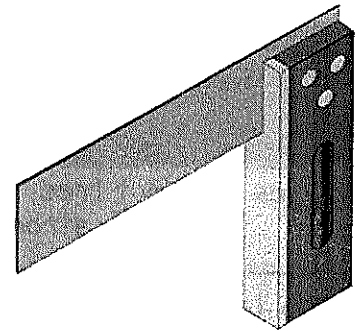
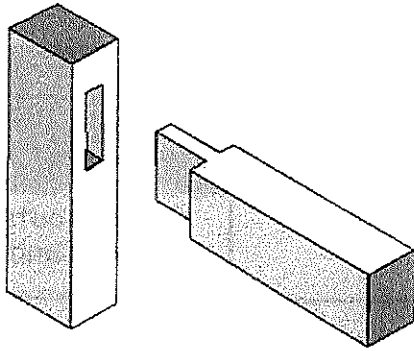


# S3

## Practical Woodworking

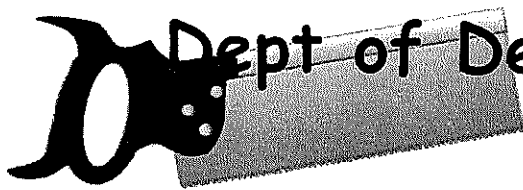
### Wood Theory



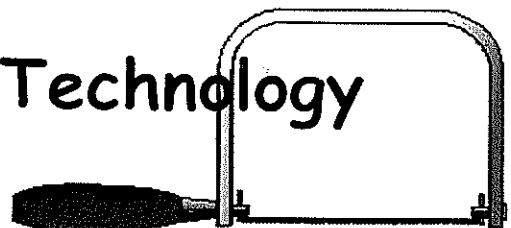
Name: \_\_\_\_\_

Class: \_\_\_\_\_

Teacher: \_\_\_\_\_



Dept of Design & Technology



## Types of Woods

**Softwood** - Comes from trees that are evergreen. These trees are fast growing but have many knots. Softwoods are generally cheaper compared to hardwoods.

**Examples of softwoods** - Pine, Spruce, Douglas Fir, Cedar

**Hardwood** - Comes from trees that lose their leaves in winter. These trees

Name	Advantages	Disadvantages	Uses
Pine	Fairly strong, easy to work and easy to work with nails and screws.	Soft, sometimes stains and has knots.	Suitable for making furniture, interior and exterior joinery.
Spruce	Fairly strong, easy to work	Has hard knots and lots of resin	General inside work
Cedar	Very durable, easy to work, knot free and attractive.	More expensive than pine and spruce and very strong.	Exterior joinery, cladding for buildings and sheds.
Douglas Fir	Knot free, straight grain, fairly strong and durable	Splits easily	General outside work, ladders and plywood.

take longer to grow and have fewer knots. Hardwood is more expensive than softwood.

**Examples of Hardwoods** - Mahogany, Teak, Oak, Beech

Name	Advantages	Disadvantages	Uses
Mahogany	Hard, strong, durable and attractive finish.	Heavy, very expensive	High quality furniture making plywood
Teak	Hard, strong, very durable, attractive straight grain and works fairly easily	Difficult to glue because of oil in the wood, very expensive	High class furniture, laboratory benches, ships decking
Oak	Very strong and durable, works well with sharp tools, finishes well and is attractive.	Heavy, expensive, contains acid which corrodes steel screws	Boat building, high class furniture and floors
Beech	Hard, tough, very strong, polishes well and is hard wearing.	Not suitable for outdoors, heavy and difficult to work	Most used hardwood in the UK. Furniture, floors, wooden tool and toys

## Types of Woods (continued)

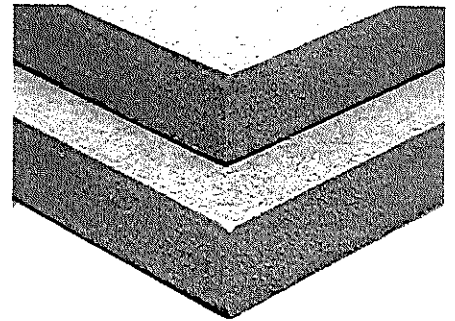
### **Man-Made Boards**

These are **man-made** not cut from a specific type of tree. Wide boards of softwood or hardwood are expensive and can warp but man-made boards are available in large boards that do not warp. There is a number of different man-made boards the most common ones are shown below.

### **MDF (medium density fibre-board)**

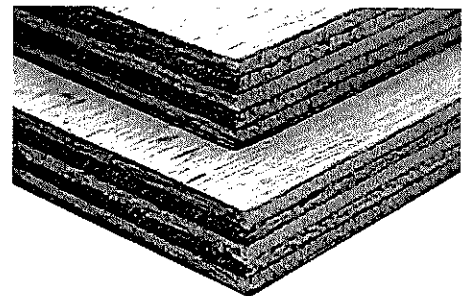
MDF is cheap, strong and is easy to cut and shape. It comes in a variety of thicknesses. MDF is used for furniture making and interior joinery and if time is spent, a good finish can be achieved.

Sometimes a plastic laminate is applied to the MDF (like the desks in the classroom) this gives a clean, easy to maintain surface.



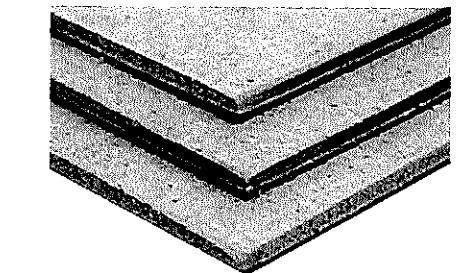
### **Plywood**

Plywood is available in a variety of thicknesses. It is very strong as it is made from a number of plies of wood glued together. When the plies are glued they are placed in sequence with the grain running in opposite directions.



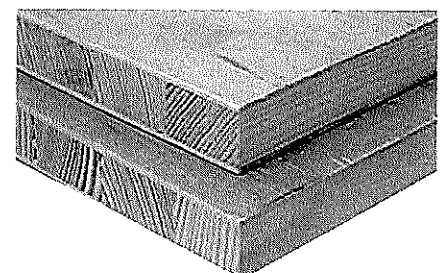
### **Hardboard**

Hardboard is similar to MDF but is usually a thickness of approx. 3mm. It commonly has one smooth side and one textured side and is usually used for the bases of drawers and the backs of cupboards and wardrobes.



### **Blockboard**

Blockboard is made by sandwiching strips of softwood between two plies making a strong heavy duty board.



## Exercise 1

1. Name the three different groups of woods.

---

2. Why are man-made boards used for desk tops?

---

3. What is a common use for hardboard?

---

4. Pine is the most used softwood in the UK. Suggest a reason why this is the case?

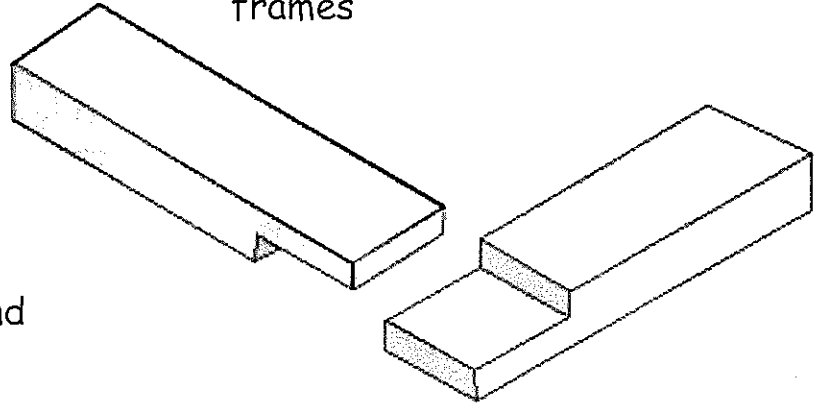
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5. Suggest a hardwood that is dark in colour that could be used to produce high class furniture.

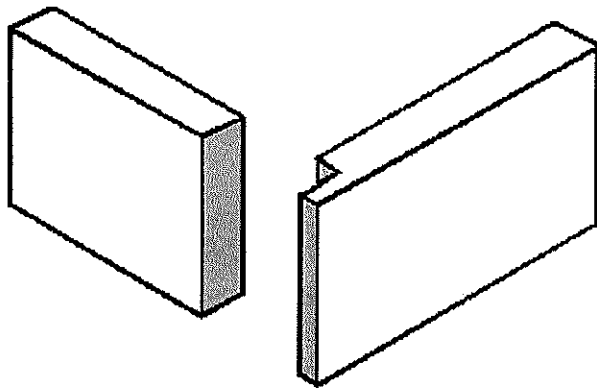
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# Wood Joints

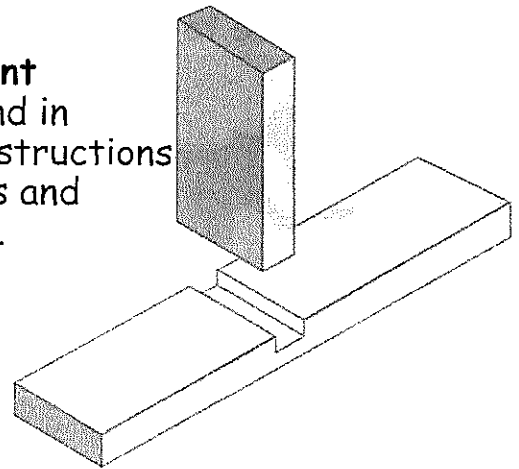
**Corner Halving Joint**  
Usually used in frame construction e.g mirror, picture frames



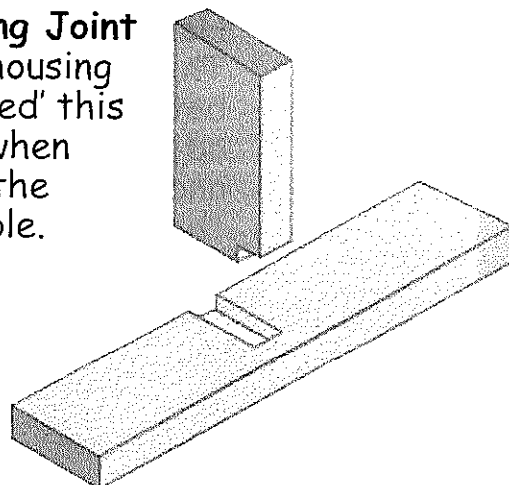
**Lap (Rebate) Joint**  
Usually found in carcass constructions e.g. bookcases and shelving units.



**Housing Joint**  
Usually found in carcass constructions e.g. bookcases and shelving units.



**Stopped Housing Joint**  
Similar to the housing joint but 'stopped' this would be used when you don't want the joint to be visible.

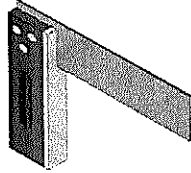


# Cutting Wood Joints

All of the joints shown on the previous page would be cut in a similar way using the tools below.

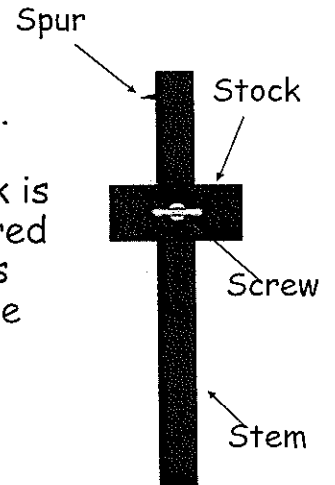
## Try-Square

This is used to draw lines across the face of the material at right angles to the edge.



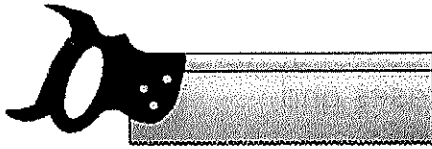
## Marking Gauge

This is used to mark the depth of the joint. The distance between the spur and the stock is adjusted to the required depth and the gauge is dragged along the edge of the material at the required position.



## Tenon Saw

A tenon saw is used to cut most wood joints. It is used to saw along a marked line. It is always used on the waste side of the line and the cut is made to the marked depth.



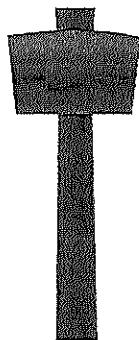
## Bevel-Edged Chisel

The remaining waste material would then be removed carefully using a chisel. The waste is removed a little at a time from both sides to ensure the material doesn't split.



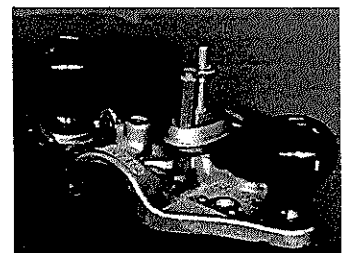
## Mallet

This is used to make the chiselling process easier. It is used to tap the end of the chisel when removing the waste material.



## Hand Router

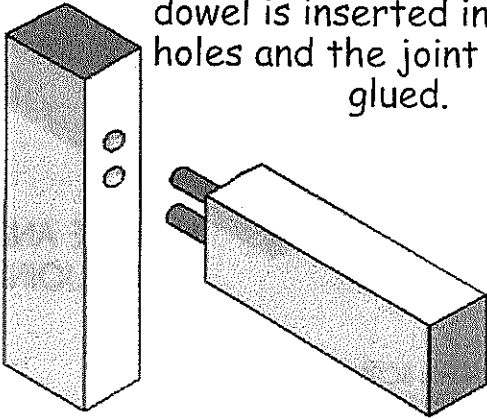
This is used to level off the bottom of the joint. The cutter is adjusted to the required depth and the router is gently pushed through the joint. This ensures the joint is completely level.



# Wood Joints

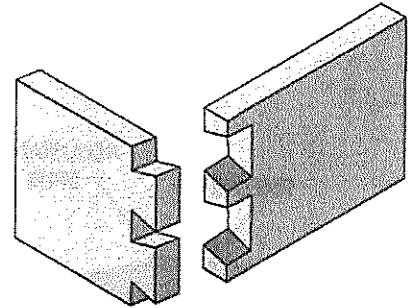
## Dowel Joint

Used in frame construction, matching holes are drilled on both pieces of material the dowel is inserted into the holes and the joint is glued.



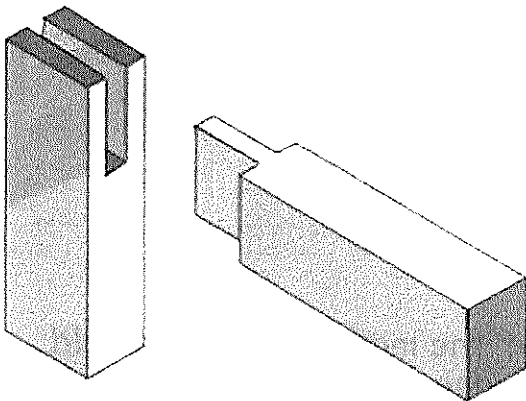
## Dovetail Joint

Usually found on traditional furniture in the construction of drawers. This is a strong joint and is also aesthetically pleasing.



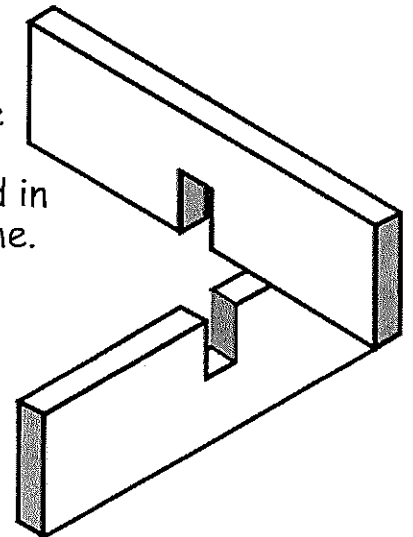
## Bridal Joint

Used in the construction of table tops and chair legs.



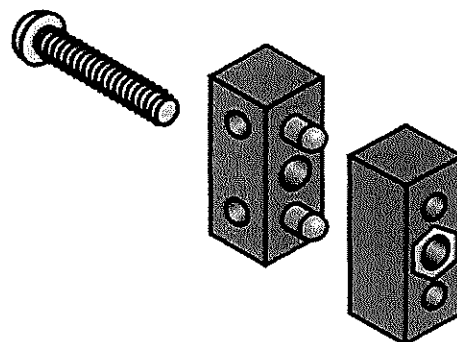
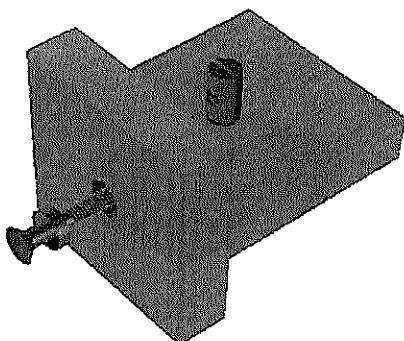
## Cross Halving

Used in frame construction, possibly found in a window frame.



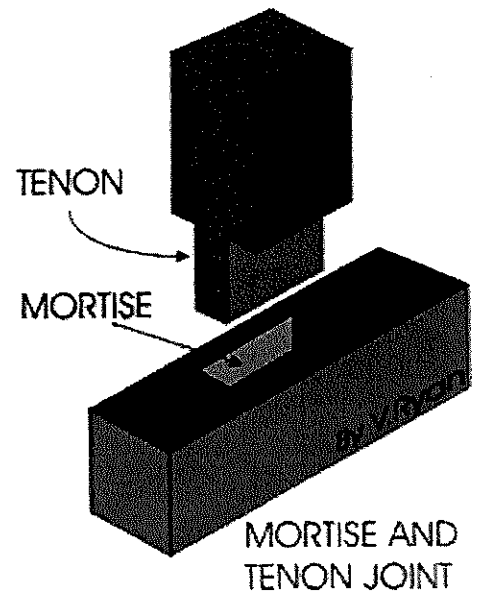
## Knock-Down Fittings

These are most commonly found in flat-pack furniture, the holes are pre drilled for the fittings which are inserted into position allowing the item to be put together very easily.

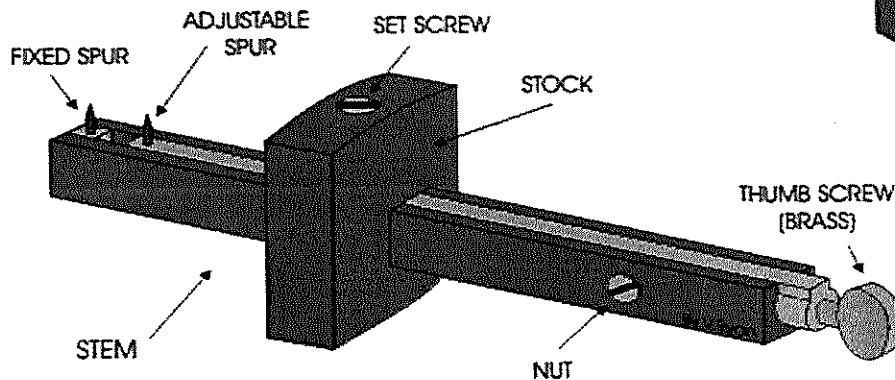


# Mortise and Tenon Joint

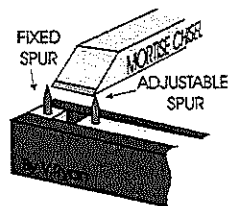
Mortise and Tenon joints are widely used in the construction of furniture, door frames, window frames etc. We would commonly see them used for coffee tables and chair legs.



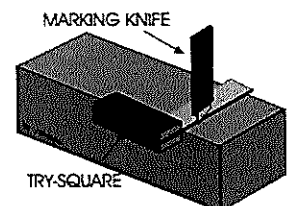
## The Mortise Gauge



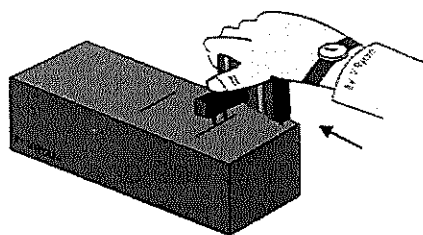
The adjustable spur is set to the size of the of the mortise chisel.



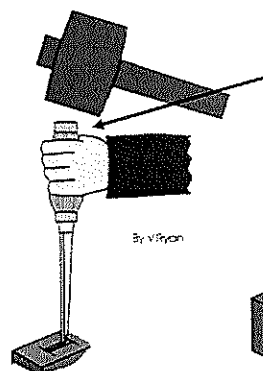
The length of the mortise joint is marked on the material.



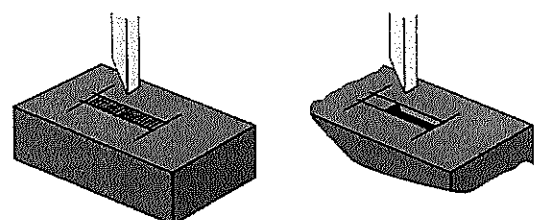
The stock of the mortise gauge is held against the edge of the material and moved along to mark the joint.



The mortise chisel and mallet are then used to break the surface of the waste wood. The waste is then slowly removed (bit by bit) by applying more pressure to the chisel. This is done until the joint is fully cut.



The mortise chisel has a ferrule on the end to absorb the pressure from the mallet.





## Exercise 2

1. What is a marking gauge used for?

\_\_\_\_\_

2. Name the four parts of the marking gauge and describe how it would be set to the correct depth.

Parts \_\_\_\_\_

Description \_\_\_\_\_

\_\_\_\_\_

3. Suggest a suitable joint that could be used to make a picture frame.

\_\_\_\_\_

4. Which tool is used to level off the bottom of a wood joint?

\_\_\_\_\_

5. Where are knock down fittings likely to be used?

\_\_\_\_\_

6. Why does a mortise chisel have a ferrule on the end of it?

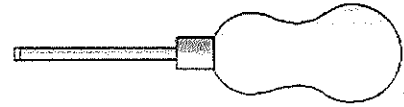
\_\_\_\_\_

7. Draw a mortise and tenon joint labelling main parts.

# Other Methods of Joining

## Screws

Screws can be used to join wood together. A **bradawl** would be used to make a pilot hole for the screw to locate into.



### Round Head Screw

The head of the screw would be raised against the surface of the material.

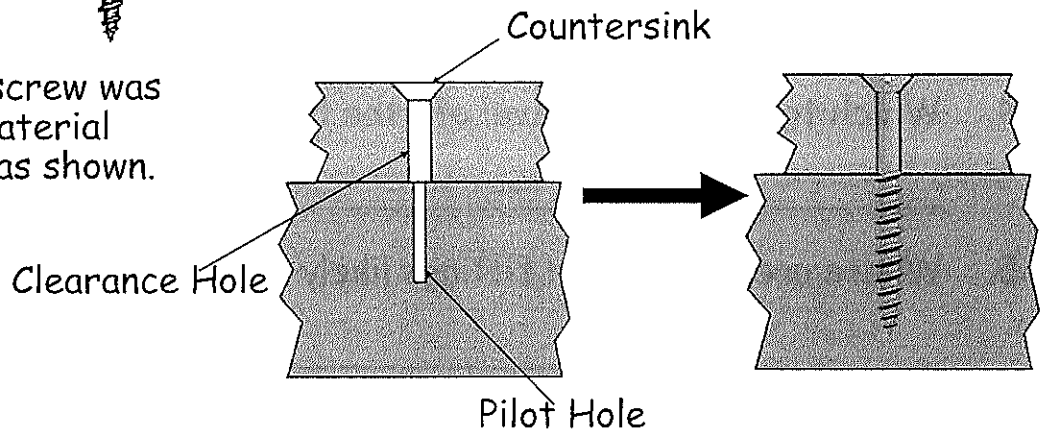


### Countersink Screw

This type of screw is used when you want the head of the screw to be **flush (level)** with the surface of the material.



If a countersink screw was to be used, the material may be prepared as shown.



## Nails / Pins

Nails and pins can be used for a variety of jobs. Either as the main joining method or as a method of clamping while glue dries. We often use this method of joining to attach a back to a cabinet.

### Wire Nail



### Panel Pin



### Oval Brad



### Claw Hammer

Used to drive in and remove pins and nails.

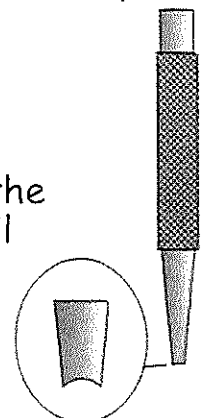


### Cross Pein Hammer

Used to drive in pins and nails.

### Nail Punch

Used to drive the head of the nail below the surface of the wood.



### Exercise 3

1. What does flush mean?

---

2. Which tool could be used to prepare a small pilot hole for a screw?

---

3. If a countersink screw were to be used, describe how the material should be prepared. (use a sketch to help)

Description \_\_\_\_\_

Sketch

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---

4. Which tool would be used to drive in pins and nails?

---

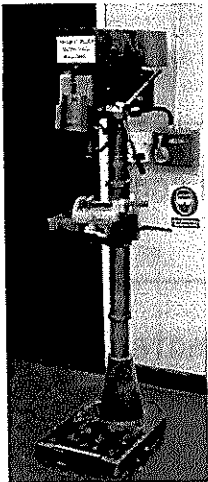
5. A claw hammer is useful for what?

---

6. Why would you use a nail punch?

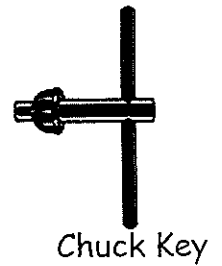
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# Drilling Wood



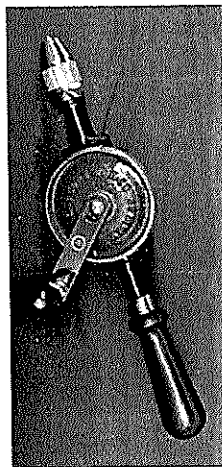
## **Pillar Drill**

This workshop machine can be used to drill wood, metal and plastic. The appropriate speed setting is selected and the required drill bit is held in the chuck. The chuck is tightened using the chuck key. The height of the drill table can be adjusted and the depth stop can be set to drill to a required depth.



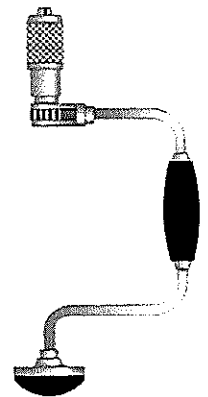
## **Hand Drill**

Hand held tool for drilling. The bit (usually twist bit) is held in the chuck.



## **Hand Brace**

The hand brace is designed for drilling larger diameter holes where there is limited access. It is designed to hold bits with a square section shank e.g. auger bits



## Drill Bits

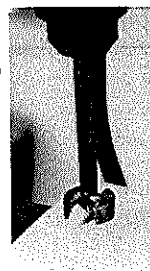
### **Twist Bit**

Common drill bit used for drilling wood, plastic & metal up to a diameter of approx 12mm.



### **Forstener Bit**

Used for drilling flat bottomed holes.



### **Flat Bit**

Used for drilling large diameter holes.



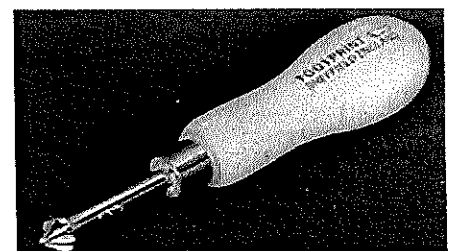
### **Auger Bit**

Used for drilling large diameter holes.



### **Rose/Countersink**

This hand tool is used to create a countersink at a drilled hole to take the head of a countersink screw.



## Exercise 4

1. When using the pillar drill where is the drill bit held?

---

2. How is the drill bit secured?

---

3. A hand brace can be used in restricted spaces but what type of drill bits does it hold?

---

4. What type of hole is made using a forstener bit?

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5. Name two drill bits used for drilling large diameter holes.

---

6. Explain when a countersink / rose tool would be used.

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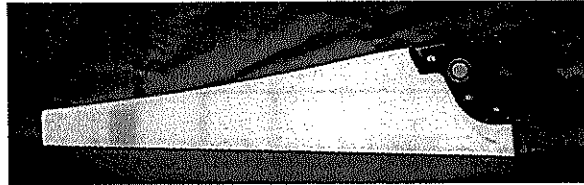
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## Cutting / Shaping

There are many tools and machines that can be used to cut and shape wood. The most common ones are shown below.

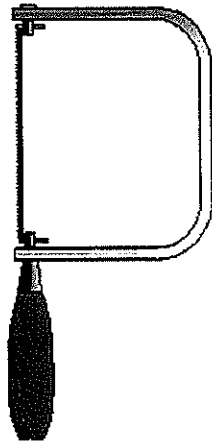
### Panel Saw

Can be used to cut wide boards and panels



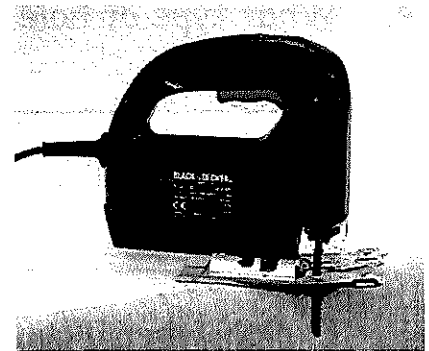
### Coping Saw

Used to cut out details on wood and plastic. Is especially good for curves.



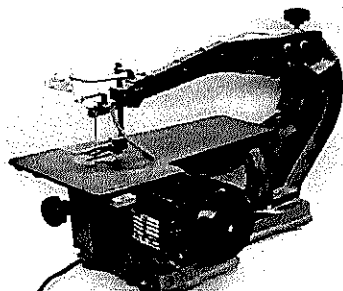
### Jigsaw

Machine tool used for same purposes as coping saw.



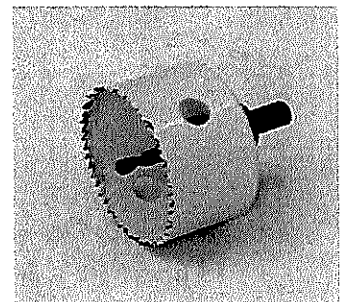
### Scroll Saw

Used to cut intricate detail on thin wood and plastic.



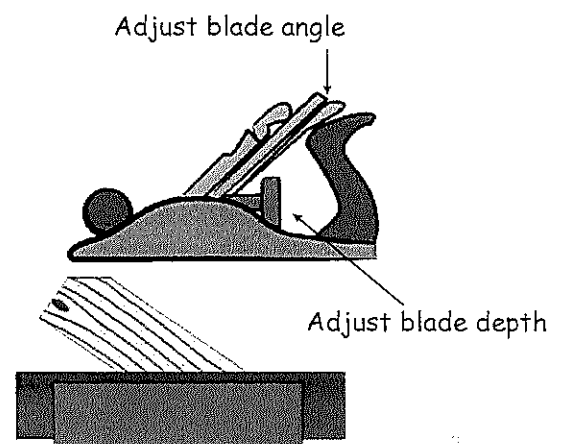
### Hole Saw

The hole saw is used on the pillar drill. It is used when large diameter holes are required.



### Jack Plane

Planes can only be used to cut along the grain of the wood. The plane would be used to reduce the thickness / breadth of the material, add a chamfer to an edge, remove corners for wood turning etc. The depth of cut and angle of blade can be adjusted as shown.



## Exercise 5

1. Which hand tool would be best suited to cutting curves?

---

2. Which machine tool could be used for the same purpose?

---

3. List 3 things that a jack plane could be used for.

---

---

---

4. Describe how the plane is set and used.

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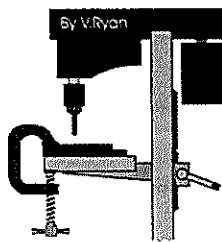
5. A hole saw is used to cut large diameter holes. Which machine is it used in?

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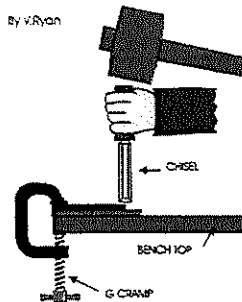
# Cramping / Clamping

## G Cramps

G Cramps are an essential tool in the workshop and they come in a range of sizes and are generally used for clamping work securely to a surface/workbench top. They can also be used to hold parts together whilst glue is drying.



G CRAMP USED TO SECURE MATERIAL TO THE TABLE BEFORE DRILLING

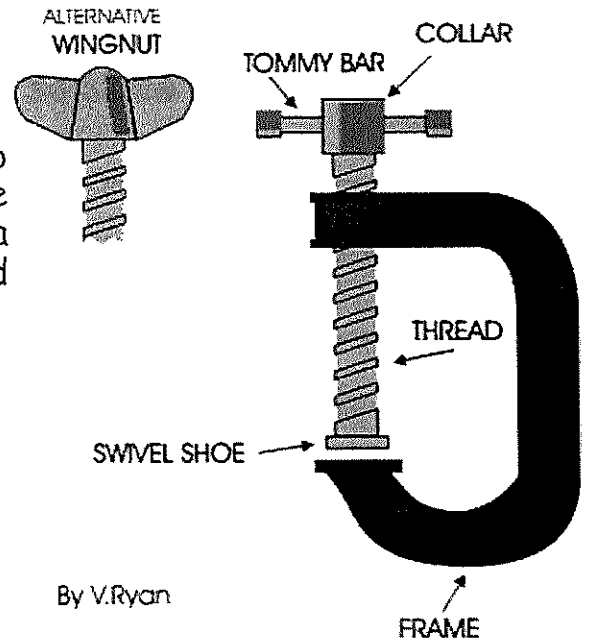


By V.Ryan

CHISEL

BENCH TOP

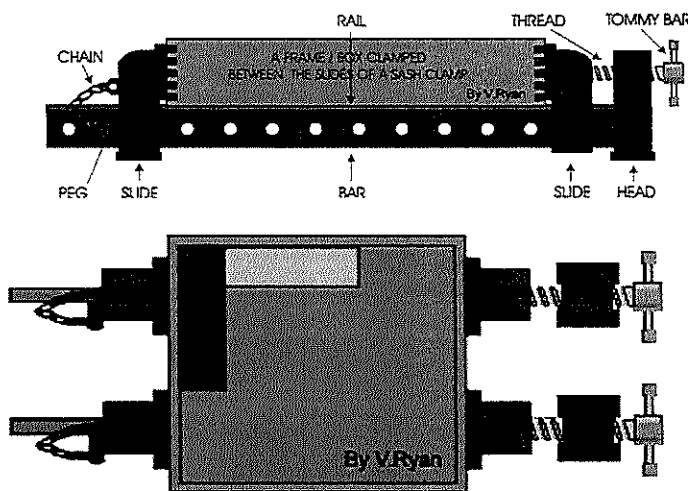
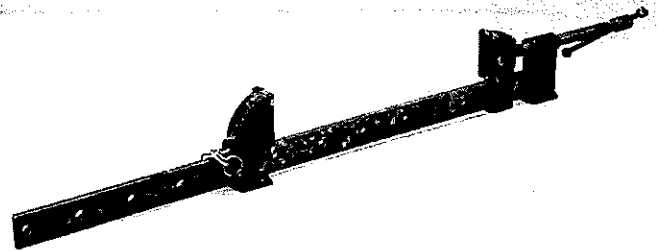
G CRAMP



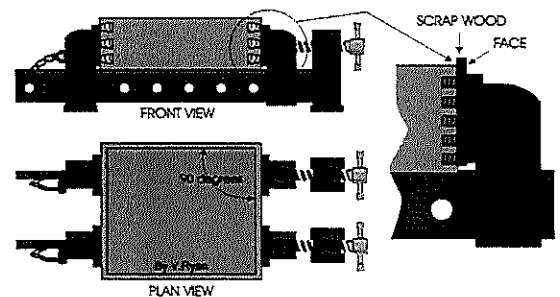
By V.Ryan

## Sash Clamps

Sash clamps are used to clamp work together when it is glued. They vary in size and are normally used in pairs. When in use, the sash clamp is placed below the work to be glued / assembled. The slides are arranged on either side and scrap wood is placed between each face and the work. This protects the work when the thread is tightened.



By V.Ryan



A try square can be pushed into the corners of a smaller frame / box, to check that the 90 degrees internal angle is correct.

**Remember:** Work should always be dry assembled first (no glue) to ensure

the model actually fits together.



## Exercise 6

1. Which tool would you use to hold material firmly to the drilling table?

---

2. When using a sash clamp, why do you need scrap wood?

---

---

3. What is meant by 'dry' assembly and why should this process be carried out

---

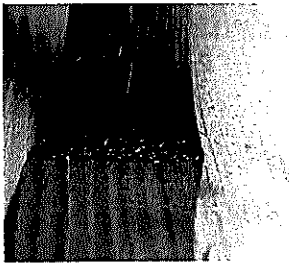
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4. When clamping together a frame or box, explain how you would check the corners are square ( $90^\circ$ )?

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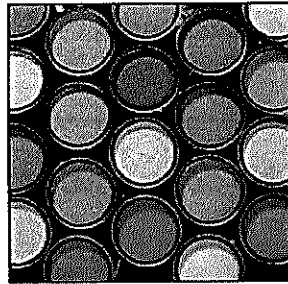
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## Finishing



### **Varnish**

Varnish is probably the most commonly used finish applied to timber. This is because it brings out the natural colour and grain of the wood. Most varnishes are clear and give the wood a nice shine without it losing its colour.



### **Paint**

There are a number of different paints available in a variety of colours. Paints are often chosen as a finish when man-made boards are being used as it completely hides the surface.



### **Wax**

Wax is a good finishes to apply to natural timber especially when you want to achieve a very natural look. Wax is also used as a finish for products that would be in contact with food items e.g. salad bowls.

Before applying a finish to any wood based product you must follow the steps shown.

Step 1 - Sand down all surfaces with rough sand paper and sanding block, removing all pencil marks, scratches and blemishes. The sanding block helps sand the surfaces flat.

Step 2 - Apply a coat of water to the surfaces, this will raise the grain (this means the fibres of the material stand on end).

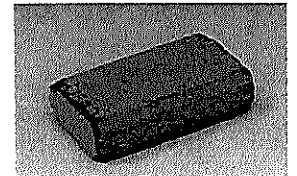
Step 3 - When dry sand down all surfaces again, this time using smoother sand paper and sanding block.

Step 4 - Apply a coat of varnish / wax / paint.

Step 5 - Once dry, lightly sand down again with fine sand paper.

Step 6 - Apply a second coat of varnish / wax / paint.

Repeat steps 5 & 6 until a quality finish is achieved.



**Remember:** Always sand down in the direction of the grain as the surface becomes scratched when you sand across the grain. The finish should also be applied with the grain as this will help to hide brush marks.

## Exercise 7

1. List some reasons why varnish is such a popular choice of finish?

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2. Which type of finish would most likely be used on MDF and why?

Finish \_\_\_\_\_ Reason \_\_\_\_\_

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3. Why is a sanding block used?

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4. Why is water applied to the model during step 2 of the sanding process?

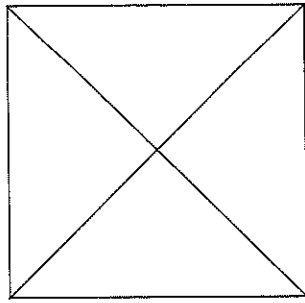
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5. Why must the wood be sanded in the direction of the grain?

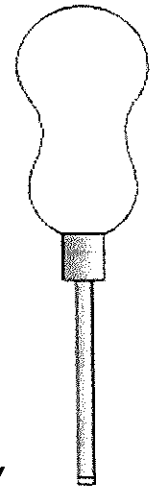
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# Preparing Material for Wood Turning

1. Mark the diagonals on both ends of the material to get the centre point.



2. Mark the centre point on each end with a bradawl.



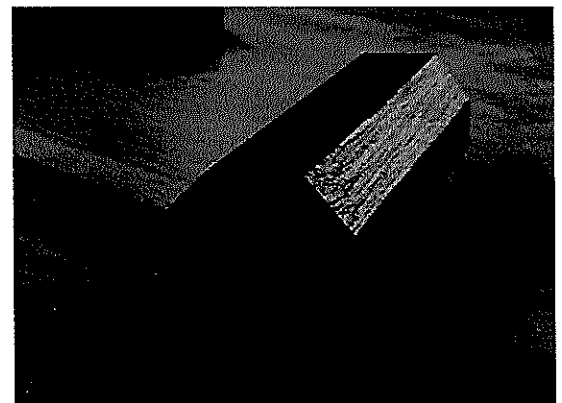
3. Use a compass to draw a circle on each end from the centre point. (the circle should be of maximum diameter therefore touching the edge of the material.)



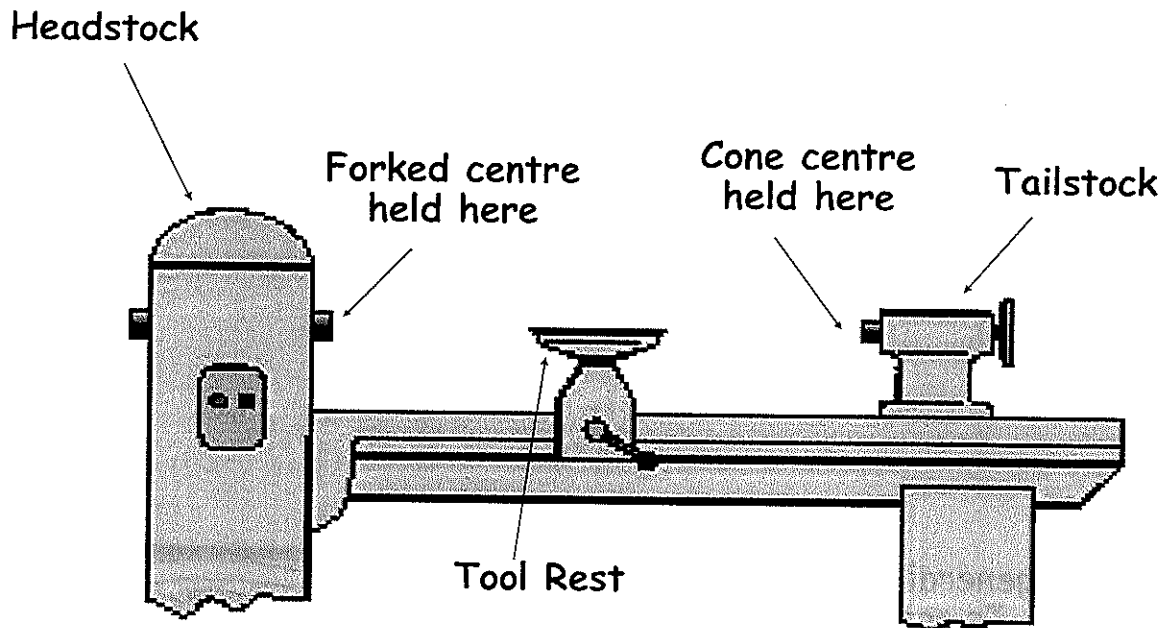
4. On one end only make a saw kerf approx 3mm deep across one on the diagonals. (This will be used to hold material in the forked centre.)



5. Plane the corners of the material down until they are level with the edge of the circle. This will give you an octagonal shape as shown.



# Woodwork Lathe



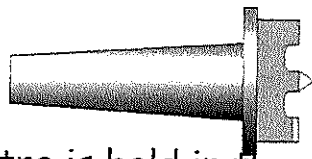
## Lathe Safety

There are certain checks that must be made before switching in the lathe:

- the material should be held firmly between the centres
- the material should turn freely
- the tool rest should be secure and at the appropriate height
- the lathe speed should be appropriate speed for the work being done

## Driving Fork

The forked centre is held in the headstock. The middle fork is aligned with the centre of the material and the outer forks with the saw mark.



## Cone Centre

The cone centre is held in the tailstock and is aligned with the centre of the material. The tailstock is tightened towards the headstock to hold the material firmly. As the cone centre is fixed it needs to be lubricated to stop the wood from burning.



## Woodwork Lathe Tools

### **Gouge**

Used for general turning and heavy removal of waste wood. Produces reasonably good finish.



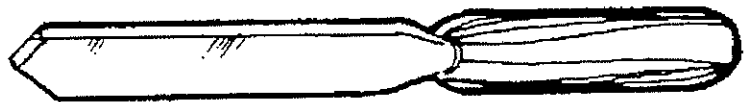
### **Scraper**

used for general machining. Is easy to use but does not give a good finish.



### **Parting Tool**

Used to cut into the work at right angles. A deep cut is made at either end of the work so very little sawing is required to remove the waste wood when the turning process is completed.



## Exercise 8

1. List the safety checks that should be carried out before starting the wood lathe.

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2. The driving fork is held on which part of the lathe?

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3. Why must the cone centre be kept lubricated?

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4. With the aid of sketches describe how material is prepared for turning.

Description \_\_\_\_\_

Sketches

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5. Name the three common lathe tools.

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# What Have I Learned

Tick the box  
when you can  
do it!

- Name the different groups of woods and suggest a purpose for which they may be used.
- Name the tools used to mark out and cut wood joints.
- Describe the process of marking out and cutting a variety of wood joints.
- Explain how to prepare material to be joined with a countersink screw.
- Name and describe the different drill bits and suggest when they may be used.
- Name the cutting and shaping tools and suggest when they may be used.
- Name the two common cramping / clamping tools and describe how they are used
- Name and describe the processes carried out before applying a finish to wood.
- Name the types of finish that could be applied and suggest when they may be used.
- Name the parts of the wood lathe and describe the purpose of each part.
- Explain the safety rules that must be followed before switching on the wood lathe.
- List the steps taken to prepare material for turning on the lathe.
- Name the tools used when wood turning and explain when each would be used.