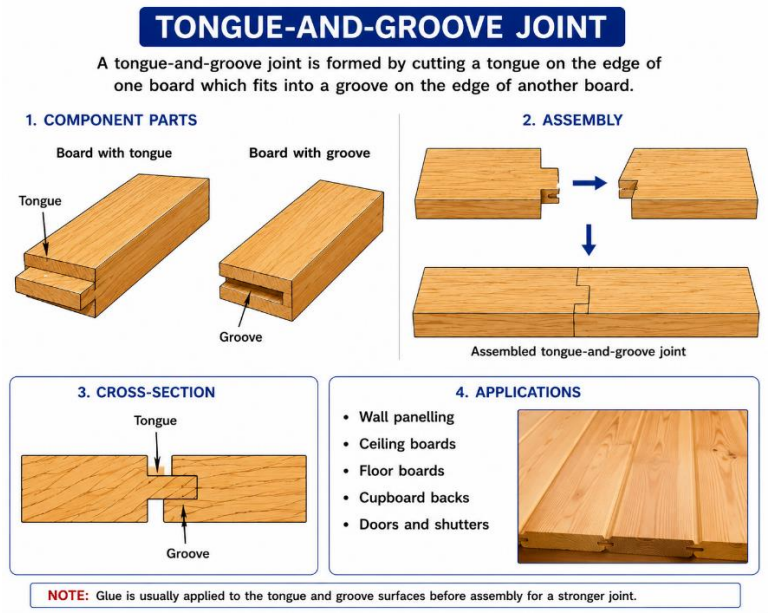


By V.Ryan

FINGER JOINT
EXPLODED VIEW



- 9. **Tongue-and-groove joint**: is when one edge is grooved and the other has a tongue . These two edges are put together to create the joint. The joint is made stronger by glue. The joints are used for table tops, wood flooring, etc.



In summary,

Common Types of Wood Joints

Wood Joint	Description	Common Uses
Butt Joint	The simplest joint where the end of one piece of wood is fixed against another. It is usually reinforced with nails, screws or glue.	Boxes, temporary structures, simple frames
Lap Joint (Half-lap Joint)	Two pieces of wood overlap each other after part of each piece has been removed.	Tables, stools, frames and benches
Mortise and Tenon Joint	A tenon (projection) on one-piece fits into a mortise (hole) in another piece. It is one of the strongest wood joints.	Doors, chairs, tables, cabinets and furniture
Dovetail Joint	Interlocking wedge-shaped projections provide a very strong joint that resists pulling apart.	Drawers, cabinets, jewellery boxes and quality furniture

Mitre (Miter) Joint	Two pieces are cut at 45° and joined to form a right angle.	Picture frames, decorative mouldings and window frames
Tongue and Groove Joint	One board has a tongue that fits into the groove of another board.	Wooden flooring, ceilings, wall panels and partitions
Dowel Joint	Wooden dowels (pins) are inserted into matching holes in two pieces of wood to strengthen the joint.	Furniture, shelves, cabinets and wooden frames
Housing (Dado) Joint	One board fits into a groove cut across another board.	Bookshelves, cabinets and cupboards

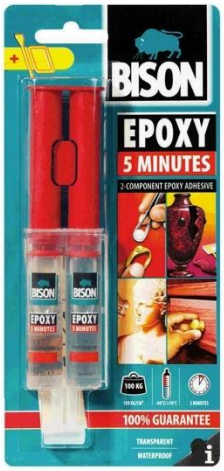
Non-wood Materials for Woodwork

Non-Wood Materials: these are materials other than wood that are used in woodwork to join, smooth, protect or improve the appearance and functionality of wooden products. They include:

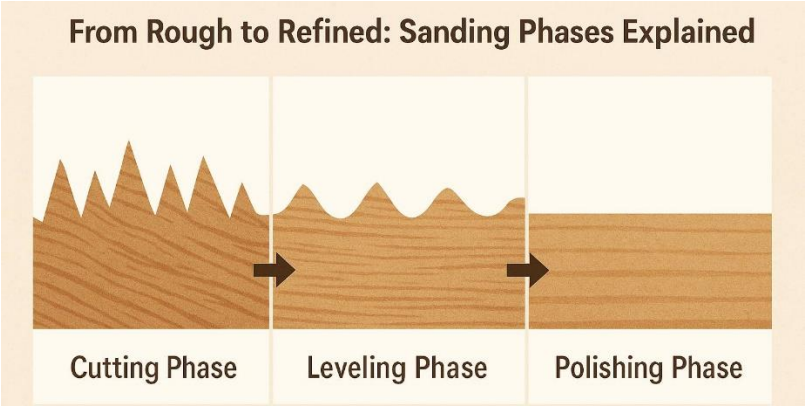
- 1. **Adhesive**: is any substance that can hold or bind two pieces of wood together. It is necessary for the wood surfaces to be clean and dry before applying adhesives. There are three (3) classes of adhesives: natural (protein), synthetic resin and contact adhesives.

Examples and Uses

Adhesive	Uses
PVA (Wood Glue)	Joining wooden parts in furniture making
Contact Adhesive	Fixing laminates, veneers and plastic edges
Epoxy Adhesive	Joining wood with metal, plastic or glass; repairing cracks
Animal (Hide) Glue	Traditional furniture restoration and musical instruments



- 2. **Abrasive**: is any material, paper or cloth coated with hard minerals that wear away the surfaces of other materials by rubbing.
- The use of coated abrasives to smoothen wood is called ‘sanding’. Sanding should be done after ‘planing’ the surfaces of wood, so that the remaining particles of abrasive broken off on wood would not damage the blade of the Jack plane.



- **Examples and Uses**

Abrasive	Uses
Coarse Sandpaper	Removes rough surfaces quickly
Medium Sandpaper	Smoothens timber after shaping
Fine Sandpaper	Produces a smooth finish before painting or polishing
Emery Cloth	Cleans and smoothens metal fittings attached to wood

- 3. **Mechanical Fasteners**: these include the following:

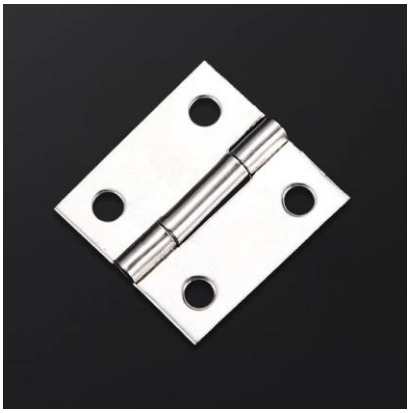
i. **Nails**: these come in different types, shapes and sizes. The different nails in common use are: round wire, oval wire, lost head, gothic head, panel pins, and steel needle points.

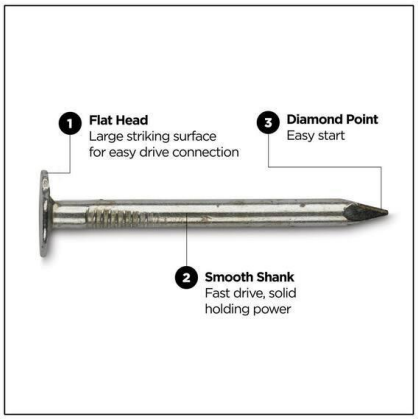
ii. **Screws**: are used to pull parts together. They are used in preference to nails, when more holding strength is required. Screws can be grouped according to their area of usage – wood screws, machine screws and bolt screws.

iii. **Fittings**: include hinges (e.g. butt, flat & tee), locks, handles, brackets, knobs, etc. They are mostly made of brass and bronze, although the use of plastic and other materials is becoming increasingly popular.

- Note:

  - ✓ The butt hinge is used for doors and windows, while tee hinge is mainly for external doors on sheds or garages.
  - ✓ The flat hinge is recessed into the wood mainly for table tops.
  - ✓ Wood screws types include counter sunk, round head and raised head.





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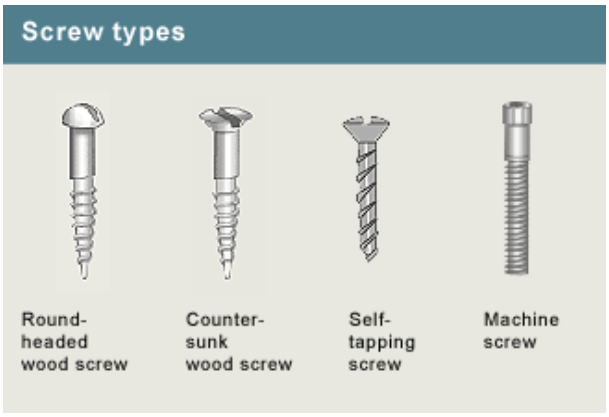

Review Questions

1. Define non-wood materials.
2. Differentiate between adhesives, abrasives and mechanical fasteners.
3. State four examples and uses of each of the following:
    a. Adhesives
    b. Abrasives
    c. Mechanical Fasteners
4. Explain six safety precautions observed during the use of non-wood materials in woodwork.

END