

**DJJ10243**

**WORKSHOP TECHNOLOGY**  
**HANDTOOL**

**SHAIFATULNAÍM BINTI SHAMSUDDIN**  
**MOHAMMAD MOKHTAR BIN PADELI**  
**SITI HAJAR BINTI MOHD NOH**



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**PATRON**

**Hasan Bin Mohd Sharif** B.C.M, P.J.K  
Director, Politeknik Port Dickson

**ADVISORS**

**Ts. Dr. Engku Shahrulerizal Bin Engku Ab Rahman**  
Deputy Director (Academic), Politeknik Port Dickson

**Norhazlina Binti Amon**  
Head of Mechanical Engineering Department,  
Politeknik Port Dickson

**Siti Hajar Binti Mohd Noh**  
Head of Diploma in Mechanical Engineering Programme,  
Politeknik Port Dickson

**EDITOR**

**Norhazlina Binti Amon**  
Department, Politeknik Port Dickson

**FACILITATORS**

**Che Azlina Binti Che Norohoseni**  
**Ahmad Qusyairi Bin Ahmad Khairiri**  
**Norhazlina Binti Amon**

**WRITERS**

**Shaifatulna'im Binti Shamsuddin**  
**Mohammad Mokhtar Bin Padeli**  
**Siti Hajar Binti Mohd Noh**

## SYNOPSIS

A **WORKSHOP TECHNOLOGY** Hand Tool e-book in a machining workshop serves several key purposes:

1. **Reference Guide:** It provides information about various hand tools, including their uses, specifications, and proper handling techniques.
2. **Safety Instructions:** It outlines safety protocols and best practices to prevent accidents and injuries while using tools.
3. **Skill Development:** It can serve as an educational resource for new learners, helping them understand fundamental machining concepts and techniques.

Overall, it enhances productivity and safety in the workshop environment.

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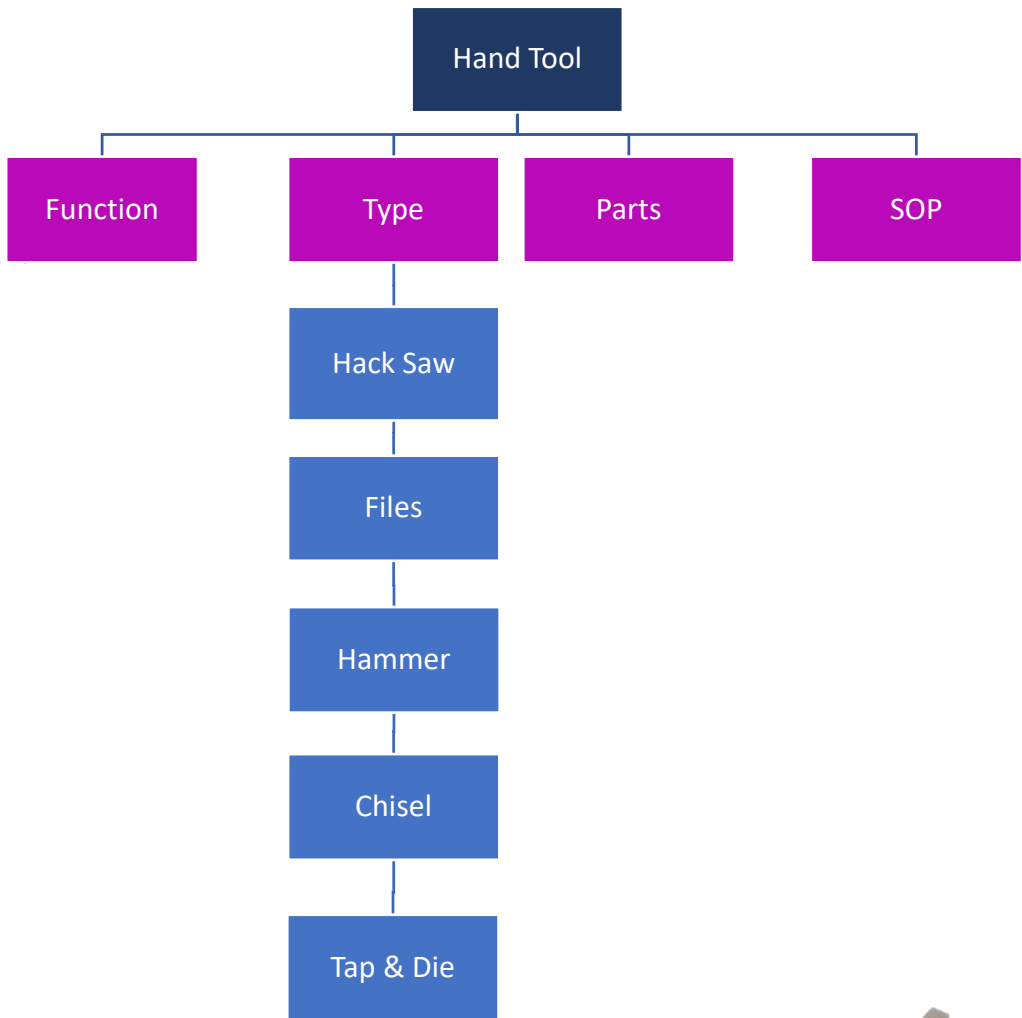
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# CHAPTER I - HAND TOOL



# 1.0 HAND TOOL

After studying this topic student will be able to :

Explain the types, parts and uses of hand tools including

1.1 Hack Saw

1.2 Files

1.3 Hammer

1.4 Chisel

1.5 Tap

1.6 Dies

# 1.0 HAND TOOLS

- Hand tool is a tool held in the hand and operated without electricity or other power. There are various types, and each serving specific functions.



Hammer



Files



Chisel



Die

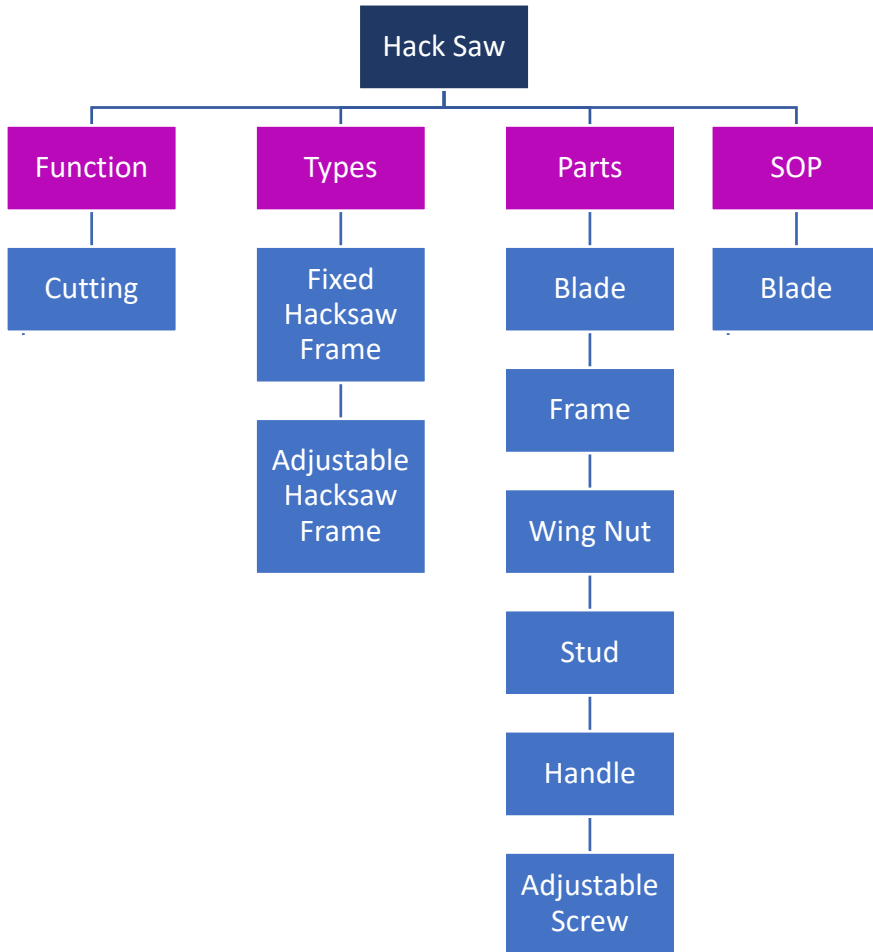


Hacksaw



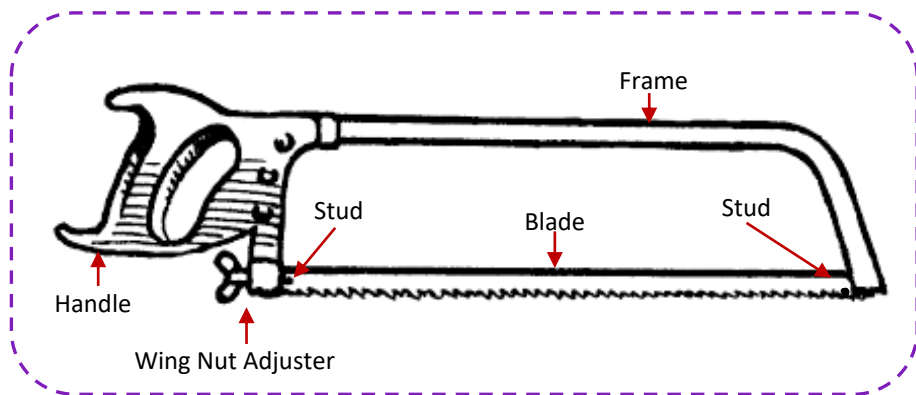
Tap

# 1.1 HACK SAW



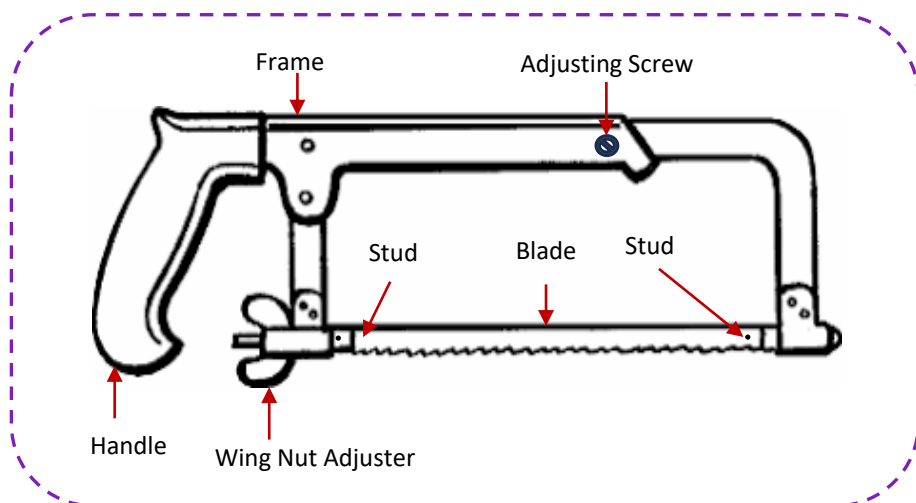
## Hacksaw – Types & Parts

- It is used to **cut metal, rods, pipes, plates or sheets of varied thickness.**
- There are two types of hacksaw : Fixed Hacksaw and Adjustable Hacksaw.



Fixed Hacksaw Frame

- The fixed hacksaw frame can take only one length of blade.



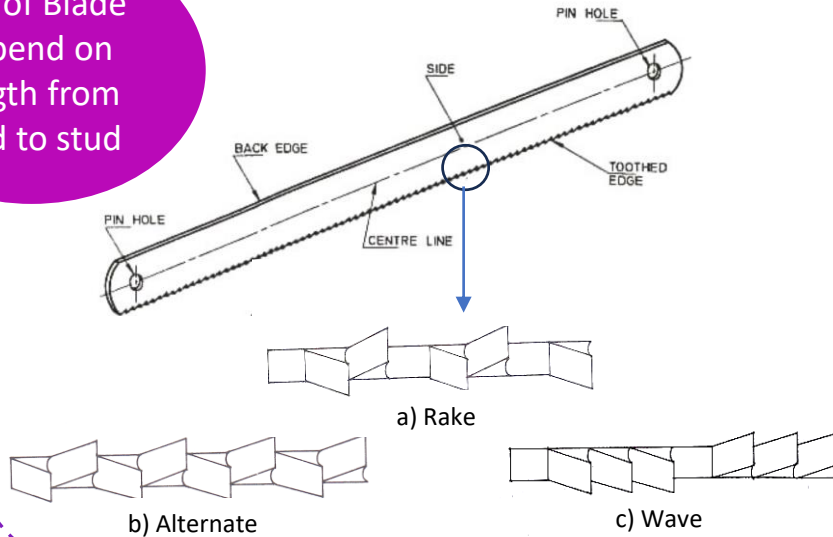
Adjustable Hacksaw Frame

- The adjustable hacksaw frame can take blade of different length.

## Hacksaw Blade



Size of Blade  
depend on  
length from  
stud to stud



Hacksaw blade teeth positioning

**Rake :** The teeth are in sets of three. This blade is ideal for thick iron piping.

**Wave :** The teeth are positioned from left to right. This blade is ideal for cutting thin but hard metal sheets.

**Alternate :** The teeth alternate between left and right, but they also touch each other. This blade is ideal for cutting soft materials like aluminum or tin

## Hacksaw Blade

- Teeth Per Inch (TPI ) is the number of teeth per inch determine the cut speed and roughness of the cut.
- Lower TPI blades cut fast because they have large teeth so they move more material away but and leave rougher edges.

Hacksaw Blade TPI Chart				
Material	Workpiece Thickness			
	3	6	10	13 mm
	1/8	1/4	3/8	1/2 inci
Magnesium Aluminum Low Carbon Steel	32	24	18	14
Brass, Copper, Carbon Steel, Low and Medium Carbon Structural Steels	32	24	18	14
High Carbon Steels Bronze, Tool Steel , Die Steel, Alloy Steel Copper Alloy , Gray Cast Iron	32	24	18	

## How To Use Hacksaw

1. Clamp workpiece onto a vise or working table.
2. Use one hand to hold the hacksaw grip, while another hand hold the end of hacksaw frame.
3. Press the saw a bit forward to make a notch onto the workpiece.
4. Start the cutting process by push the saw forward and backward in full strokes.
5. Push and press down during the forward stroke and ease up on the pressure during the backward stroke. [1]

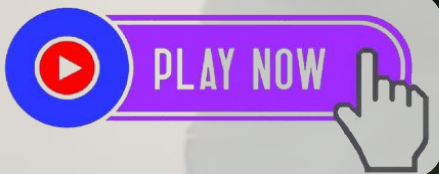


Figure 1 : How to use hacksaw [2]

## Changing Hacksaw Blade

Blades need replacing when it wear or break ;

1. **Loosening the wing nut adjuster** until blade comes off from two studs.
2. **Install** the blade with the teeth **point away** from the handle.
3. **Tighten the wing nut thumbscrew clockwise** until the blade is tight and does not wobble side to side.

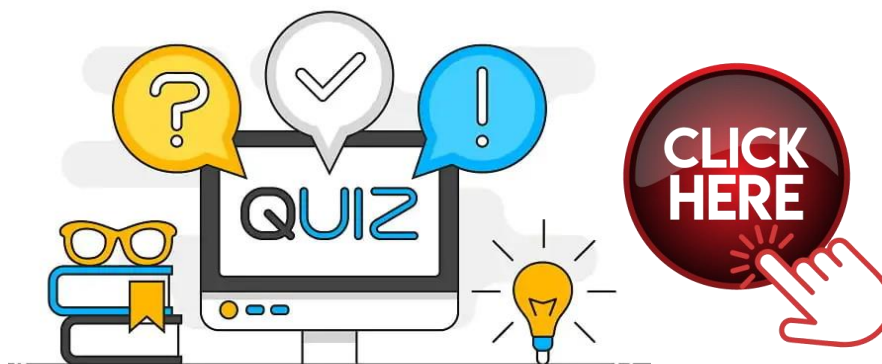


Figure 2 : How to change hacksaw blade. [3]



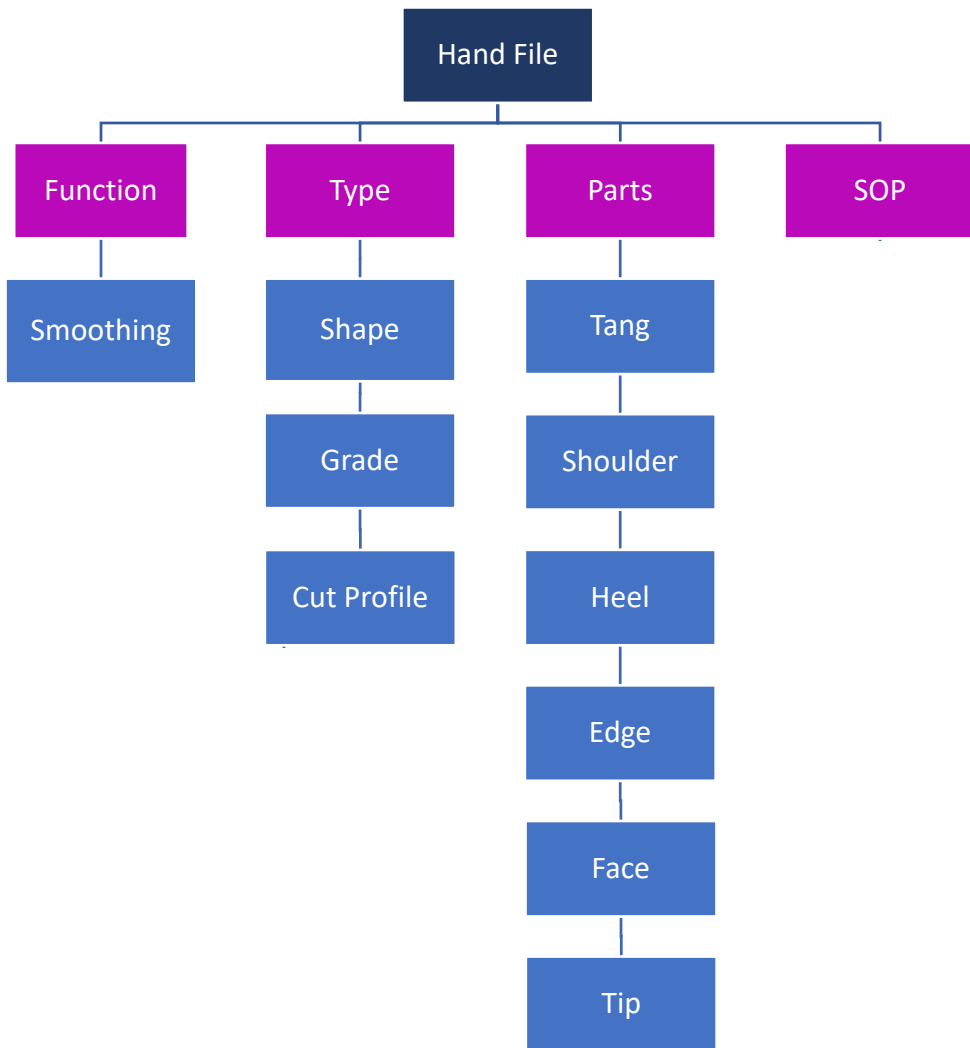
# EXERCISE

1. What is a hacksaw.
2. What is the use of hacksaw.
3. Name 5 parts of adjustable hacksaw .
4. Compare TWO different types of hacksaw.
5. What is TPI of hacksaw blade.
6. When to use hacksaw blade TPI chart.
7. Higher TPI blades cut \_\_\_ because they have \_\_\_ teeth so they leave \_\_\_ material away but leave \_\_\_ edges.
8. How to use a hacksaw.
9. How to change hacksaw blade.
10. Why we have to change hacksaw blade.



**ONLINE QUIZ - HACKSAW**

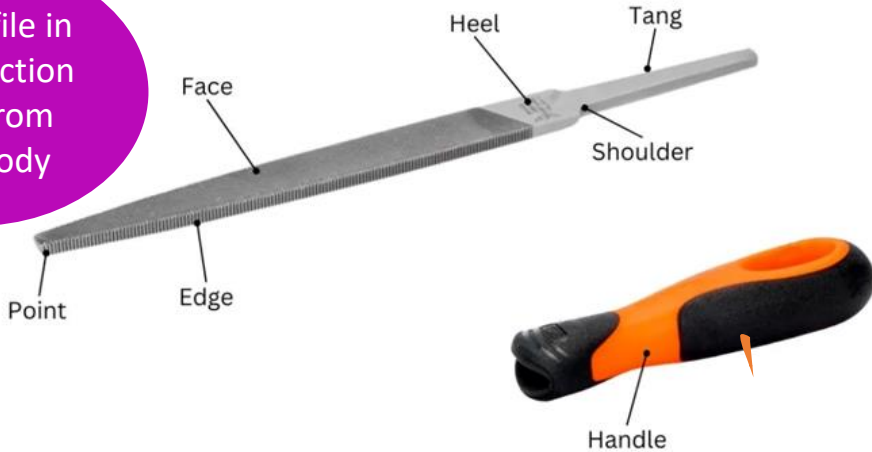
## 1.2 HAND FILE



## Hand file

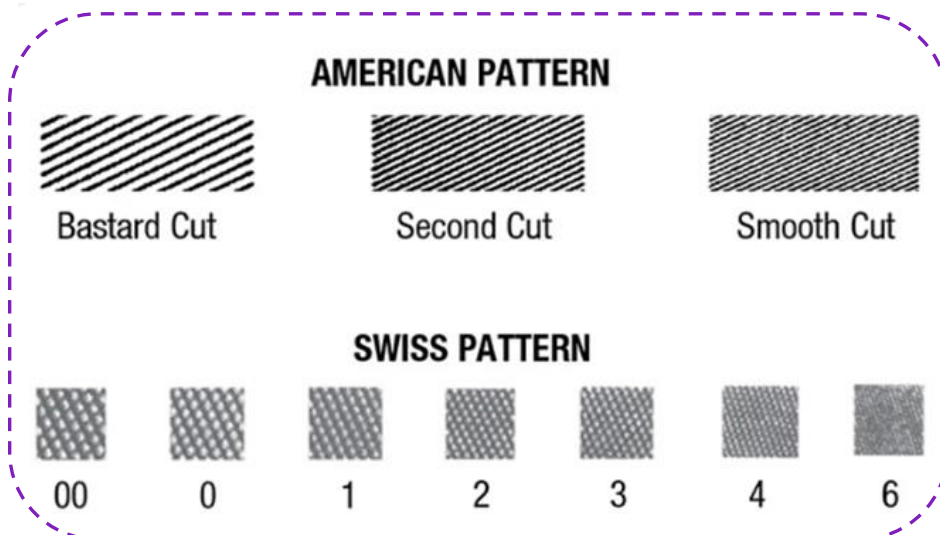
- A tool used for **roughing** and **finishing** by removing fine amounts of material from a workpiece.

Always file in one direction away from your body



Parts of Hand File

- Swiss Pattern Files are **smaller in size** and **finer in coarseness** compared to American Pattern. Swiss Pattern Files are used for more **precise and intricate work**.
- **Higher grade number** represent **finer pattern** of hand file.



Coarseness of Hand File [4]

## American Standard Hand File

### Rough Files

It is a file of with the coarsest cutting ridges. Hence, it have big size teeth but less in quantity. It is use to cut soft materials. Because of its rough cutting, it cannot be used for hard metal.



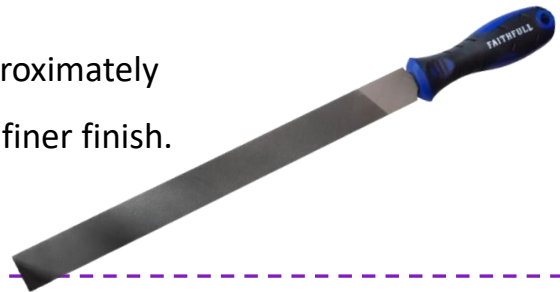
### Bastard Files

The teeth is smaller than rough file, approximately 26tpi. It generally used first for quick removal of material.



### Second Cut File

Medium grade file. File with approximately 36tpi, use after coarser file for a finer finish.



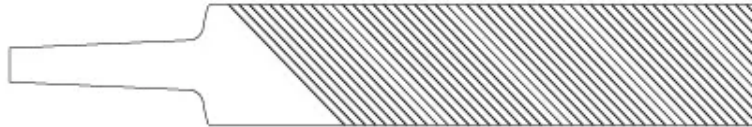
### Smooth Files

Use for getting a flush surface after it has already been filed down with a coarser file.

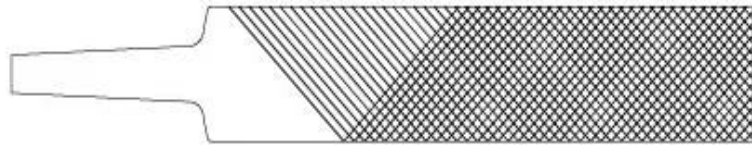


## Cut Profile on Hand file

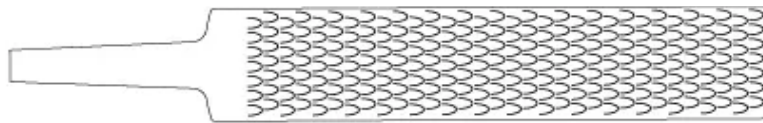
**Single Cut** - One continuous parallel line of slanted teeth, equally spaced along the file's face. This can produce a smooth finish with light pressure. [5]



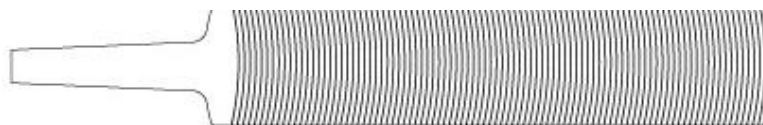
**Double Cut** - Two overlapping rows of teeth, running parallel in opposite directions. Requires heavier pressure but is great for fast removal. [5]



**Rasp Cut** - Rows of teeth that have been created by a pointed tool (similar to a cheese grater). Primarily for softer materials such as wood, aluminium, and lead. It leaves a rough finish. [5]



**Curved cut teeth/milled tooth** : Teeth are arranged in curved contours along a rounded file face. Commonly used in the automotive industry for smoothing body panels. [5]



## Shape of Hand Files

### Round File



Round cross - section tapering toward the end. Use for rubbing or finishing.

### Square File



Square cross - section and tapered towards the tip. Use for filing of square groove or slots.

### Half Round File



Half round cross - section is a chord of a circle with its taper towards the tip.

### Flat File



Rectangular cross section.

### Triangular File



Triangular cross section with three square files angles at  $60^\circ$ . Use for filing of V slot job.

### Needle File



It is very small in size and comes in various type. Use for filling on tiny components and intricate work.

## How to Use Hand files

1. File only in **one direction away** from our body.
2. Remember, filing is not a back-and-forth motion.
3. Select a file with a **rough cut** to work quickly on workpiece.
4. Apply a **pressure on the forward stroke**, while **lift the file during backward** to avoid blunting the file's teeth.

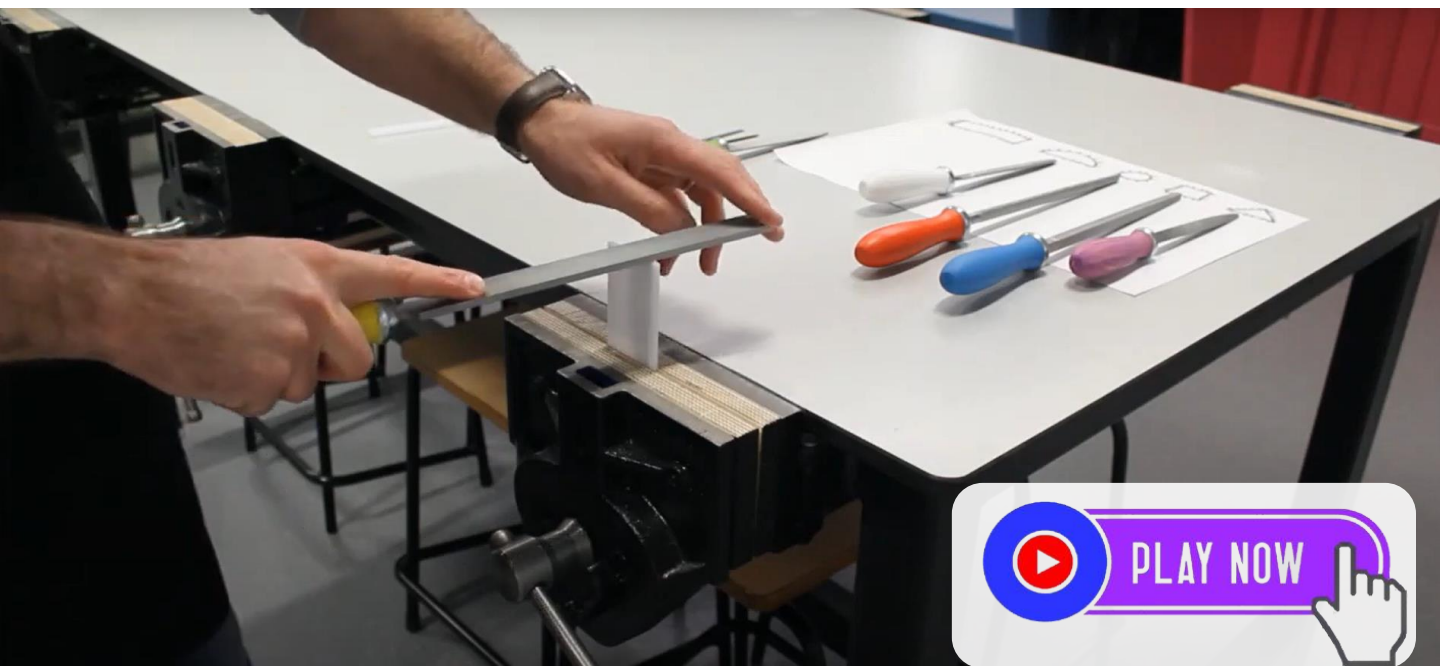
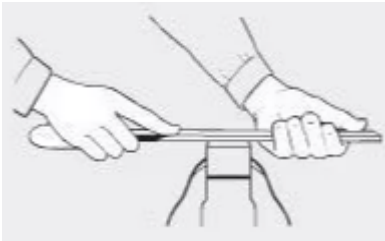


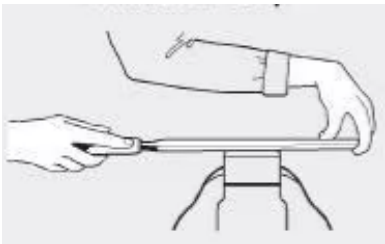
Figure 3 : How to use hand file correctly. [6]

## Filing Technique



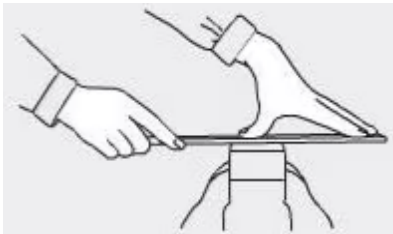
Heavy Stroke Grip

- The thumb on the point is normally in line with the file.
- The tip of the thumb pointed forward



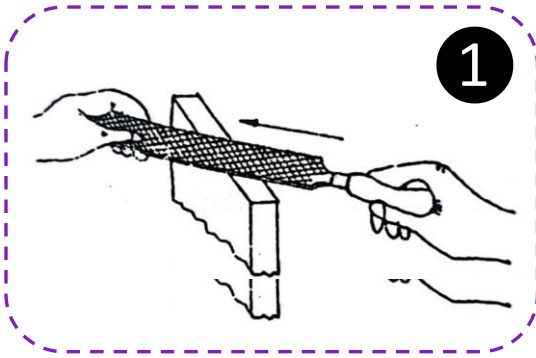
Standard Grip

- The file handle should be rested in the palm with the thumb pointing along the top of the handle and the fingers gripping the underside.
- The point of the file should be grasped between the thumb and the first two fingers with the thumb being on the top of the file.

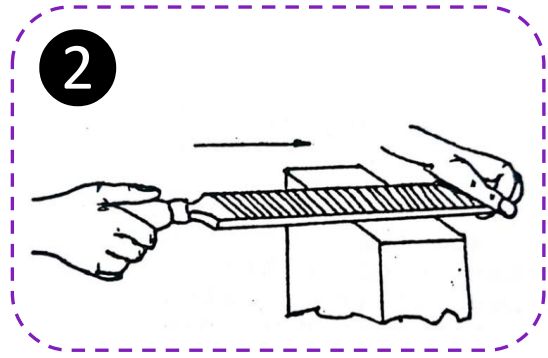


Light Stroke Grip

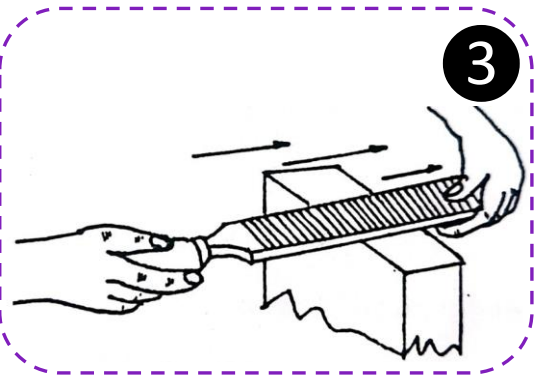
- The thumb can be turned to as much as a right angle to the direction of the stroke



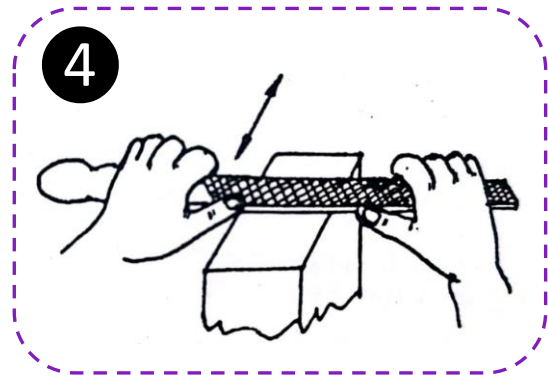
File diagonally in one direction



File forward stroke



Lift the file during backward to avoid blunting the file's teeth.



File perpendicularly to work piece surface

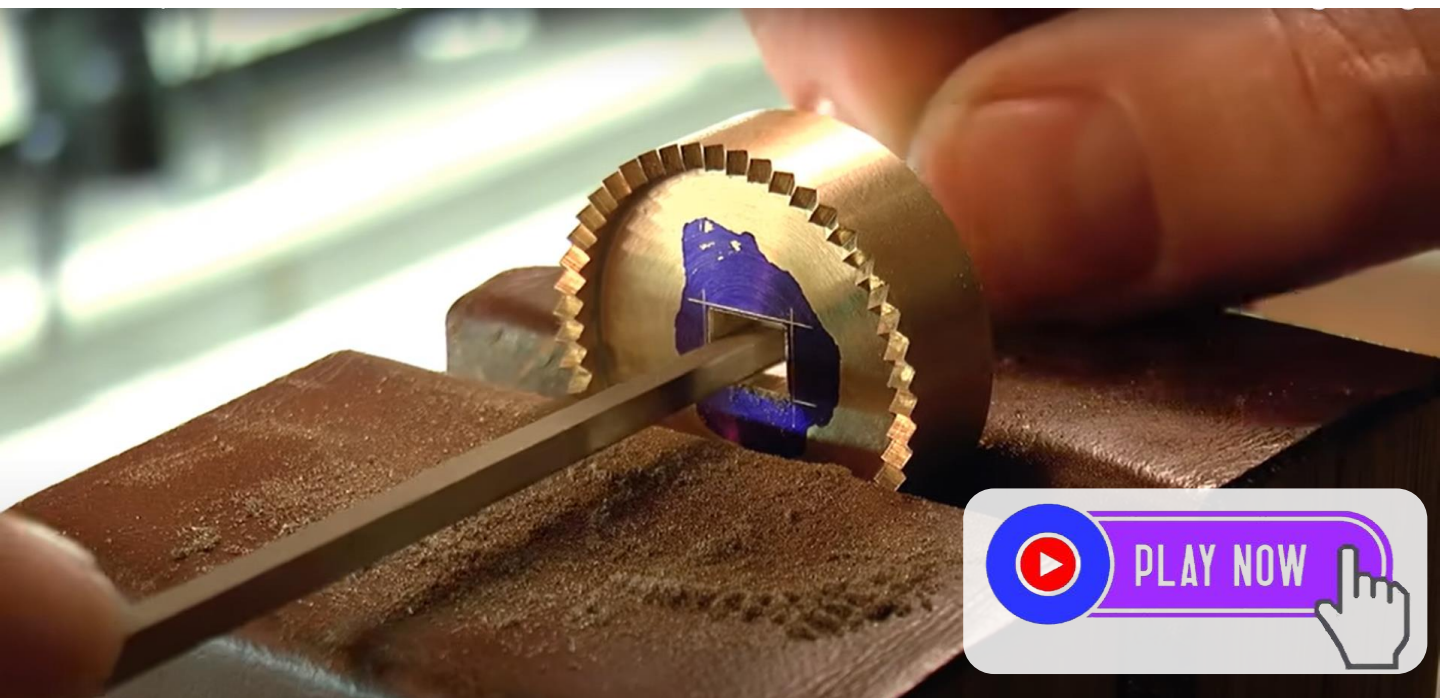
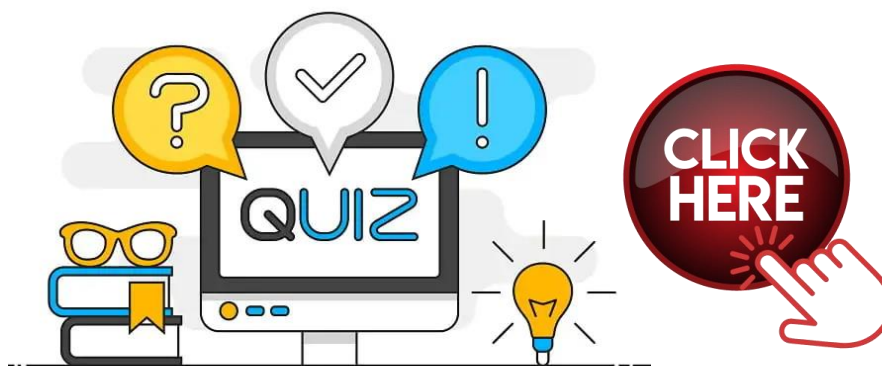


Figure 4 : Tips for better hand filing. [7]



# EXERCISE

1. Define hand file.
2. What is the main purpose of hand file.
3. What are the 5 types of hand file.
4. What are the 5 parts of a hand file?
5. How are files classified.
6. How to measure a hand file.
7. How to properly use a file?
8. Sketch and label parts of a square file?
9. What is the difference between a hand file and flat file ?
10. How to safely use a hand file?
11. Why is it important to file correctly.



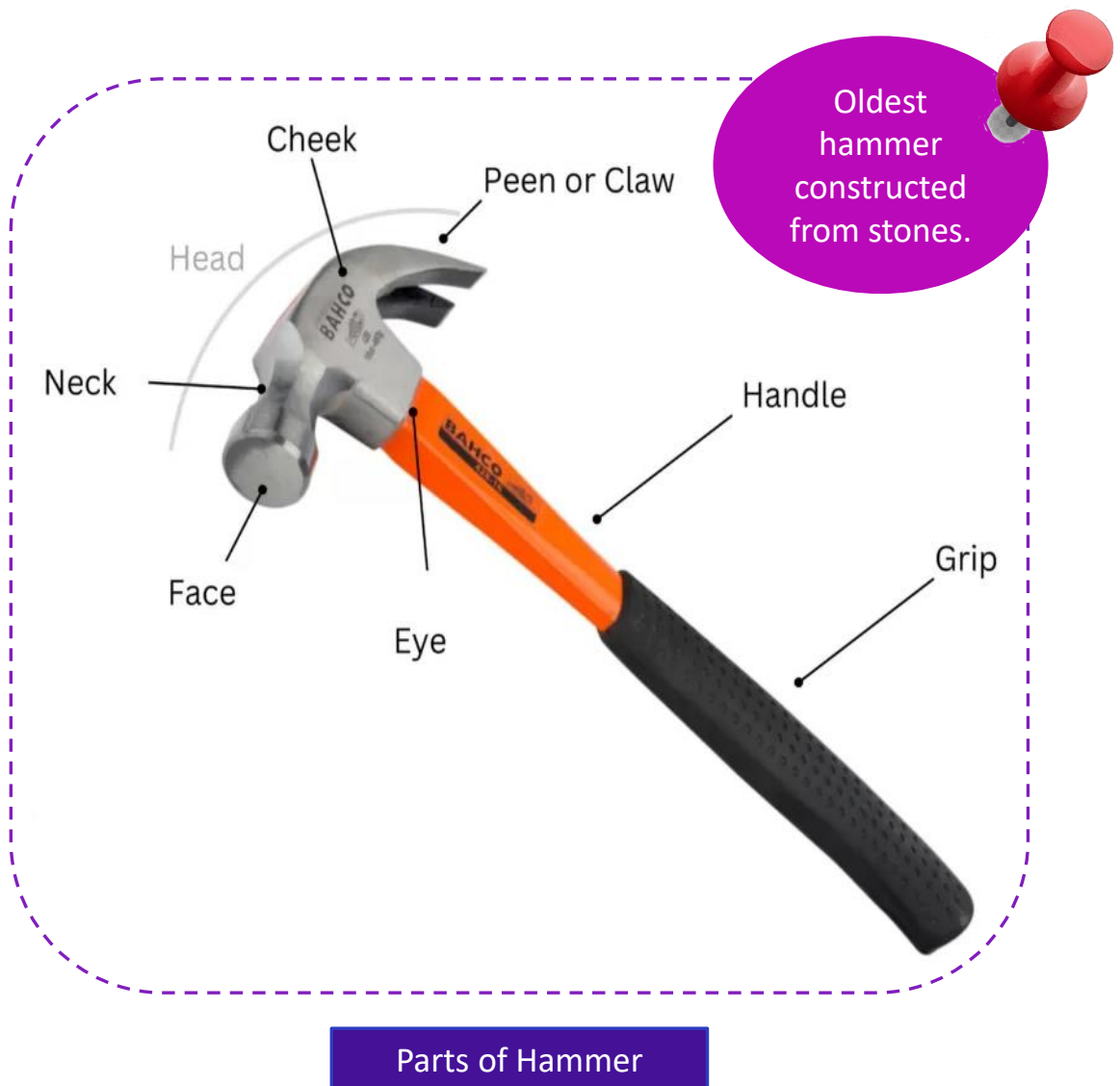
## ONLINE QUIZ – HAND FILES

## 1.3 HAMMER



## Part of Hammer

- It is define as a hand tool comprising of a **solid head** set crosswise on a handle. It is use **for pounding**.



## Type of Hammer



Ball Peen Hammer

A flat faced on one end and rounded on another end. The flat end is responsible for jobs such as driving punches, setting rivets, while the rounded - peen is used for shaping metal.



Cross Peen Hammer

A flat faced on one end and cross peen on the other. Used to strike where space is a little restricted, such as working in narrow gap or corner of metal that **perpendicular** to the handle.



Straight Peen Hammer

A flat faced on one end and straight peen on the other. Used to strike where space is a little restricted, such as working in narrow gap or corner of metal that **parallel** to the handle.

## Type of Hammer



Claw Hammer

It have a small, circular, flat face on one side. On the other side, it has two V-shaped prongs, separated by a narrow opening that used to remove nails.



Chipping Hammer

Used to remove welding slag from a weld and welding spatter from along side welds.



Mallet

A soft-faced hammer, perfect for non-marring applications.

The head is from rubber and perfect for gently nudging ceramic tiles or laminate flooring into place, ensuring a flawless finish.



Figure 4 : Ball peen hammer used to shape metal. [8]



Figure 5 - Cross Peen Hammer is use where space is a little restricted, such as working in narrow gap or corner [8]

## How To Use Hammer

1. Before striking work, make sure to check the hammer head is grip securely and safely not loose to the handle.
3. Make sure there no one at your back
4. Hold the hammer at the grip.
5. Swing the hammer properly.
6. Wear eye protection.

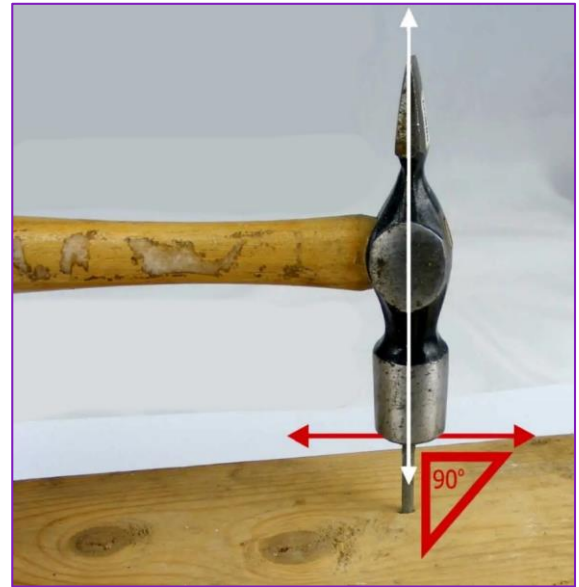
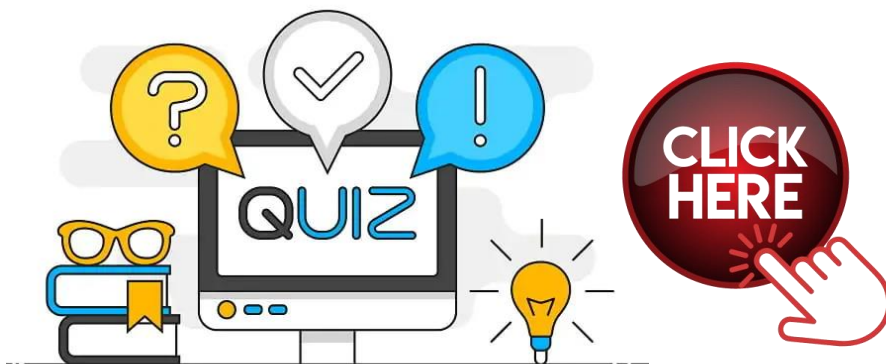


Figure 6 : How to use hammer. [9]



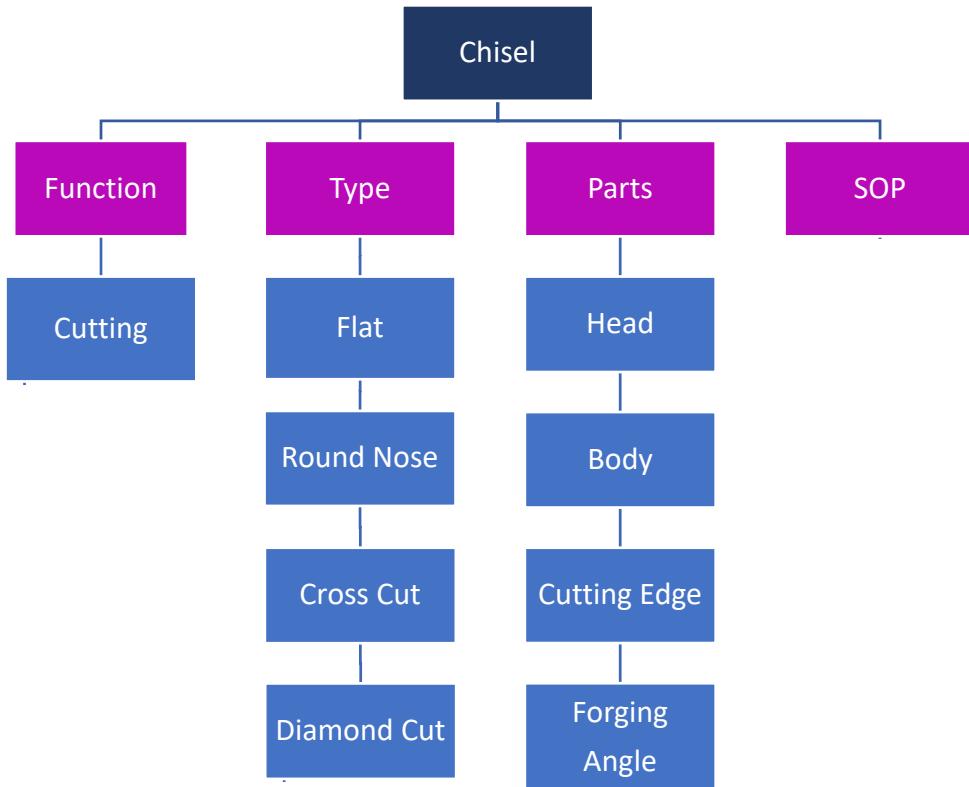
# EXERCISE

1. Define a hammer.
2. List 5 main part of hammer.
3. Discuss the application of hammer.
4. State the 5 common types of hammer.
5. Which hammer is suitable for delicate work to avoid scratch on surface.
6. Identify a perfect hammer to be use where a space is narrow and restricted.



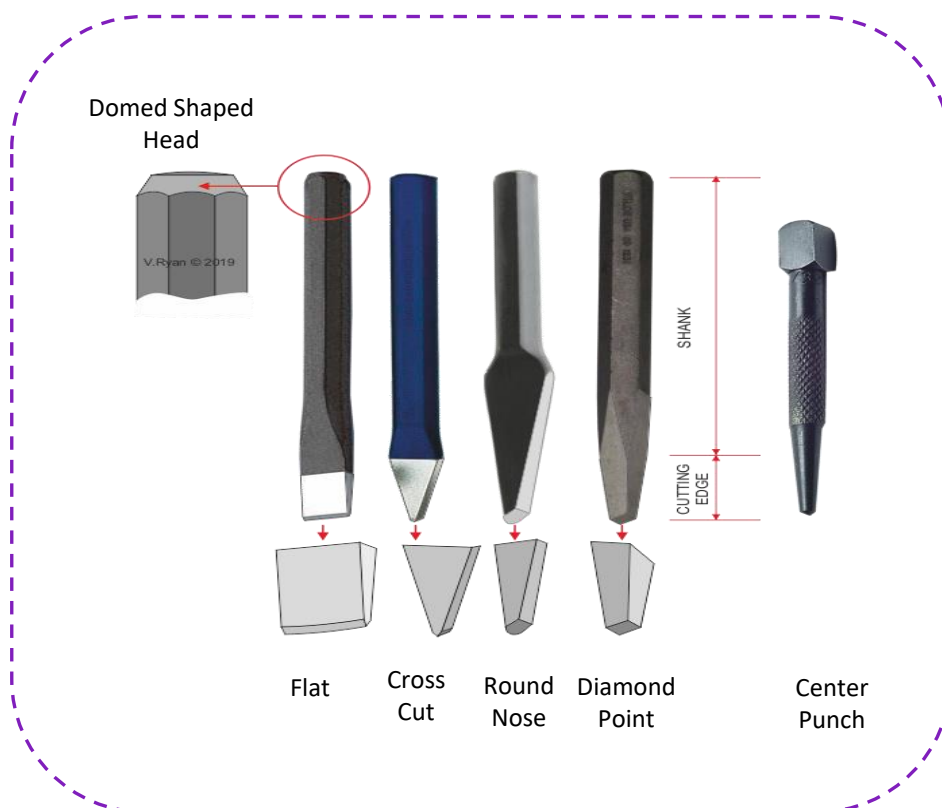
**ONLINE QUIZ - HAMMER**

## 1.4 CHISEL



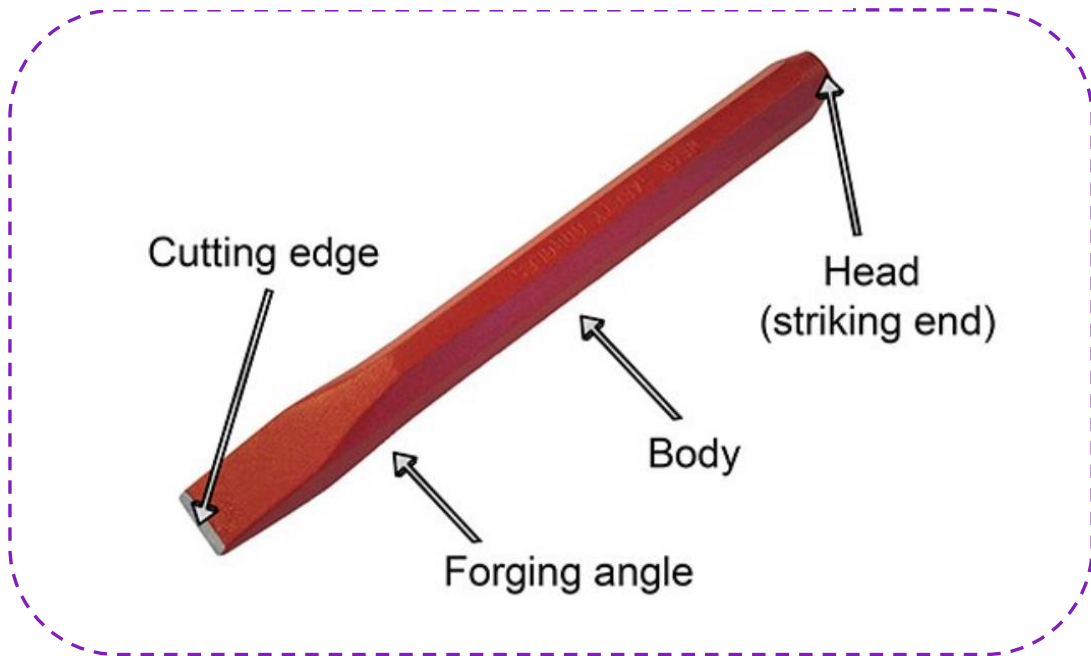
## Type of Chisel

- A chisel is a **cutting tools used with hammer to chip and cut flat surface , slot and groove.**
- **Chipping** means is an operation of removing access metal with the help of hammer and **chisel.**
- Two types of chisel is **hot chisel** and **cold chisel.** **Cold chisels** are used to cut **metal at room temperature.**



Types of Chisel [10]

## Parts of Chisel

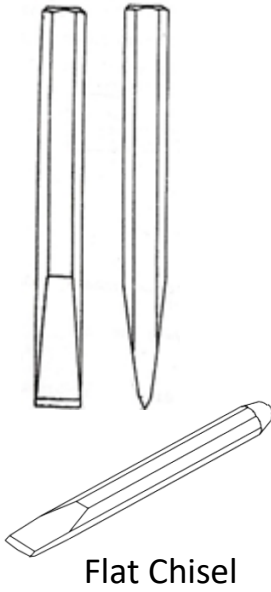

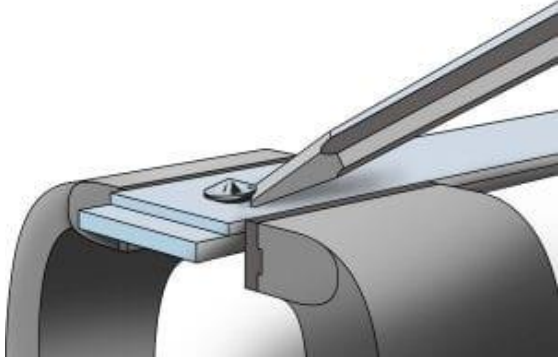
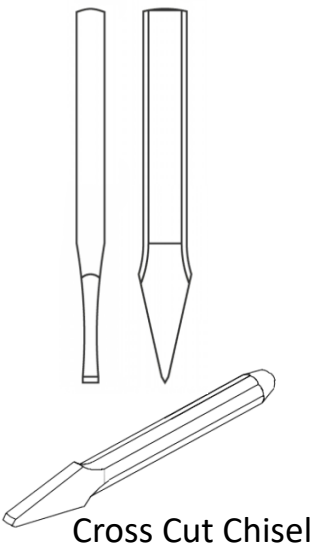
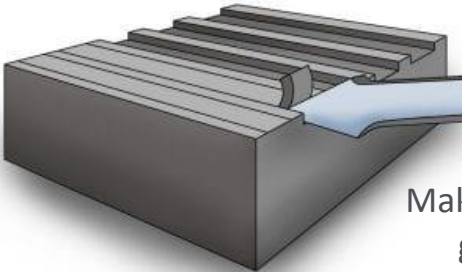
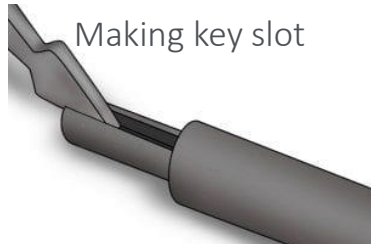


Parts of Chisel [11]

## How to use

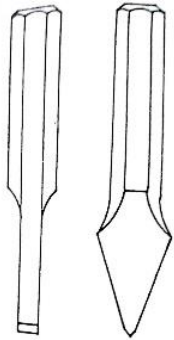
1. Wear safety glasses.
2. Position the work piece in the middle of the jaws and tighten the vise firmly.
3. Else for cutting task, securely position work piece on anvil
4. In order to maximize the power of each strike , align the chisel with the vise screw and cut perpendicular to work piece.
5. Do not use chisel with damage end.
6. Grind off damage end of chisel by sharpen the chisel to a 60° - 70° bevel to avoid any curled metal before it splinters off. [12]

## Types of Chisel

Type	Usage
 <p data-bbox="269 1114 425 1156">Flat Chisel</p>	 <p data-bbox="876 576 1190 617">Cutting sheet metals</p>  <p data-bbox="534 996 753 1038">Cutting metals</p>
 <p data-bbox="229 1763 472 1804">Cross Cut Chisel</p>	 <p data-bbox="915 1446 1139 1529">Making square grooves</p>  <p data-bbox="586 1638 815 1680">Making key slot</p>

# Types of Chisel

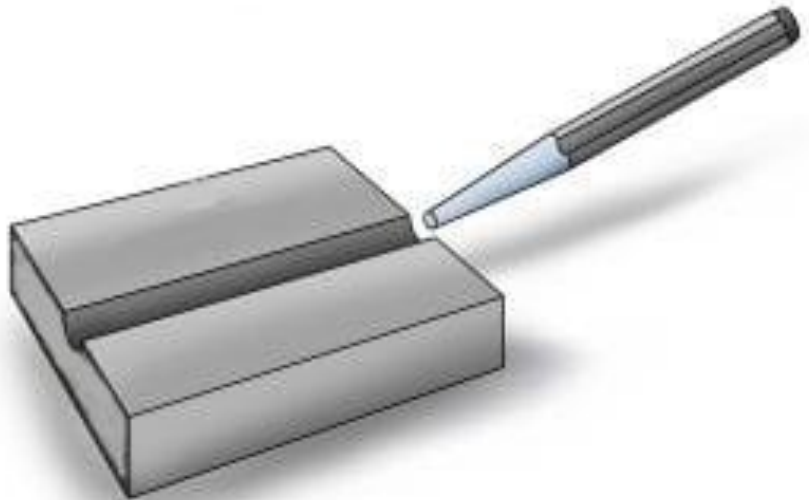
## Type



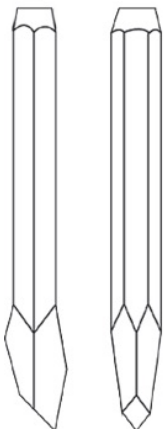
Round Nose  
Chisel



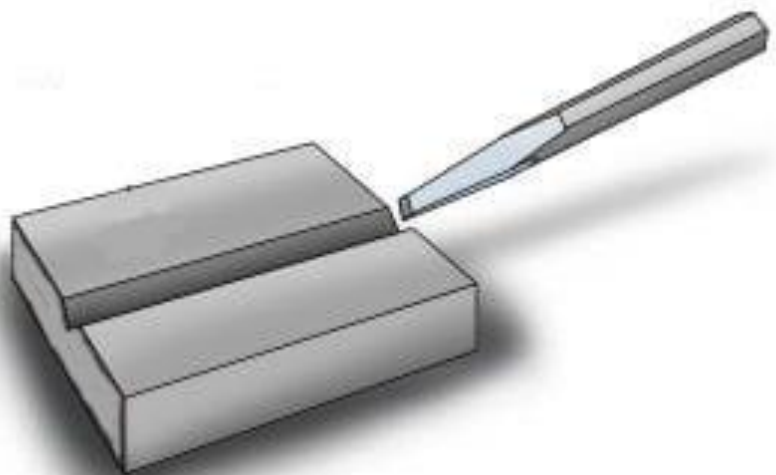
## Usage



Create grooves/channels with  
rounded bottoms



Diamond Point  
Chisel



Making v-shape groove

# Chisel Types

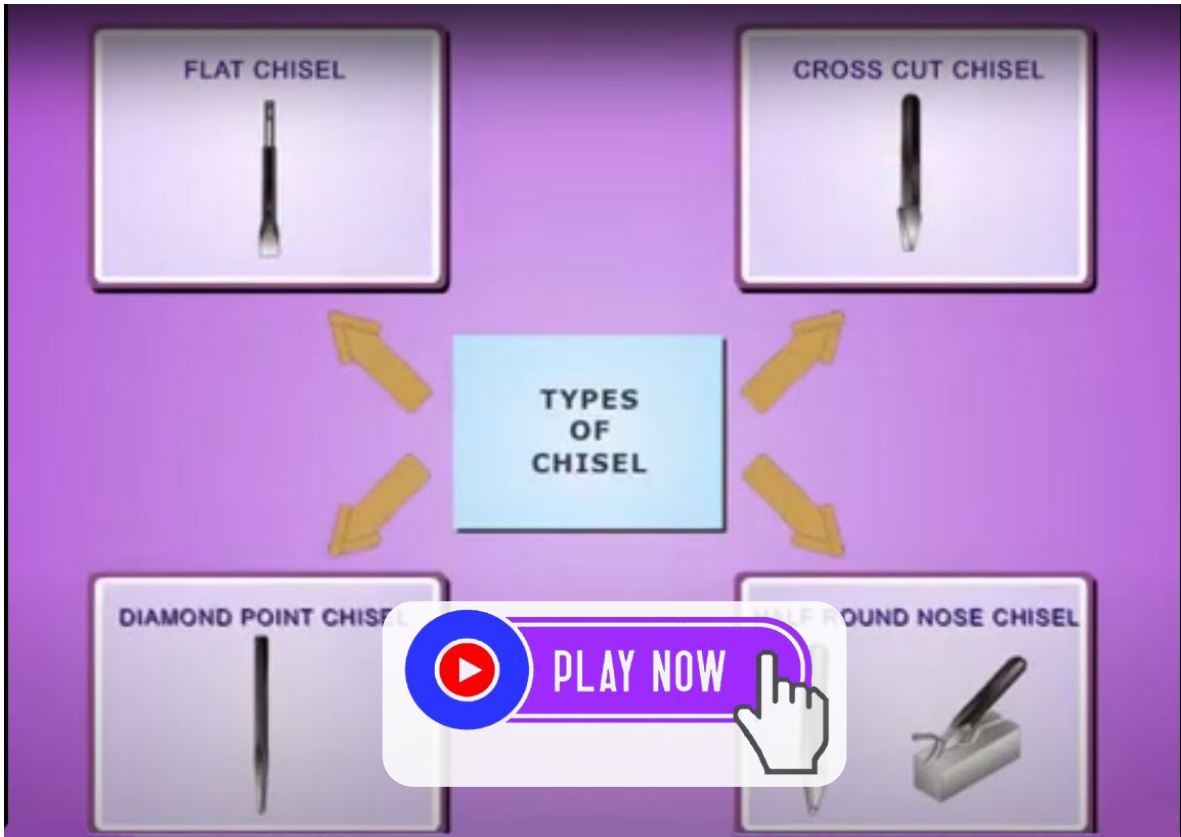


Figure 7 - Type of Chisel and their applications together with general precautions.[13]

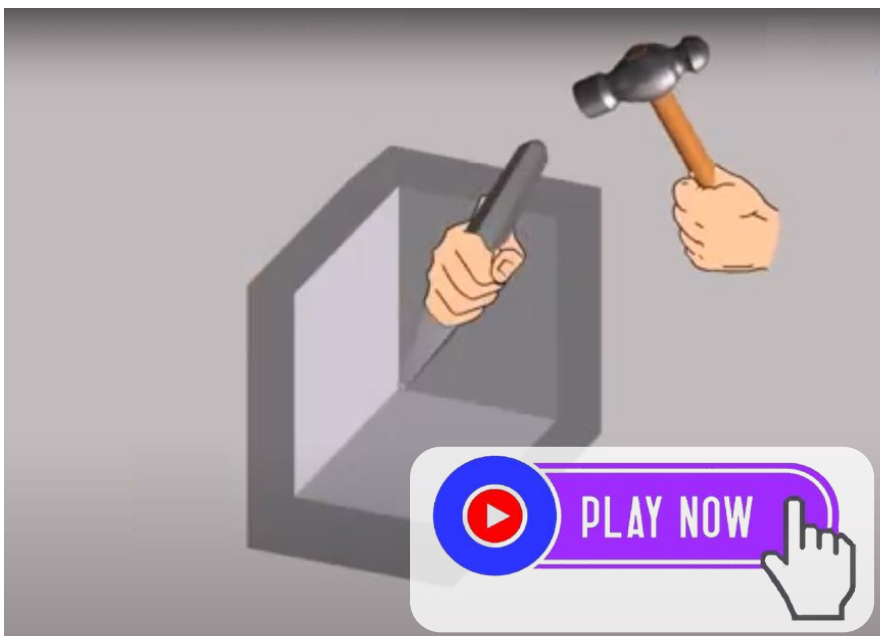
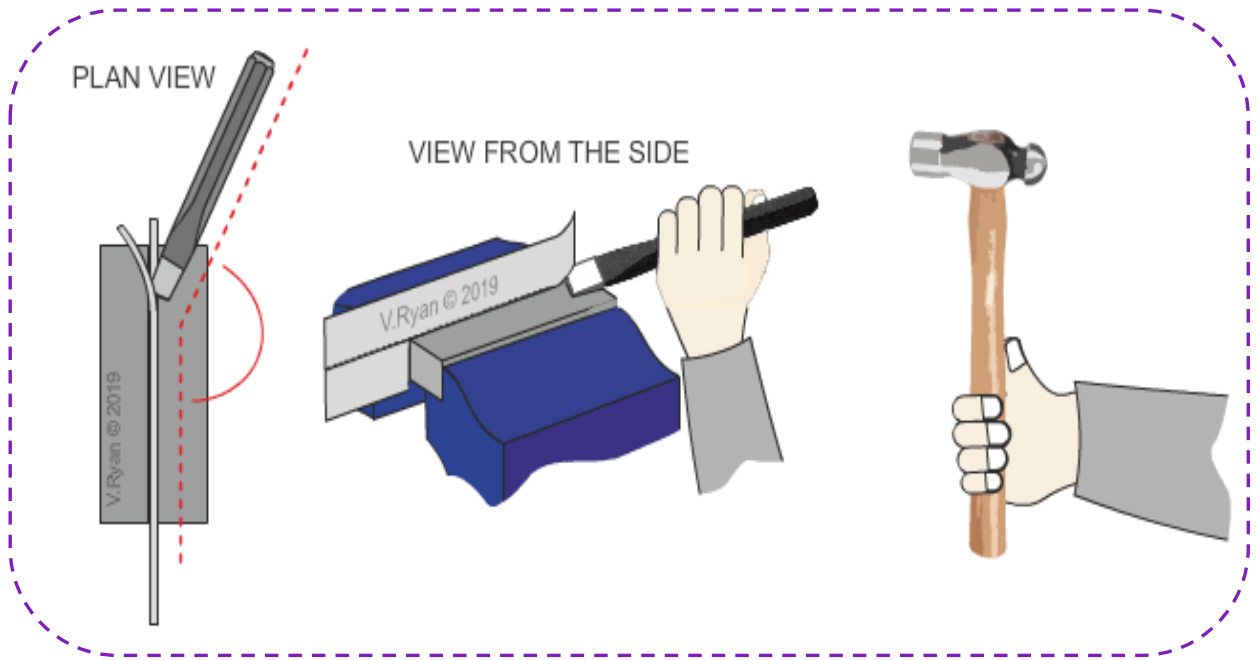
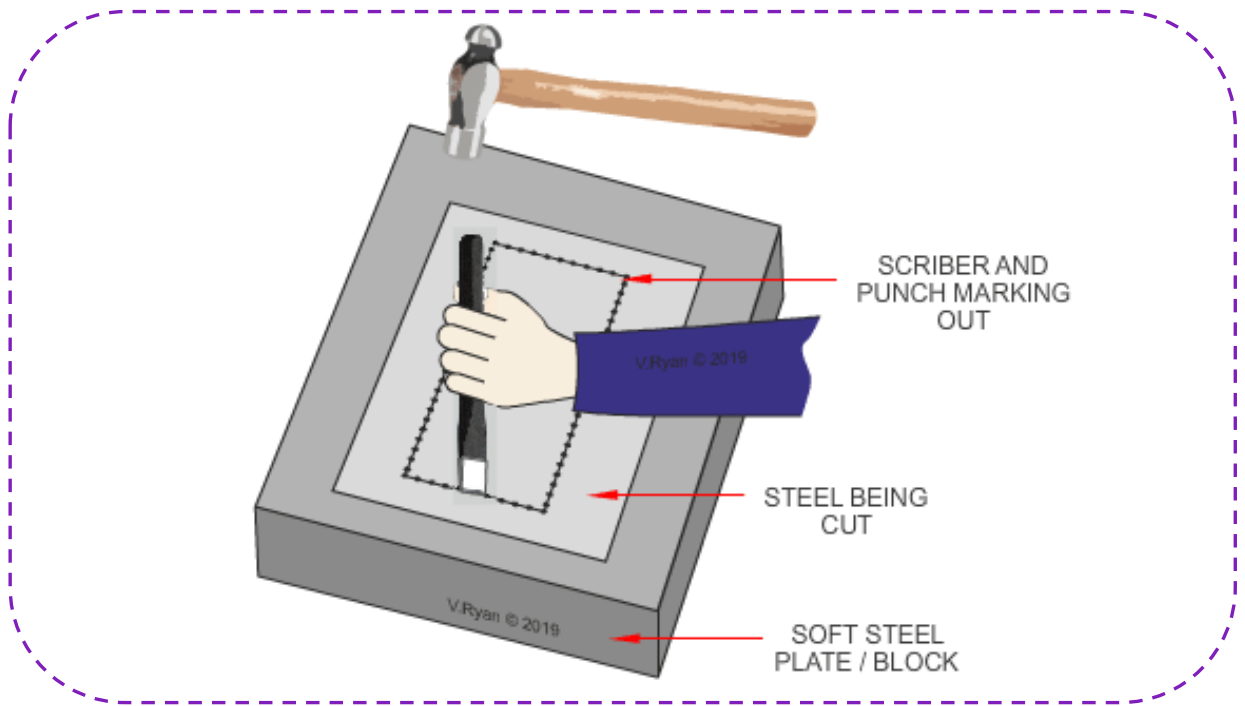


Figure 8 - Diamond Point chisel.[14]

# Chisel Technique

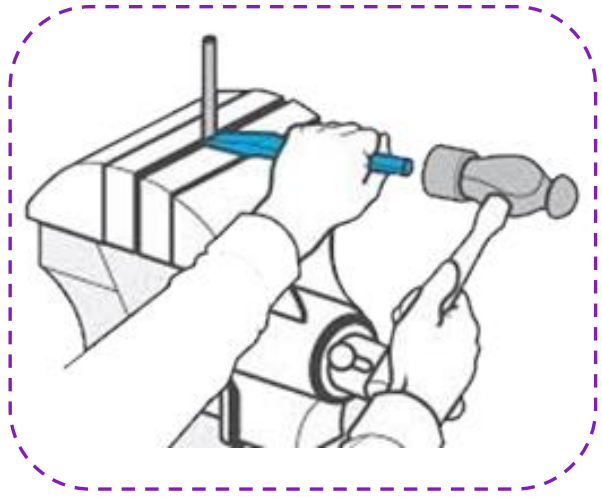
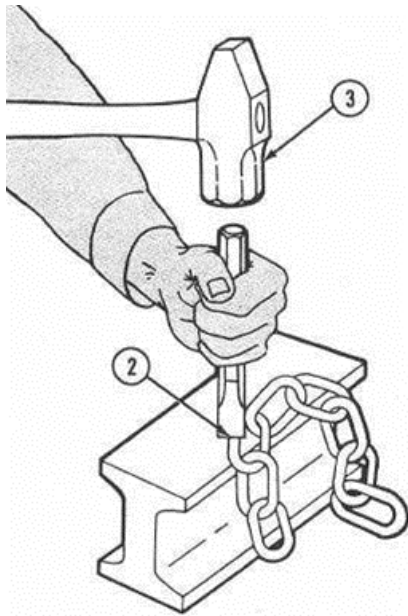


Cutting steel sheet with a flat cold chisel.[16]



Cutting sheet plate with a flat cold chisel.[16]

## Chisel Application



Cutting metals using chisel and hammer

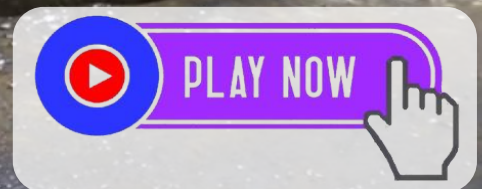
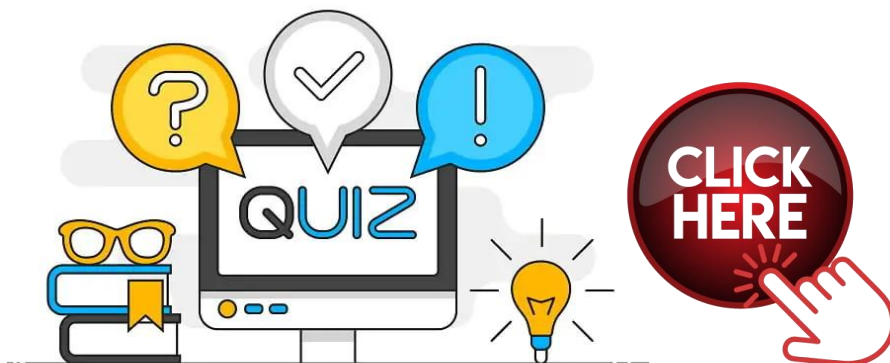


Figure 9 : How to properly use cold chisel [17].



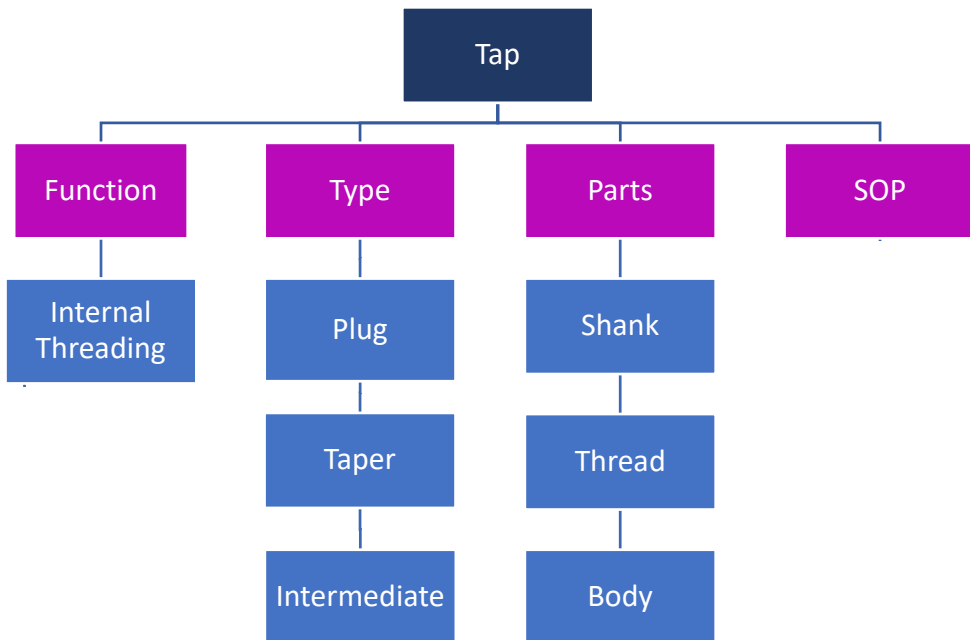
# EXERCISE

1. What is a chisel.
2. State 4 parts of a chisel?
3. What is chisel used for? Why do people use chisel?
4. What is the different between 4 types of chisel.
5. Which chisel is used for cutting key ways?
6. What tool is used with a chisel.
7. Draw and label four types of chisel.
8. What is the process of chiseling
9. How to use a chisel correctly.



**ONLINE QUIZ - CHISEL**

## 1.5 Tap



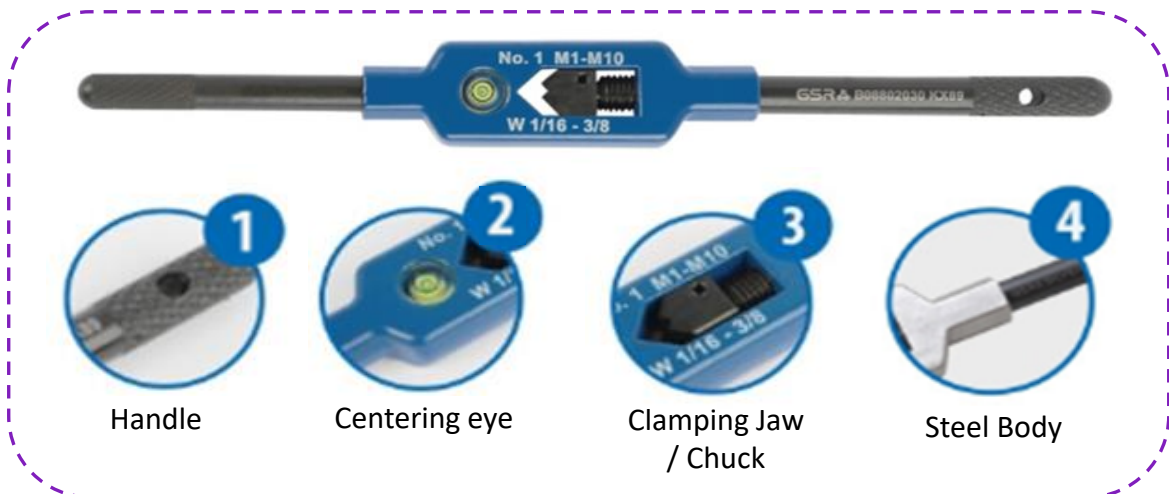
# Tap

- Used for **manual internal threading** operation.
- A tap is a threaded tool that **cuts** or **forms threads** in the **inside of a hole**.
- Materials for Tap – **High Speed Steel** is good for all-purpose application, while **Cobalt and Carbide** are more durable and can handle tougher materials.

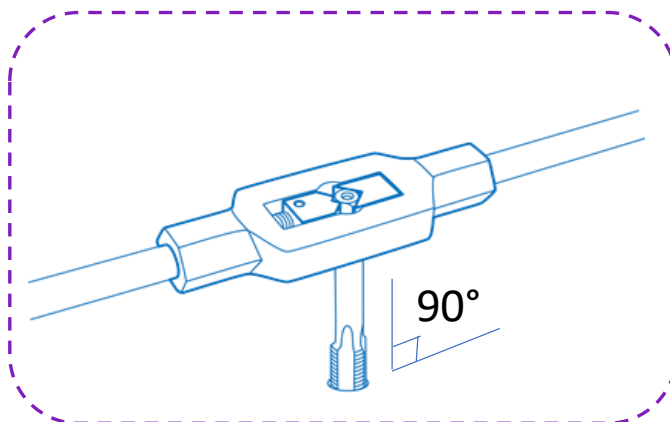


## Tap Wrench

- Tap wrench is a **holding tool** to rotate taps by hand.
- Consists of a handle with a chuck at one end that can be tightened to hold the tool securely, and a T-shaped handle at the other end that allows the user to apply torque to the tool.
- The chuck usually adjustable to accommodate tools of different sizes[18].



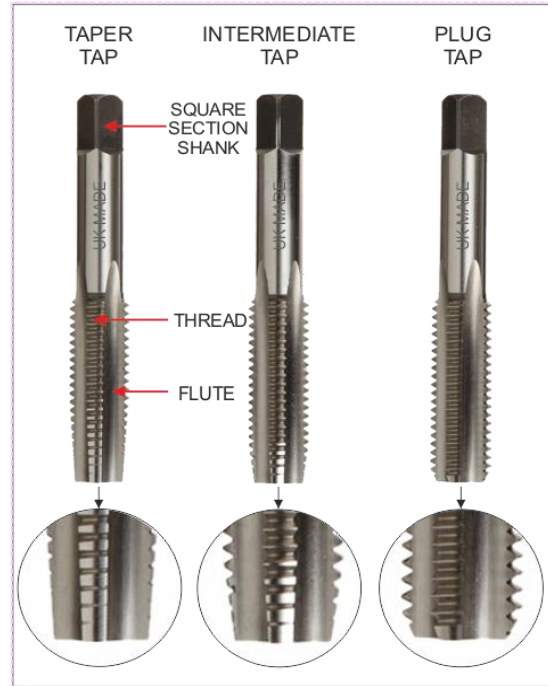
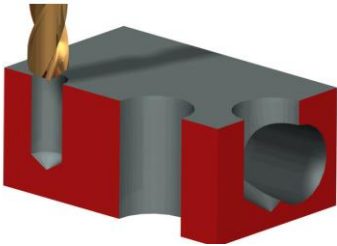
Adjustable Tap Wrench



Tap wrench is holding the tap. Tap is 90° apart from workpiece

## Type of Tap

Blind Hole refers to a hole in a workpiece that doesn't penetrate to the other side of the part.



Types of Tap [19]

### Taper Tap

- Has the longest which is 7 - 10 thread chamfer of the three
- Use as a guide in starting the cutting action in blind holes.

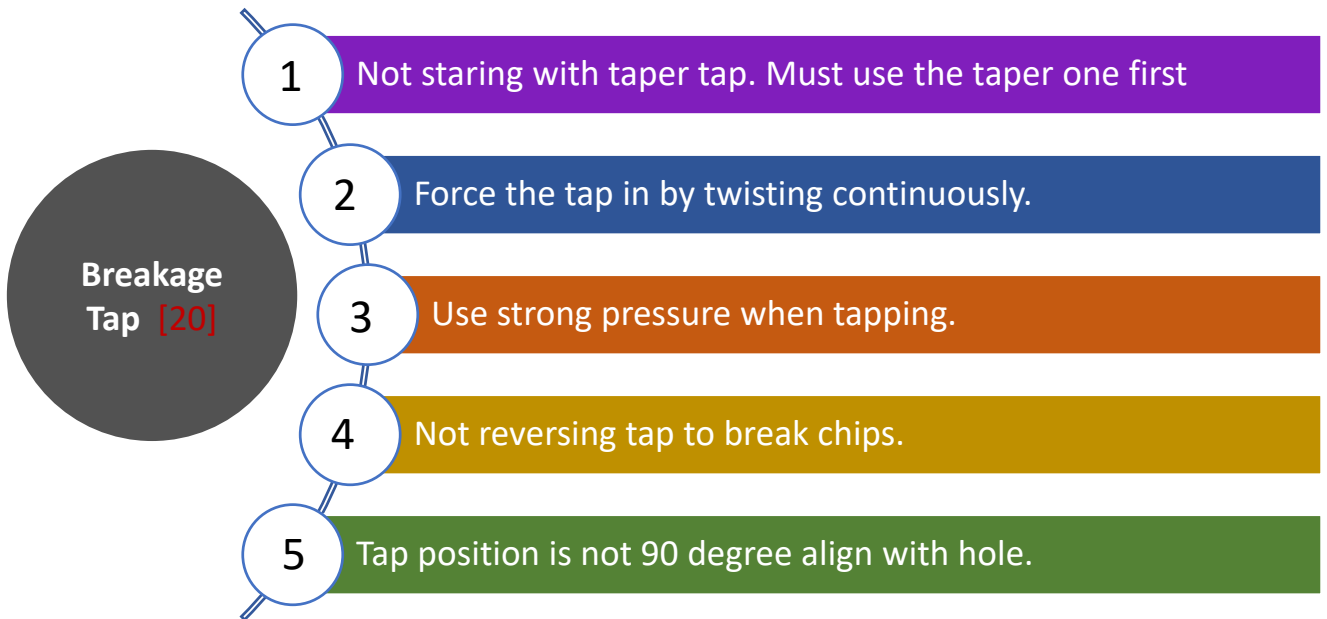
### Intermediate Tap

- Has about 3 - 4 thread chamfer .
- Used after the taper tap to cut the thread as far as possible.

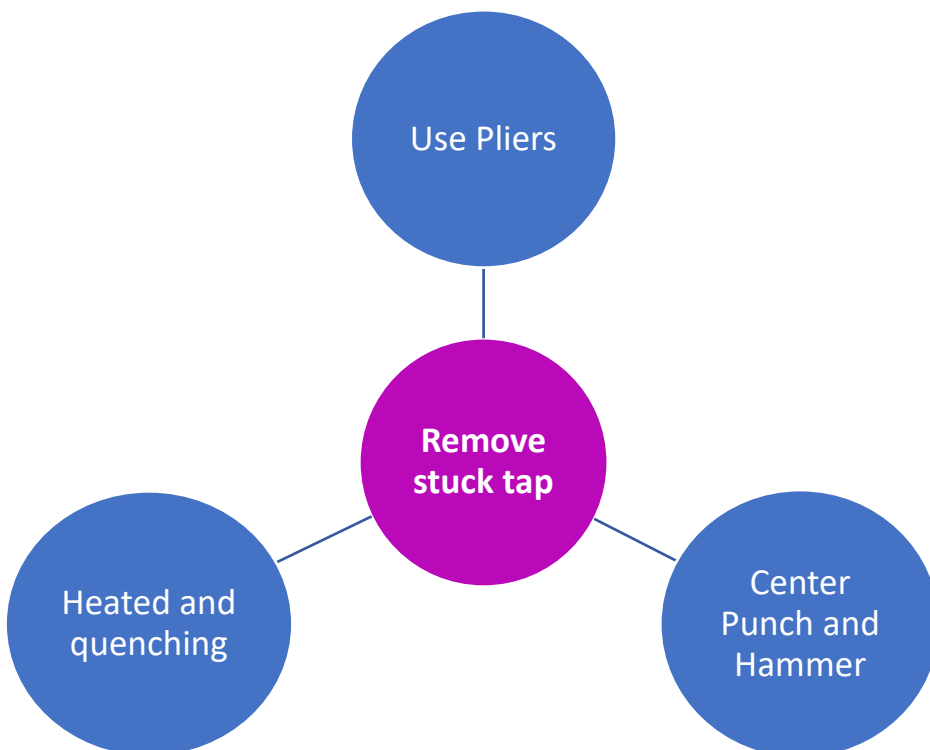
### Bottoming Tap

- Has 2 thread chamfer.
- Used in blind holes drilled.
- Used to finish the threads of a blind hole to the correct depth.

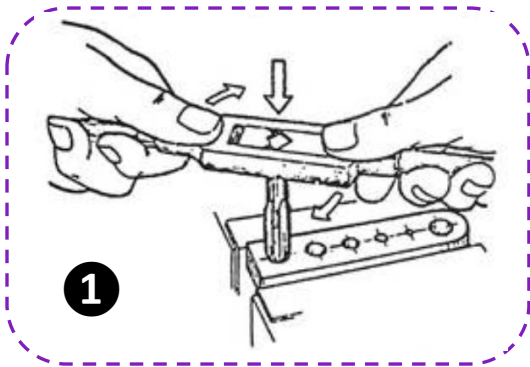
## Tapping faults and Causes



## How To Remove Stuck Tap



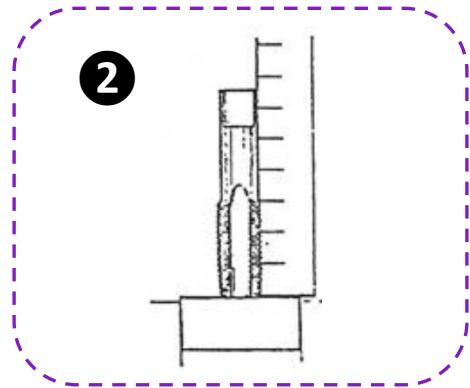
## Tapping a Through Hole



1

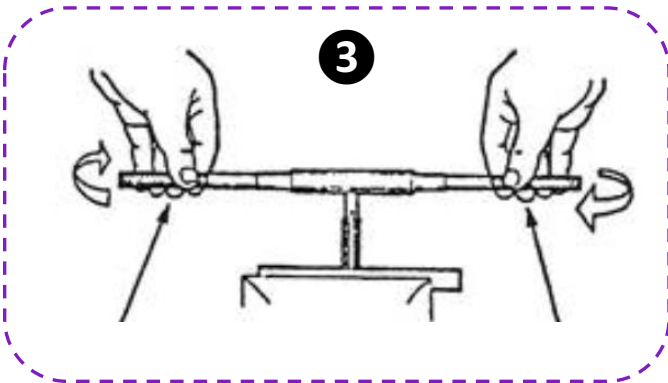
Starting the tap by apply downward pressure while turning

Check with try square to test the tap is 90° apart



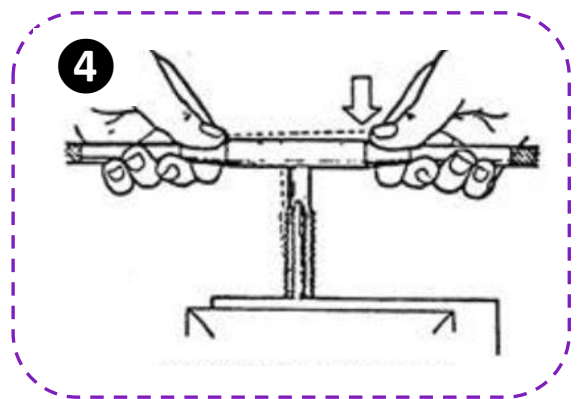
2

Slightly greater pressure while turning



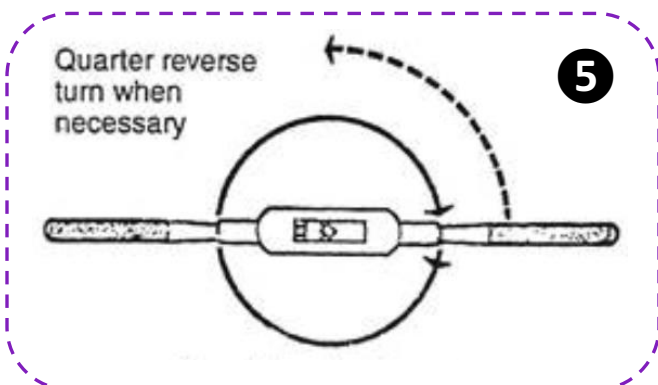
3

Apply constant turning pressure



4

Complete clockwise turn [20]

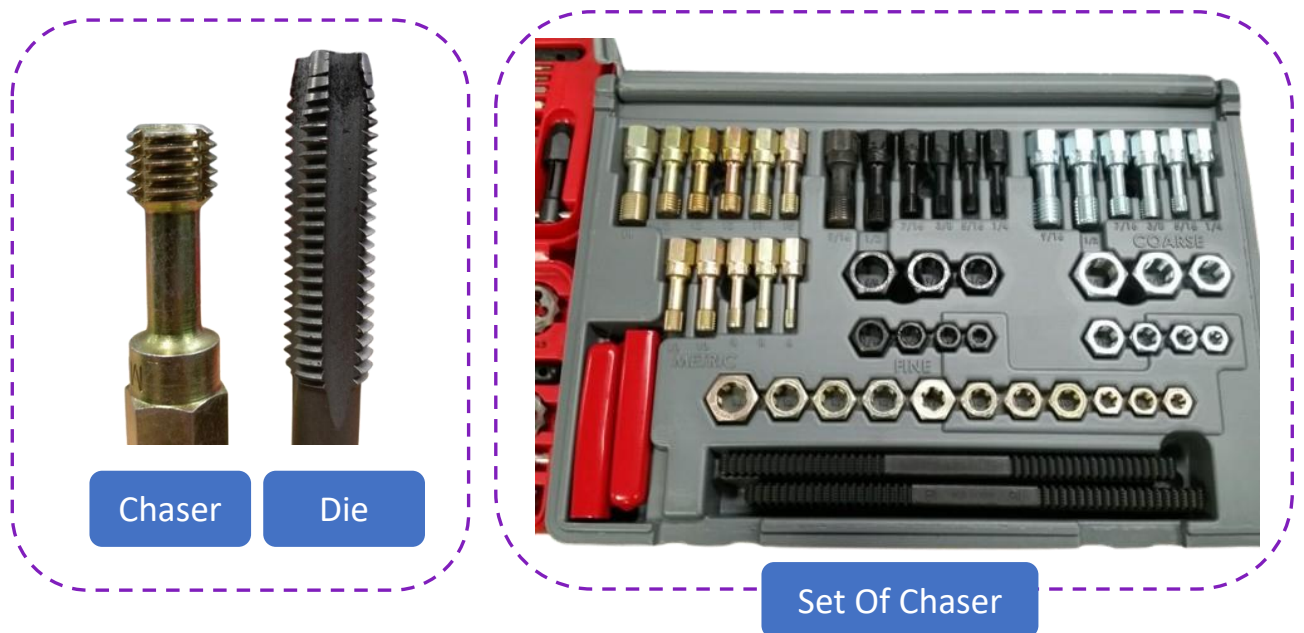


5

Quarter reverse turn when necessary



Figure 10: How to properly use Tap [21]



Chaser

Die

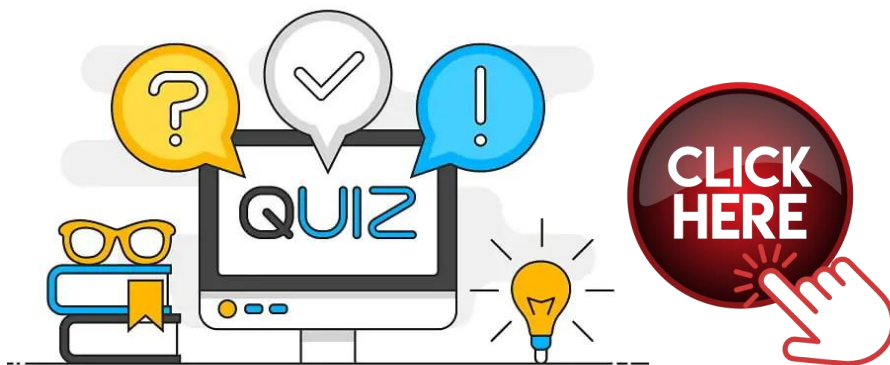
Set Of Chaser

- **Chasing** is a process to **clean up thread** and can be done using both Tap or Chaser.
- Using a tap to clean thread will generally **removes some material**, resulting in a **looser** and **weaker threads**.
- A Chaser is a **special dies**, generally used by machinist to clean threads.
- Chasers **not designed to cut new thread**, but for **cleaning rusty** or **damaged thread**.
- Chasers are made of **softer materials** and **don't cut new threads**. [22]



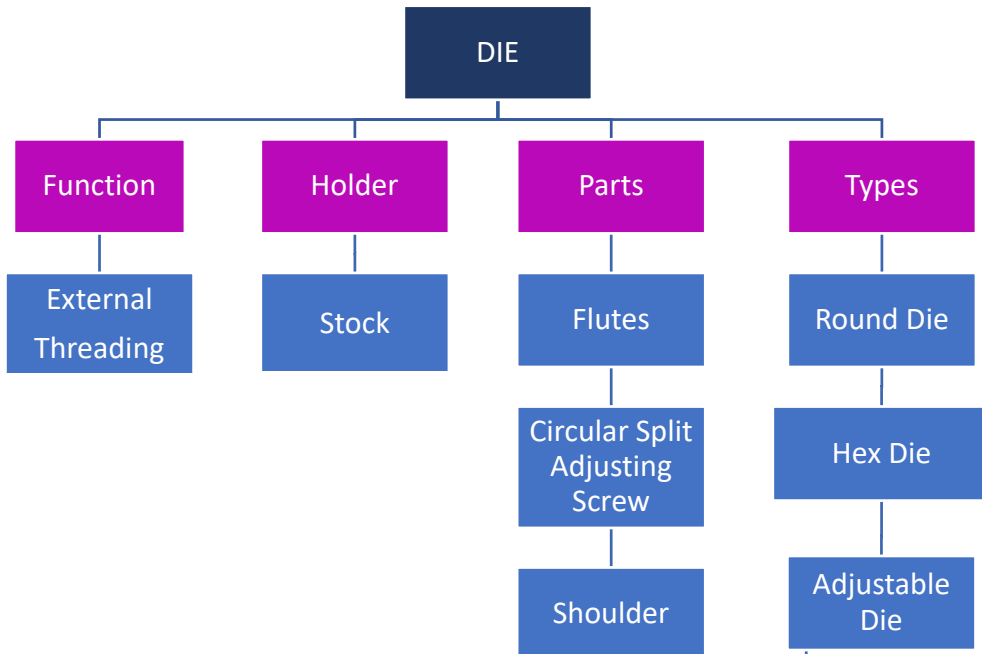
# EXERCISE

1. Describe the application of Tap.
2. Name 3 types of Tap.
3. Identify the function of 3 tap mention in Question2.
4. What is the materials used for Tap?
5. How to determine Tap size.
6. How to choose correct Tap to use?
7. How to use Tap wrench safely?
8. What is the strongest type of Tap?



## ONLINE QUIZ - TAP

## I.6 DIE



## 1.6 Die

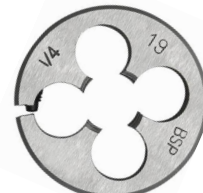
- Used to **cut external threads** on round bars and on pipes by **rotating die** that is **held in stocks** [20].
- Used for repairing threads in stripped holes or bolts.
- Die is divided in two types solid die and adjustable die.
- Different types of die shape such as round dies, hex dies, square, cone [30] and adjustable dies, each tailored to specific threading applications [25].



Round die



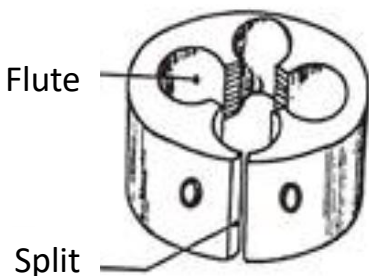
Hex die



Adjustable die

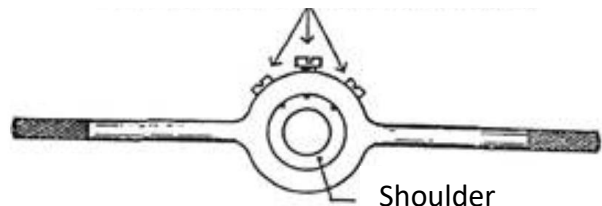
### Types of Die [26,27,28]

- Die stocks also known as die holders are tubular parts that are used for fitting and turning dies when cutting or shaping materials.
- Die holder is the holding tool for dies.



Die

### Circular Split Die Adjusting Screws



Die stock

### Parts of die and die stock [20]

## Type of Hammer



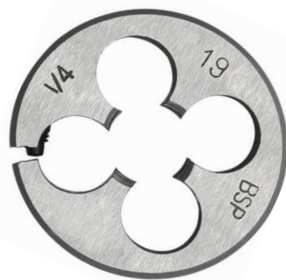
Solid Die - Round shape

- Type of die that has a cylindrical shape
- Easier to handle and turn with a die wrench or by hand
- Less precise compared to hex die. [29]



Solid Die - Hex shape

- Die that has six sides
- The six-sided shape of the hex die makes it easier to grip and turn with a wrench or pliers.
- More precise than round dies because distribution pressure is more even. [29]



Adjustable die

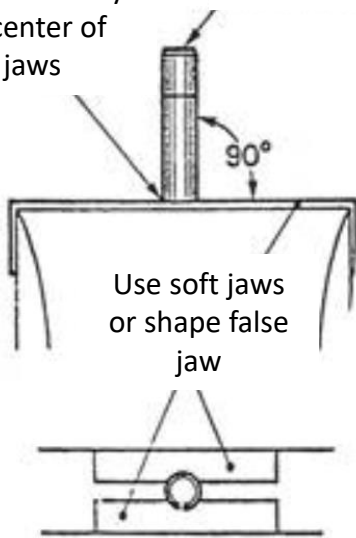
- Because the size of the opening or split, the adjustable die allows the size and shape of the die to be adjusted to produce different types or sizes of parts [31].

# How To Create An External Thread On A Rod.

**1**

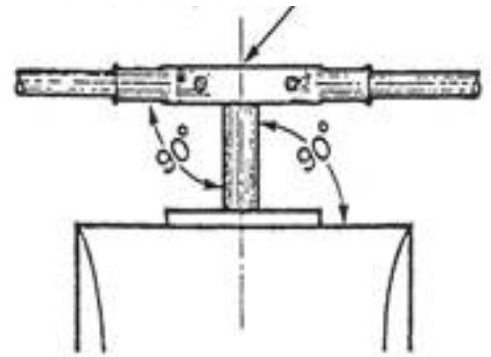
Hold vertically  
in center of  
jaws

File to mark



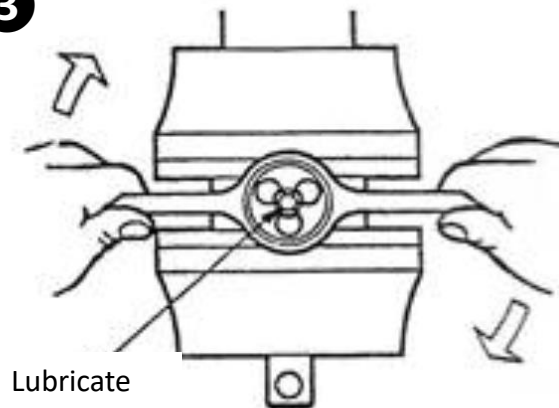
**2**

Keep die square with rod



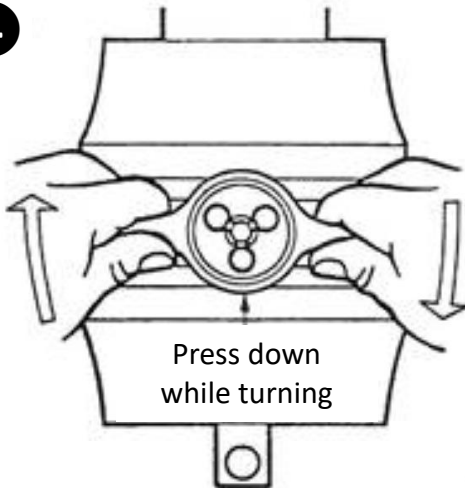
CHECKING BY SIGHTING

**3**

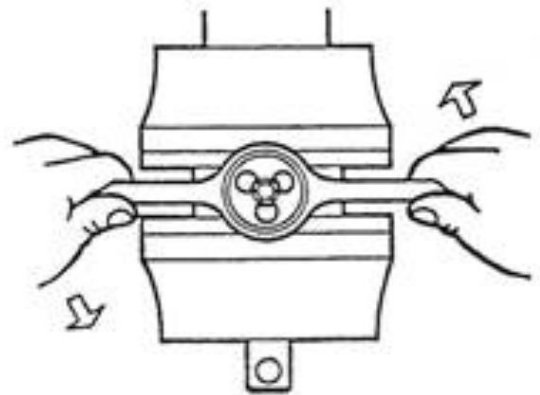


TURN STEADILY

4



5



USE SHORT REVERSE TURN TO  
BREAK CHIPS [20]



#### Cause Of Broken Die Teeth [20]

- Oversize workpiece
- Not starting with chamfered side of die
- Die not perpendicular to workpiece.
- Not reversing die

#### Cause of Stripped Thread [20]

- Cut too heavy
- Clogged flutes
- Lack of cutting fluid
- Not reversing die

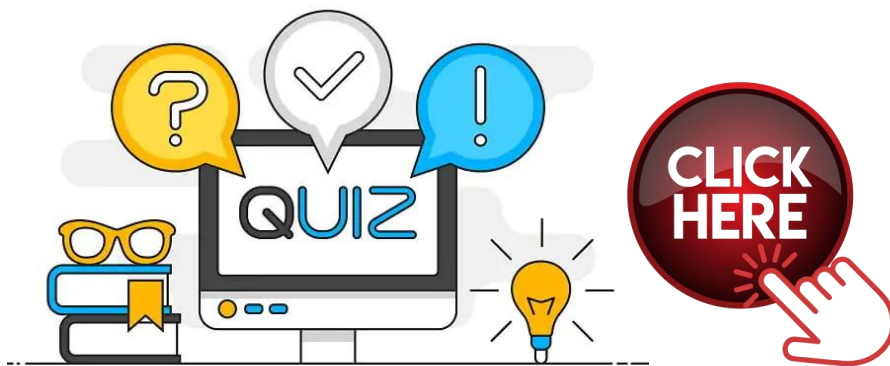


Figure 11 : How to properly threading using Die. [24]



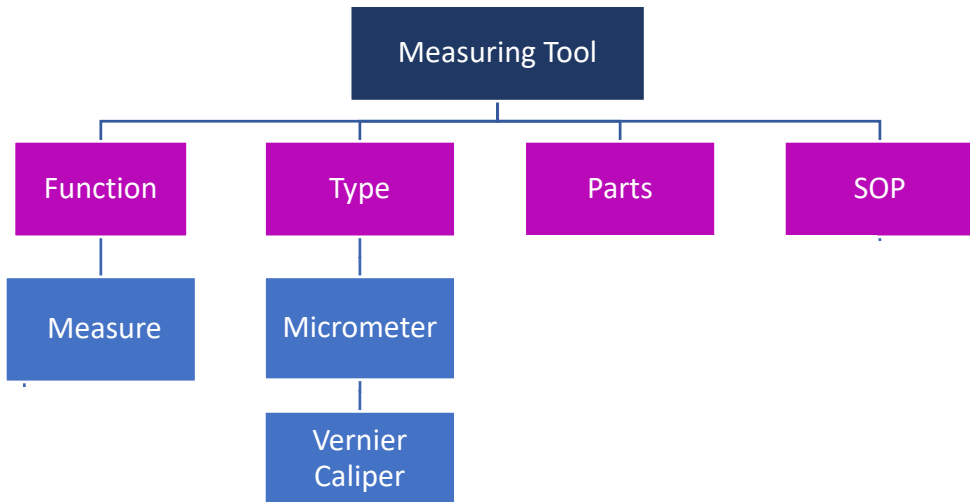
# EXERCISE

1. What is the purpose of Die.
2. Describe the application of Die.
3. What is correct method to clean the thread?
4. Explain the differences between Chaser and Die.
5. Why it is safe to use Chaser?



## ONLINE QUIZ - DIE

# CHAPTER 2 – MEASURING TOOL



# 2.0 MEASURING TOOL

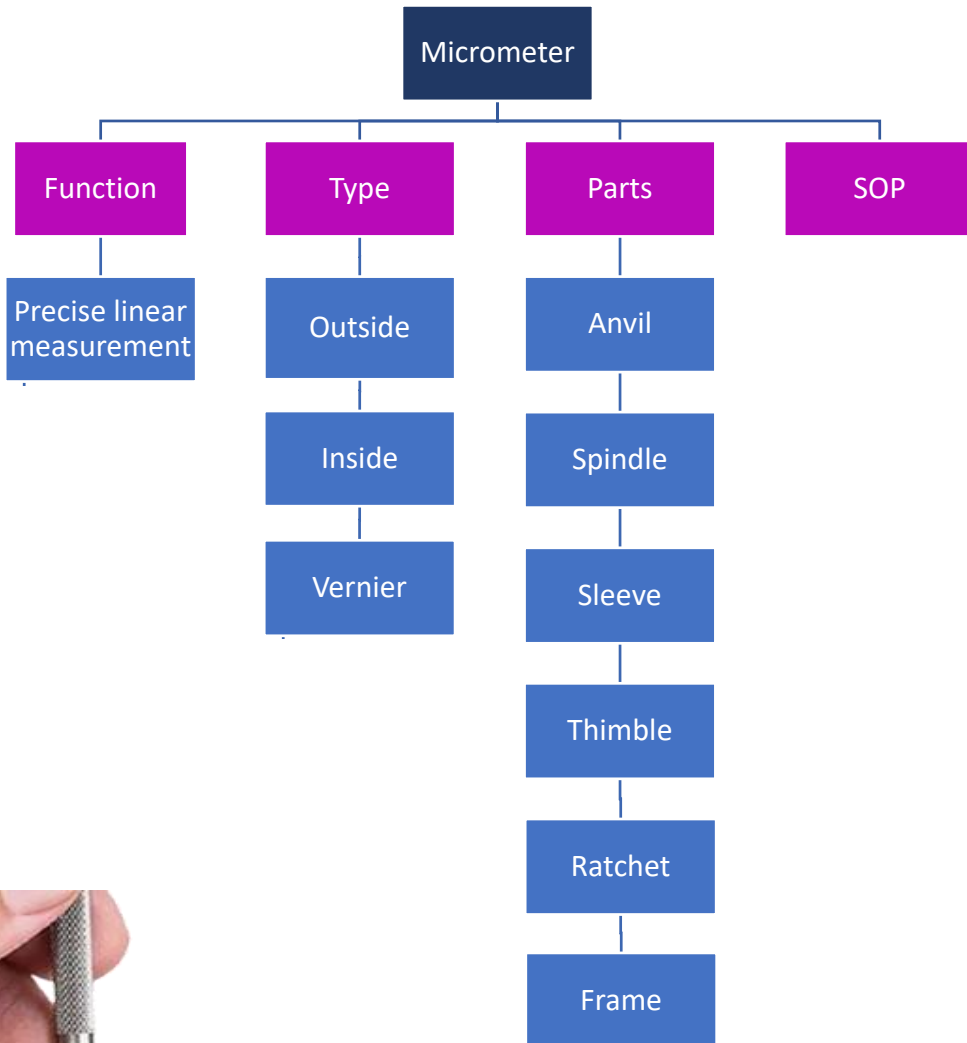
After studying this topic student will be able to :

Explain the types, parts and uses of testing tools including

2.1 Micrometer

2.2 Vernier Caliper

## 2.1 Micrometer

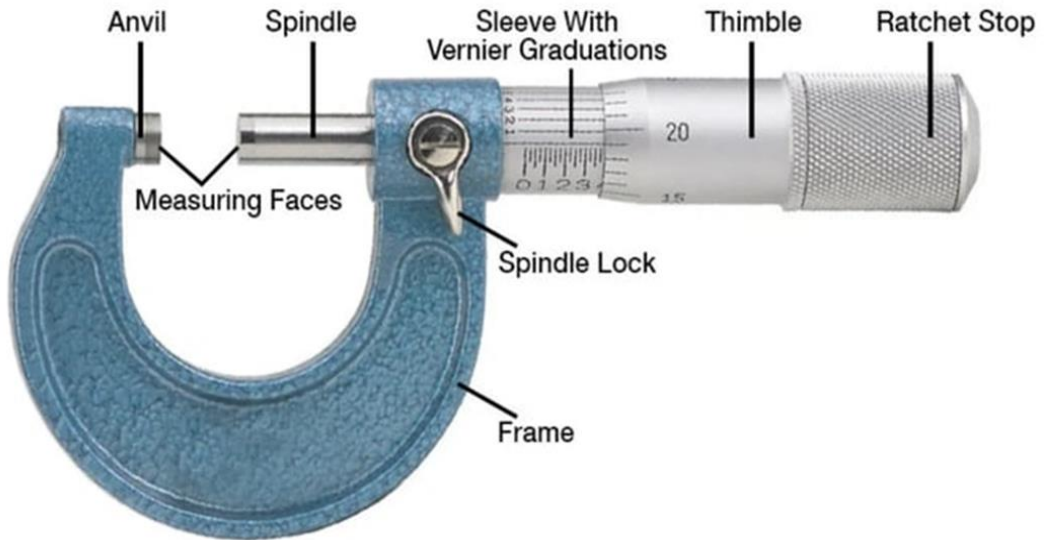


## 2.1 Micrometer

- A micrometer also known as screw gauges.
- It is an instrument used for making precise linear measurements of dimensions such as diameter, thickness, and lengths of solid bodies.
- It is made of a C-shaped frame with a movable jaw operated by an integral screw. [32]



## Part Of Micrometer



## Type Of Micrometer



Outside Micrometer

## Type Of Micrometer



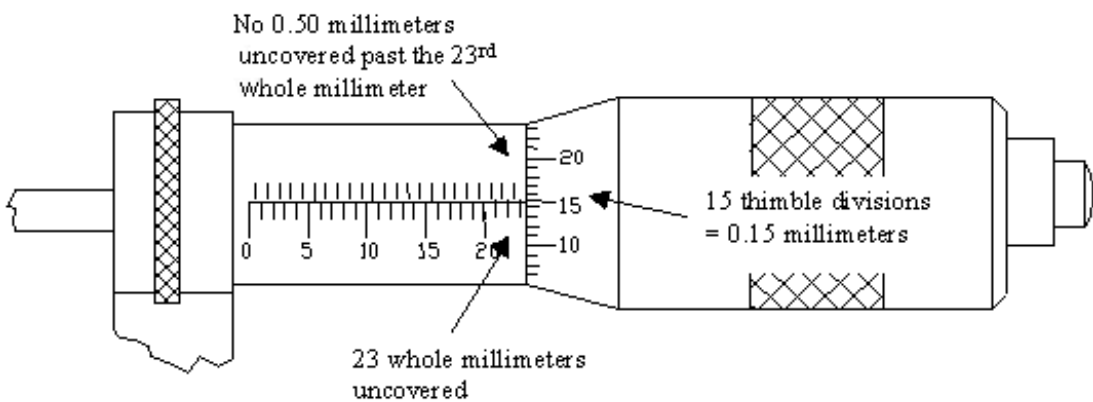
Inside Micrometer



Depth Micrometer

## How To Use Micrometer.

1. Get a soft cloth to clean the micrometer.
2. Attach the object between anvil and spindle to start measure.
3. Rotate the thimble until the spindle is firmly pressed against the object
4. Then rotate spindle lock to avoid any movement of spindle.
5. Read the sleeve measurement.
6. Read the thimble measurement.
7. Total up both reading. [33]



Sleeve Scale : 23.00 mm  
 Thimble Scale : 0.15 mm  
 Total : **23.15 mm**

Micrometer reading

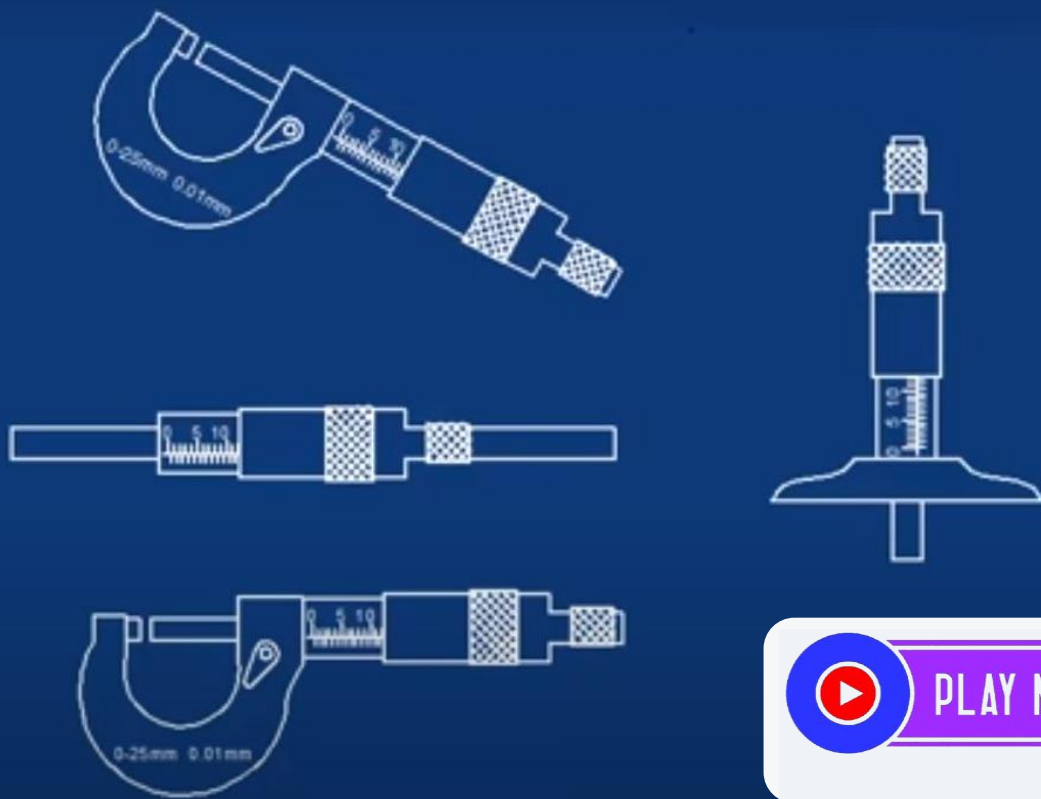
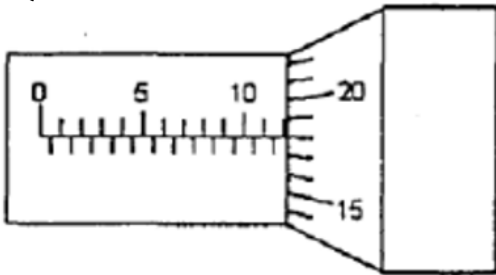


Figure 12 : How to use micrometer. [34]



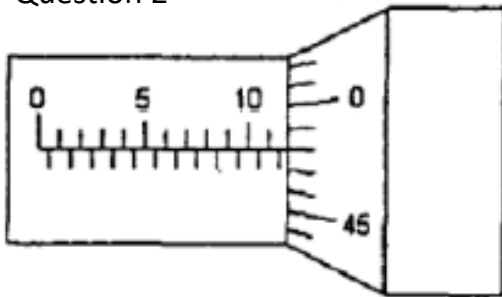
# EXERCISE

Question 1



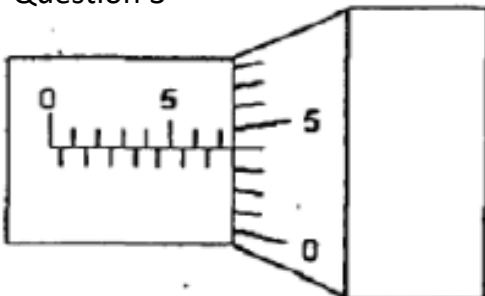
Sleeve Scale	:	_____
Thimble Scale	:	_____
Total	:	_____

Question 2



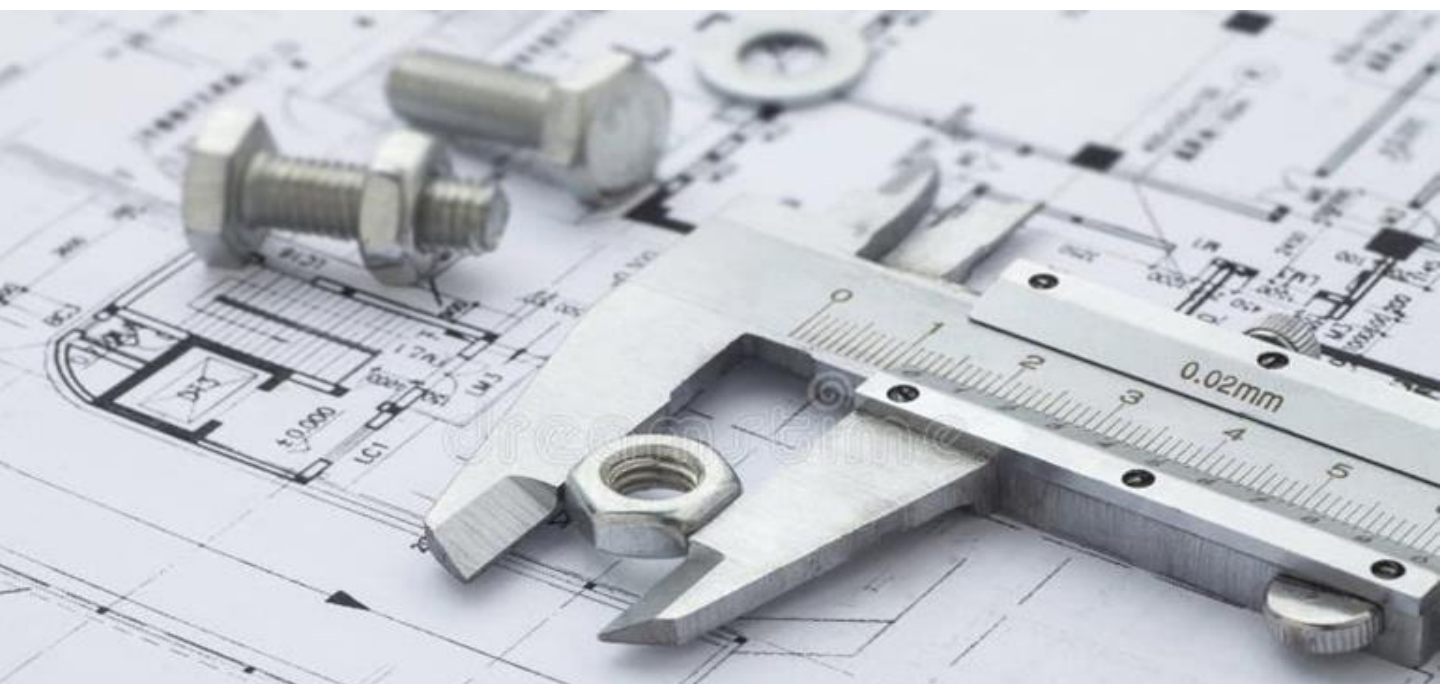
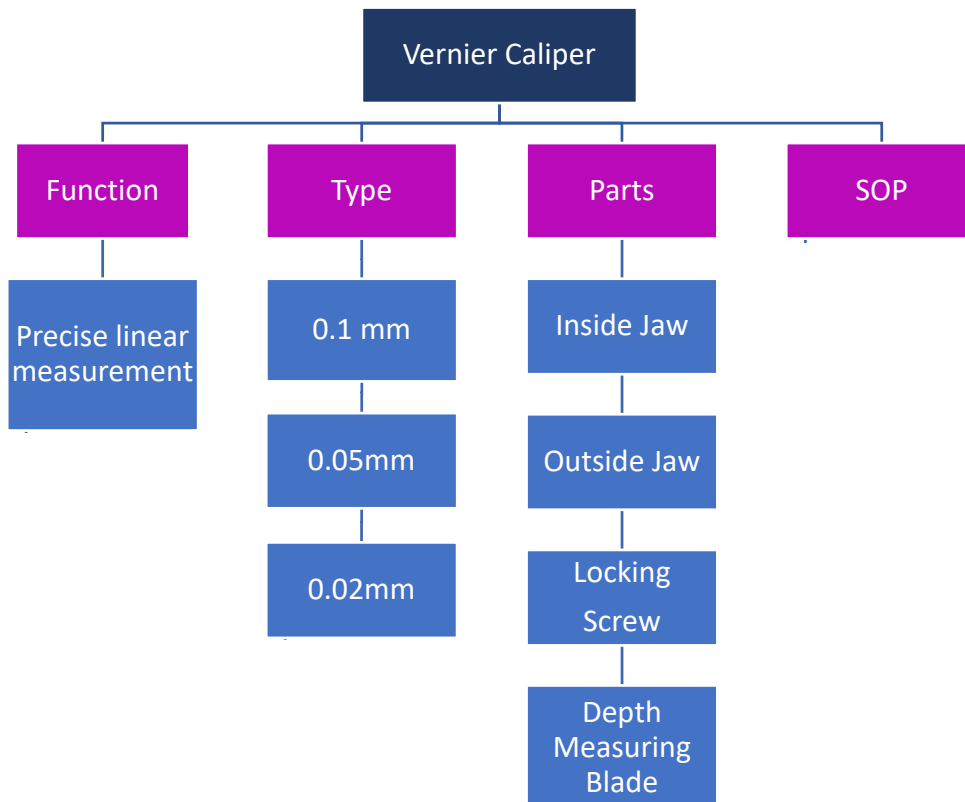
Sleeve Scale	:	_____
Thimble Scale	:	_____
Total	:	_____

Question 3



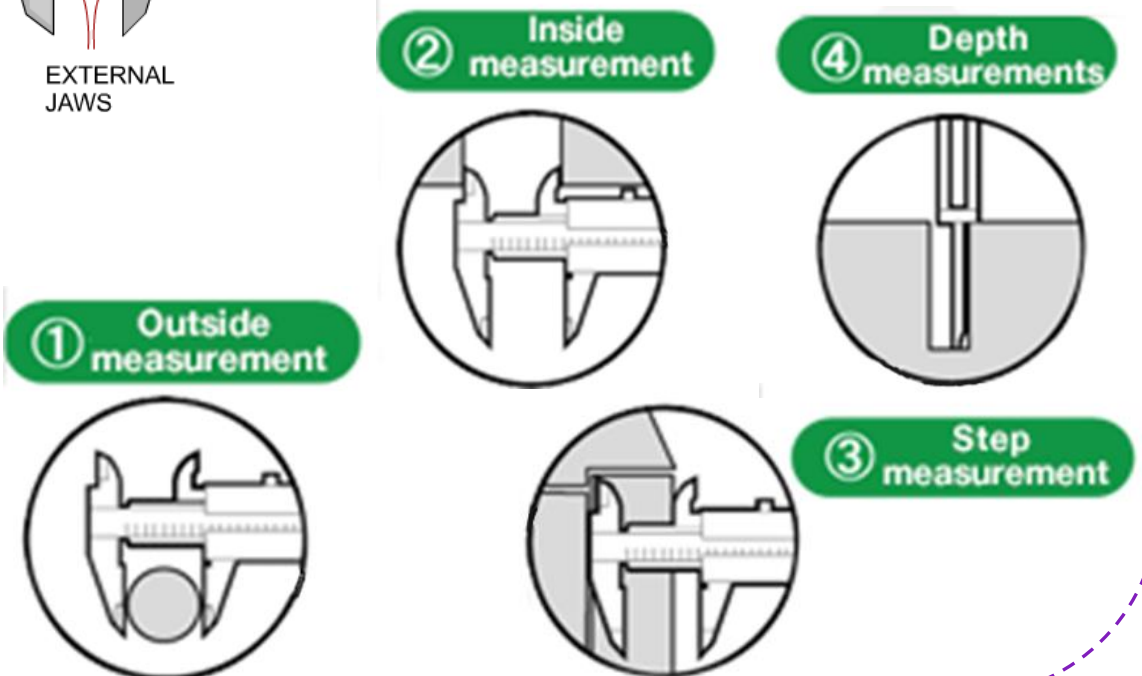
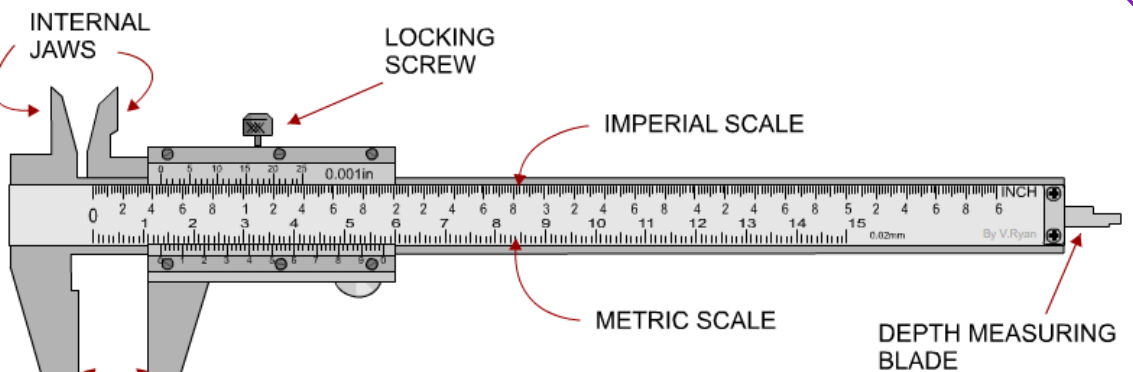
Sleeve Scale	:	_____
Thimble Scale	:	_____
Total	:	_____

## 2.2 Vernier Caliper



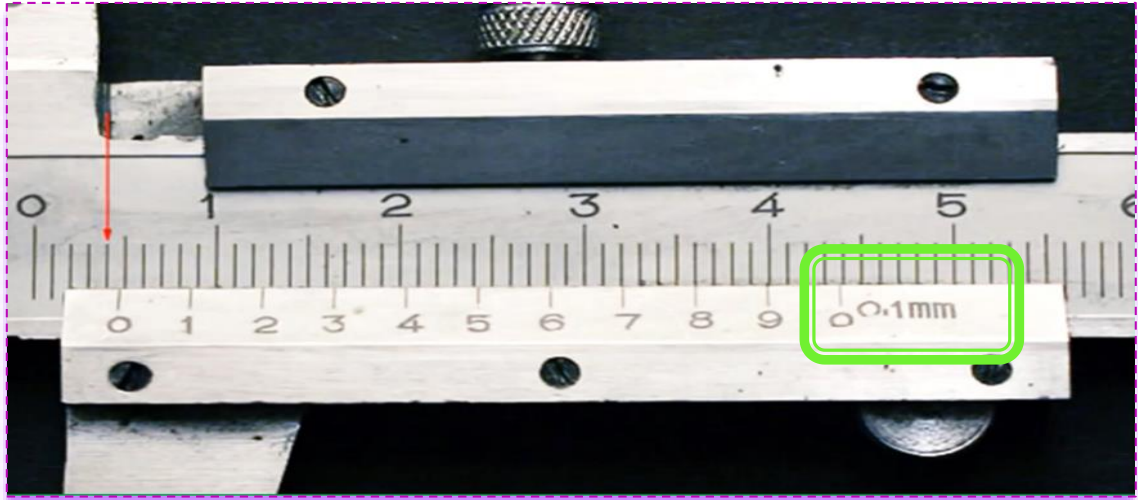
## 2.2 Vernier Caliper

- Used to **measure exact linear measurements** which is **distance between objects** for both **internal and external dimensions** accurately.
- To **inspect the dimensions** of an object. [36]



Part of Vernier Caliper. [35]

## Type Of Vernier Caliper



Metric Vernier Caliper with 0.1mm, 0.05 mm, and 0.02 mm Resolution

Reading Metric Vernier Caliper with 0.1 mm Resolution

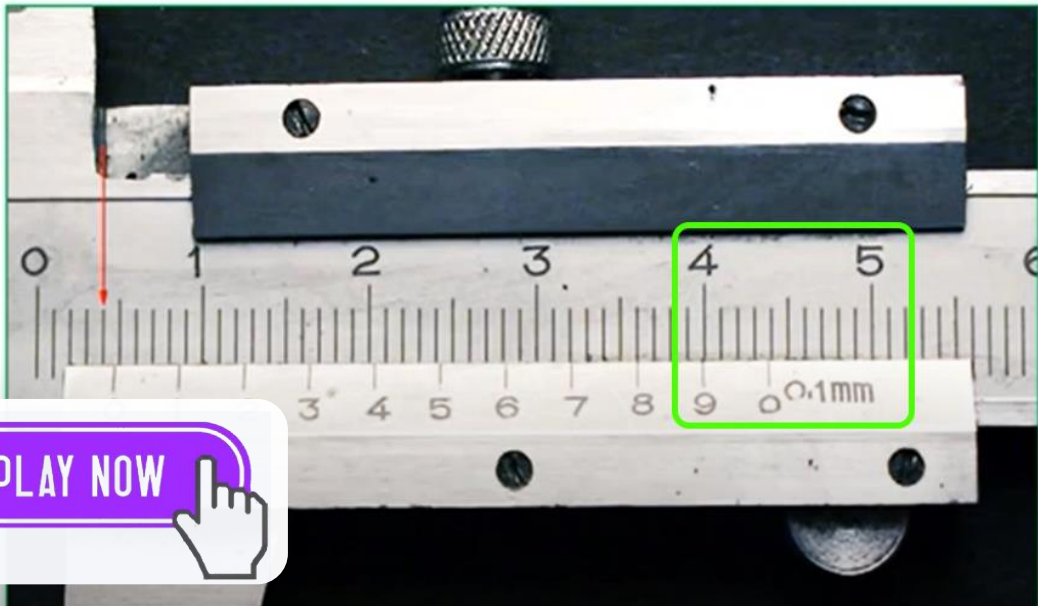


Figure 12 : How to use Vernier caliper (0.1mm) [36]

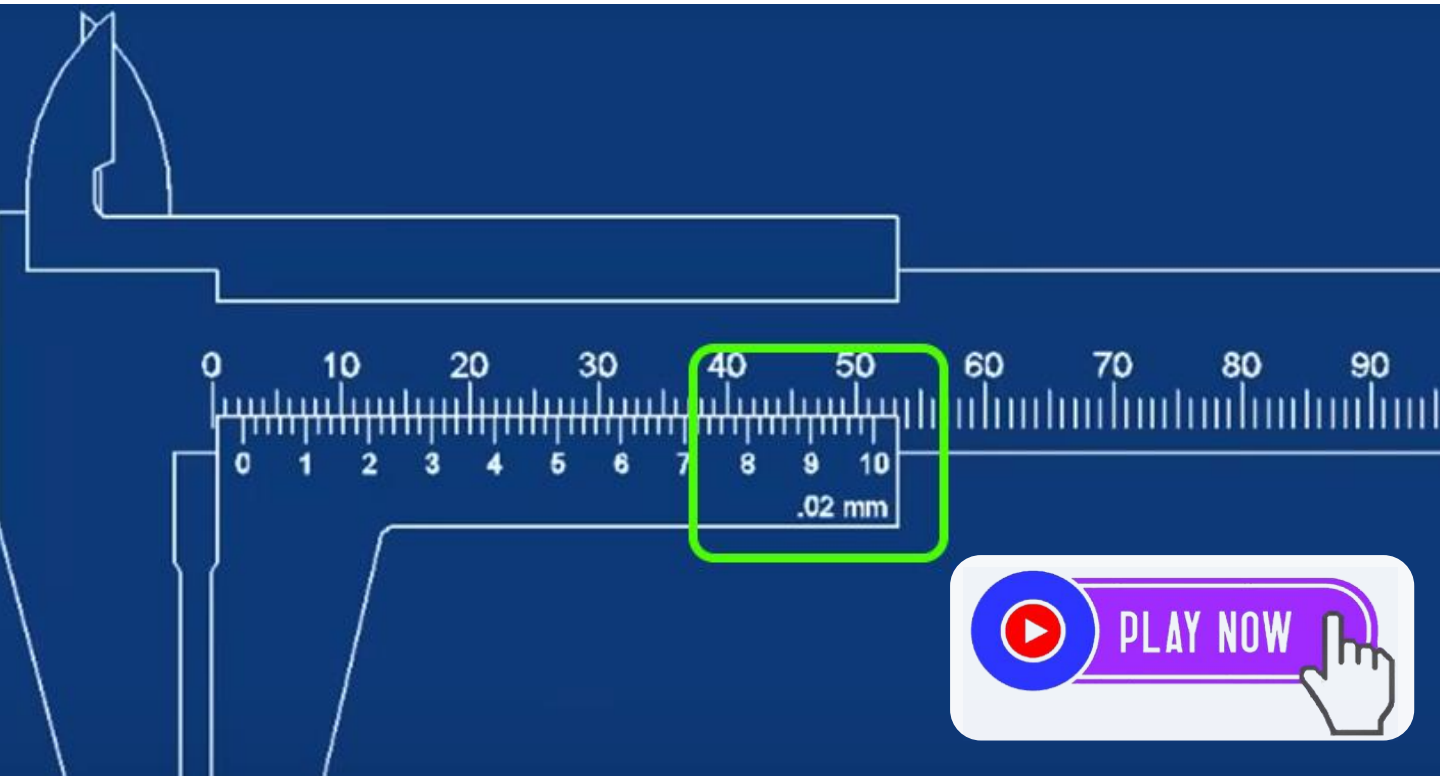


Figure 12 : How to use Vernier caliper (0.02mm). [37]

*Reading Metric Vernier Caliper with 0.05 mm Resolution*

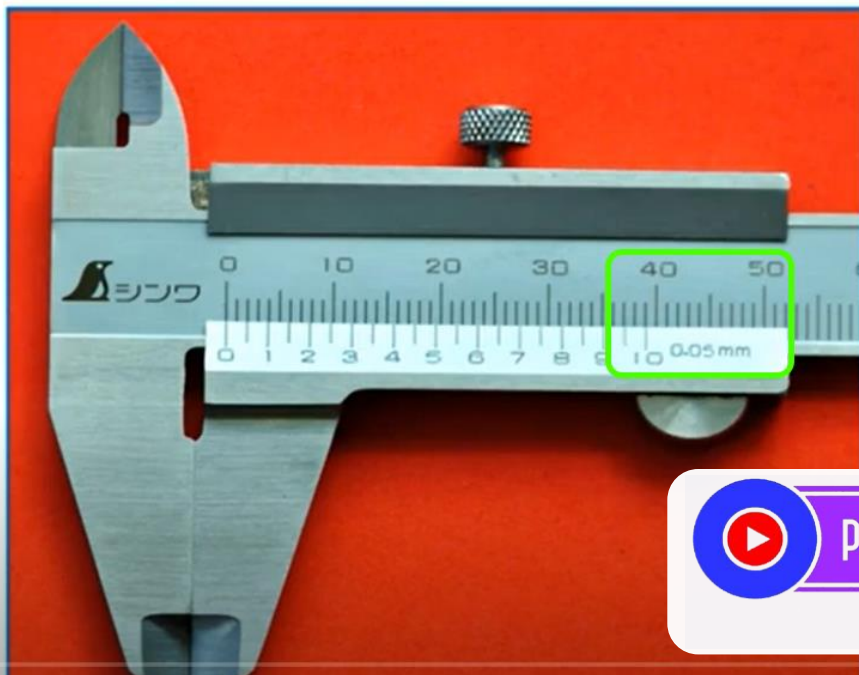


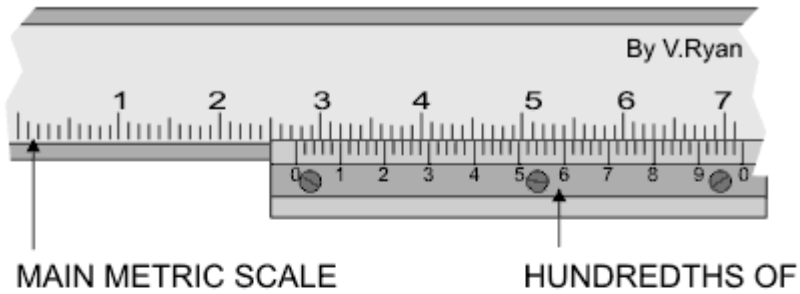
Figure 12 : How to use Vernier caliper (0.05mm) [38]

## How To Use And Read Vernier Scale.

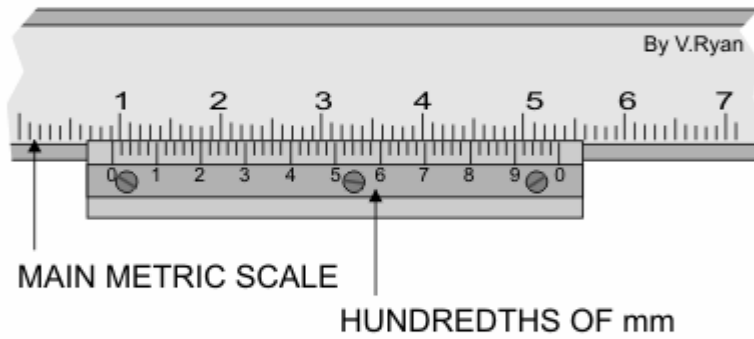
1. Prior to use, adjust the vernier caliper by first loosening it by rotating the locking screw counterclockwise.
2. As you close the jaws check that the 0 marks on the main and vernier scales line up. This stage is to guarantee a precise measurement at a later time. To obtain the precise measurement there are steps to adjust for the zero error if the caliper is not zeroed out from the start.
3. Then with the jaws open place an object between them and close the jaws to secure it.
4. After the jaws are positioned around or within the object tighten them by turning the locking screw in a clockwise direction.
5. Examine the main scale line that corresponds to the vernier scale zero.
6. Ascertain which mark on the Vernier scale corresponds to which line on the main scale.
7. Add the two measurements together. [39]

## How to use and read vernier scale

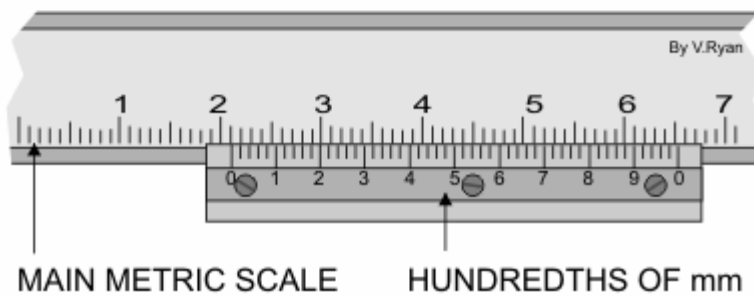
### QUESTION 1:



### QUESTION 2:



### QUESTION 3:





# EXERCISE

1. What is a Vernier caliper.
2. Describe Vernier caliper applications.
3. What are the main parts of Vernier caliper
4. Why is the Vernier caliper more accurate?
5. What are the advantages of Vernier caliper?
6. How to read the depth using Vernier caliper?
7. What are precautions while using a Vernier caliper.

prof. Stefanelli - www.stefanelli.eng.br

0 1 2 3 4 5

0 1 2 3 4 5 6 7

**CLICK HERE**

2 Interpretation: [ ] FOLD

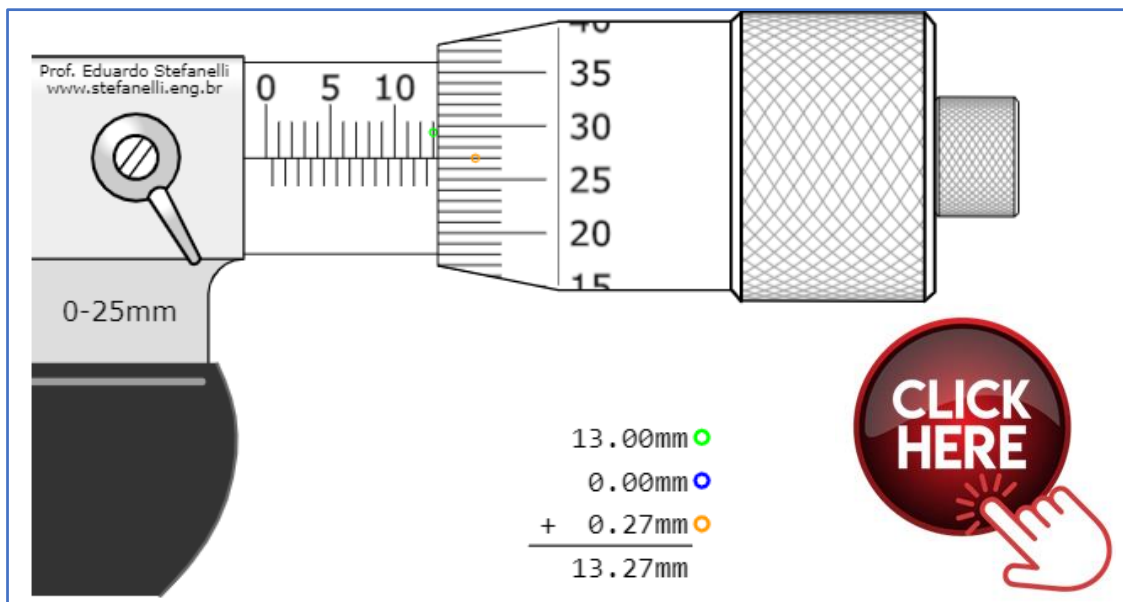
1

**CLICK TO EVALUATE YOUR PERFORMANCE. [40]**



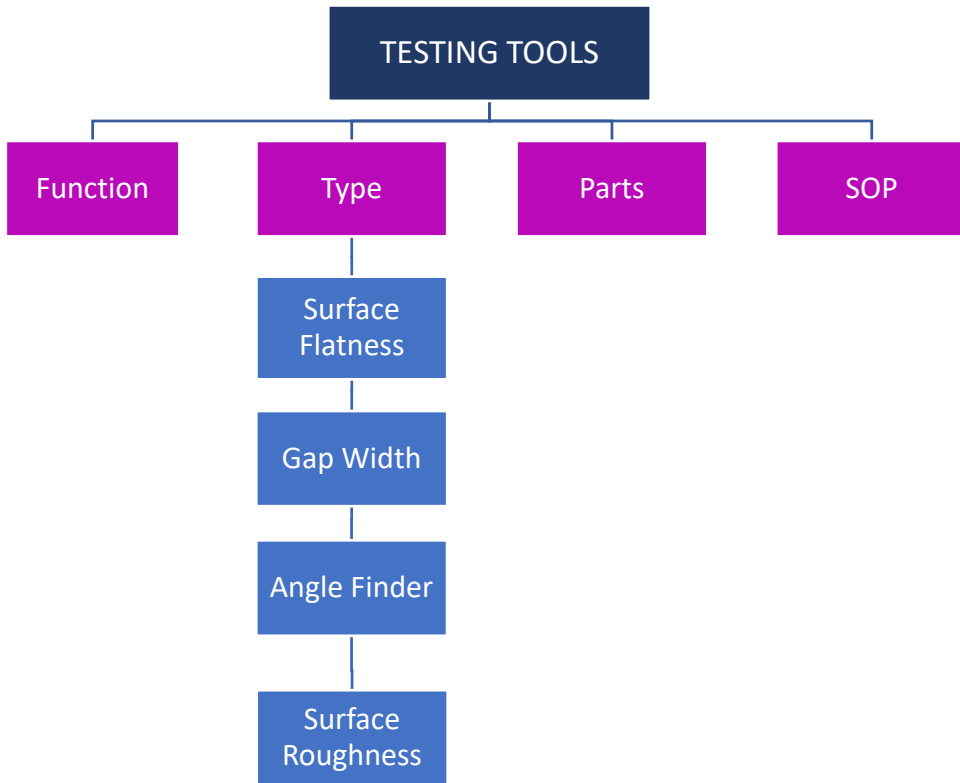
# EXERCISE

1. Identify the function of micrometer.
2. Name part of micrometer that holds anvil and barrel.
3. State THREE types of micrometer commonly use.
4. Which part of micrometer responsible to enable thimble movement.
5. What is a locknut in a micrometer.



CHECK MICROMETER READING HERE [41]

# CHAPTER 3 - TESTING TOOL



# 3.0 TESTING TOOLS

After studying this topic student will be able to :

Explain the types, parts and uses of testing tools including

3.1 Surface Flatness

3.2 Gap Width

3.3 Angle Finder

3.4 Surface Roughness



## 3.1 Surface flatness



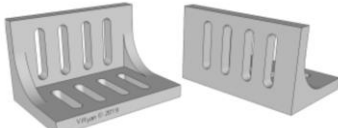
L Square

To inspect squareness, straightness flatness, and perpendicularity of workpiece



Surface Plate

The surface plate is used as a baseline for all workpiece measurements.



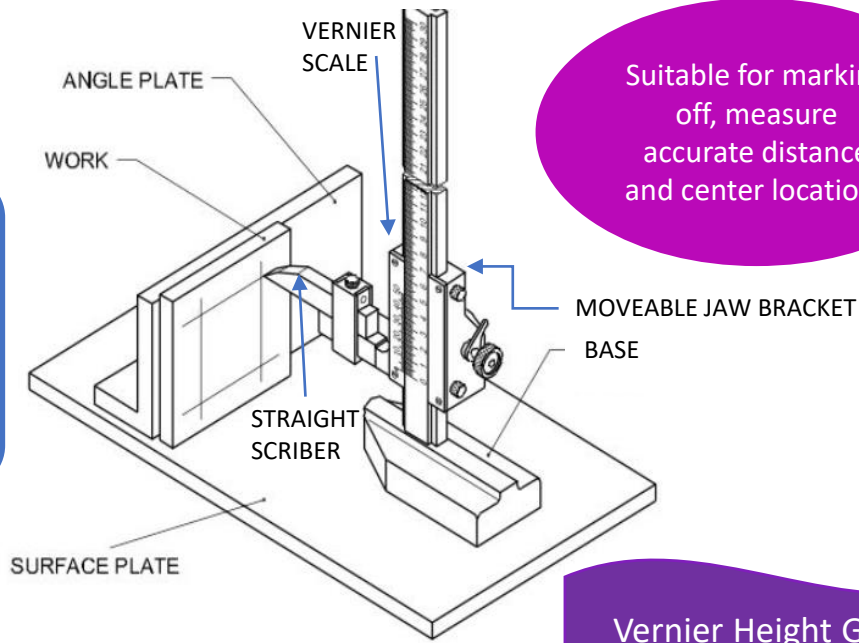
Angle Plates

A holding device used to support work piece when marking.



High Gauge

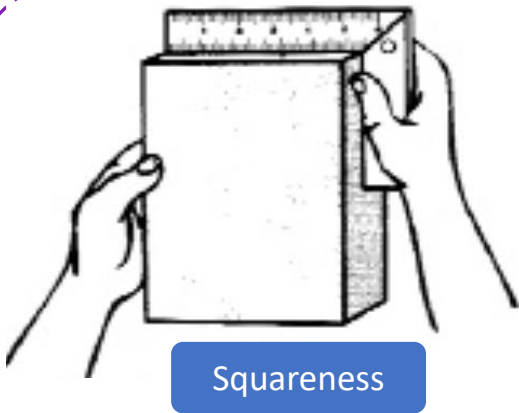
To inspect squareness , straightness and flatness, perpendicularity of workpiece.



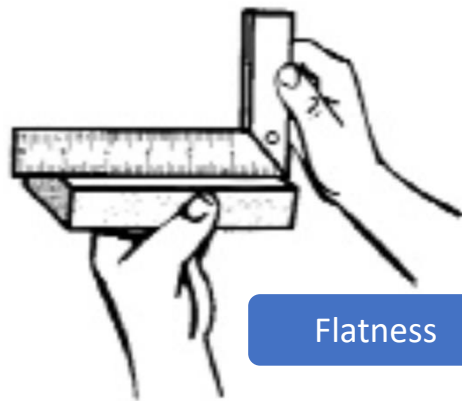
For straight scribe- zero setting measured at level above datum

Suitable for marking off, measure accurate distance and center locations

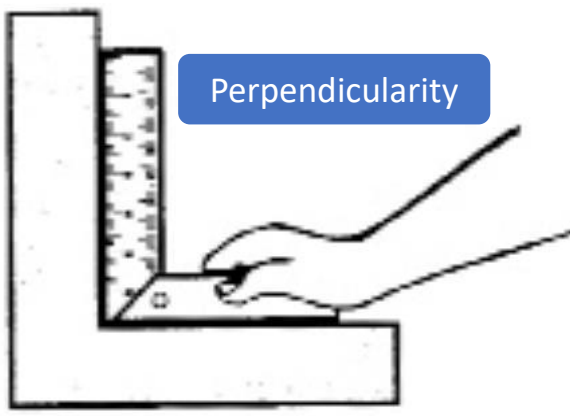
Vernier Height Gauge



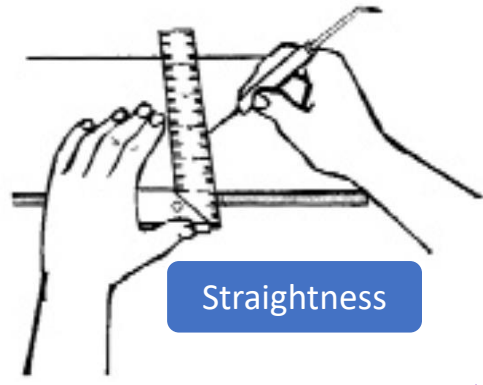
Squareness



Flatness



Perpendicularity



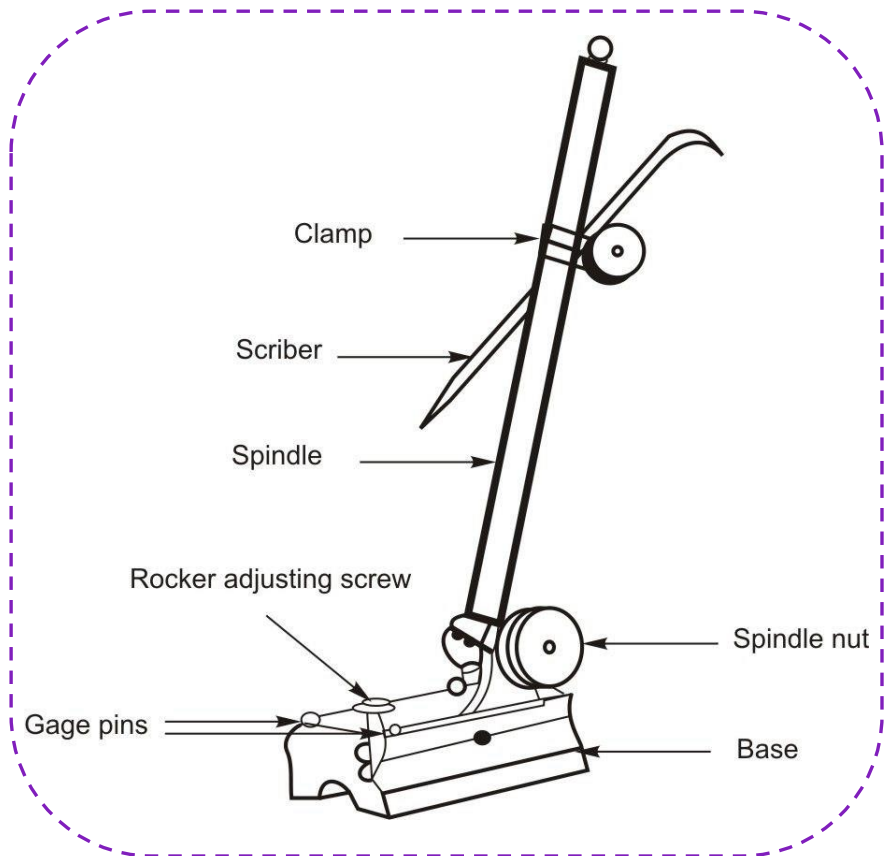
Straightness

L square are use to **measure** and to **inspect squareness** , **straightness**, **flatness**, and **perpendicularity** of works piece.

Both instrument are used for checking and ;

- **detecting small differences** in linear measurement of identical objects.
- **measuring concentricity** of round objects.
- **parallelism** of bar and rods;
- **flatness** of surfaces;

Surface Gauge



Dial Indicator

## 3.2 Gap Width

- A feeler gauge is used in metalworking **to measure the clearance (gap width)** between two parts or components in an easy way.
- Also known as **Thickness Gauges**.



Straight Blade Feler Gauge

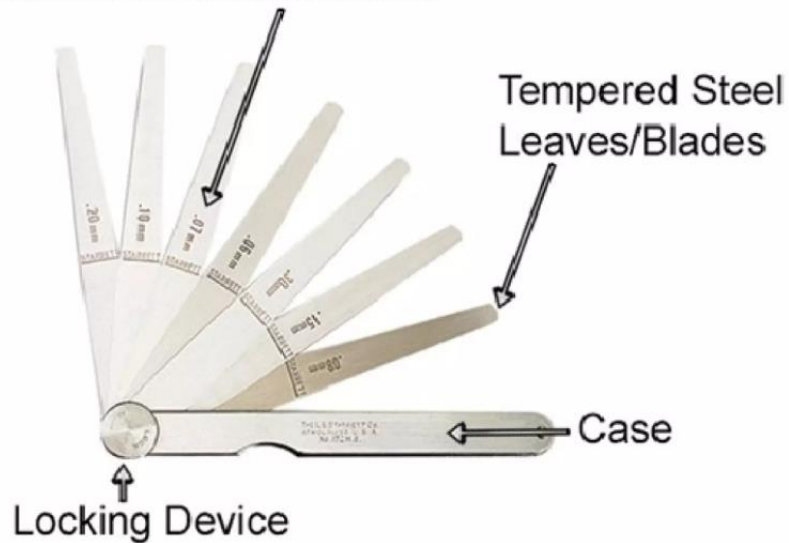


Hook Feler Gauge



Pitch Gauge

## Inscribed measurement



Parts of Tapered Feeler Gauge

**How to use**

1. Unfold Blades
2. Select Leaf
3. Fold away other leaf
4. Hold gauge
5. Feel frictional resistance
6. Check for measurement

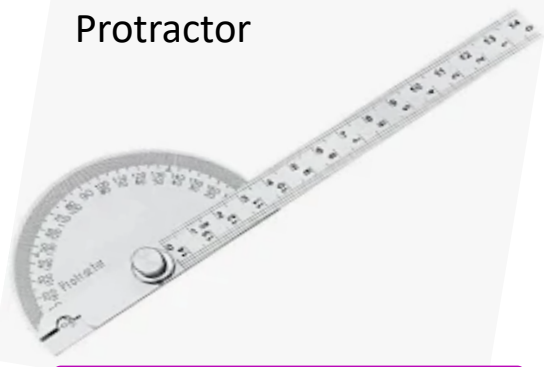
**Example of Applications**

1. Automotive - checking clearance between rocker arms and valve stem, regulate spark plug gap, etc
2. Oil Refinery – check wall slot size in reactor vessels.
3. Machining applications – identify and setting the gaps.
4. Fold away other leaf
5. Hold gauge
6. Feel frictional resistance
7. Check for measurement

## 3.3 Angle finder

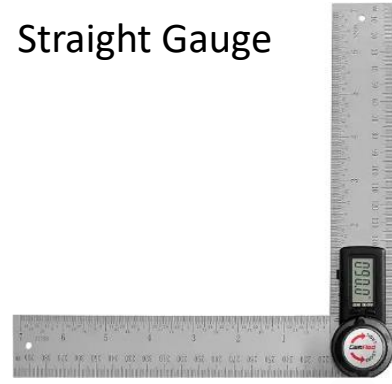
- Use to measuring the angles and for replicating the angle

Protractor



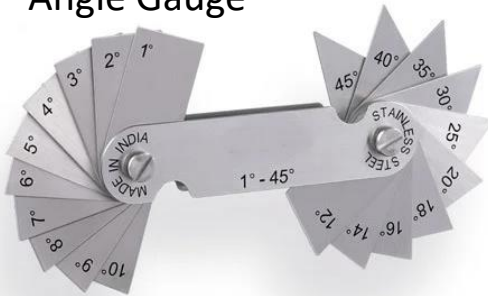
Measure  $0^\circ - 180^\circ$

Straight Gauge



Measure  $0^\circ - 90^\circ$

Angle Gauge



Measure  $1^\circ - 45^\circ$

Radial Gauge



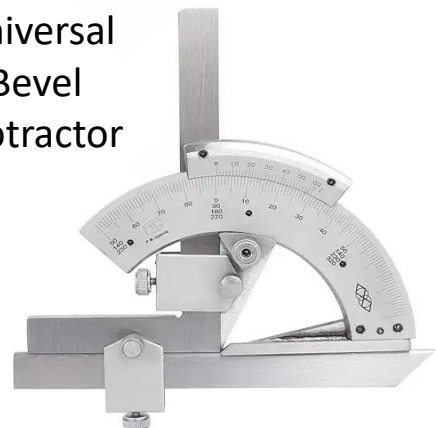
Measure fillet of workpiece

Metal Angle Finder



Measure  $0^\circ - 360^\circ$

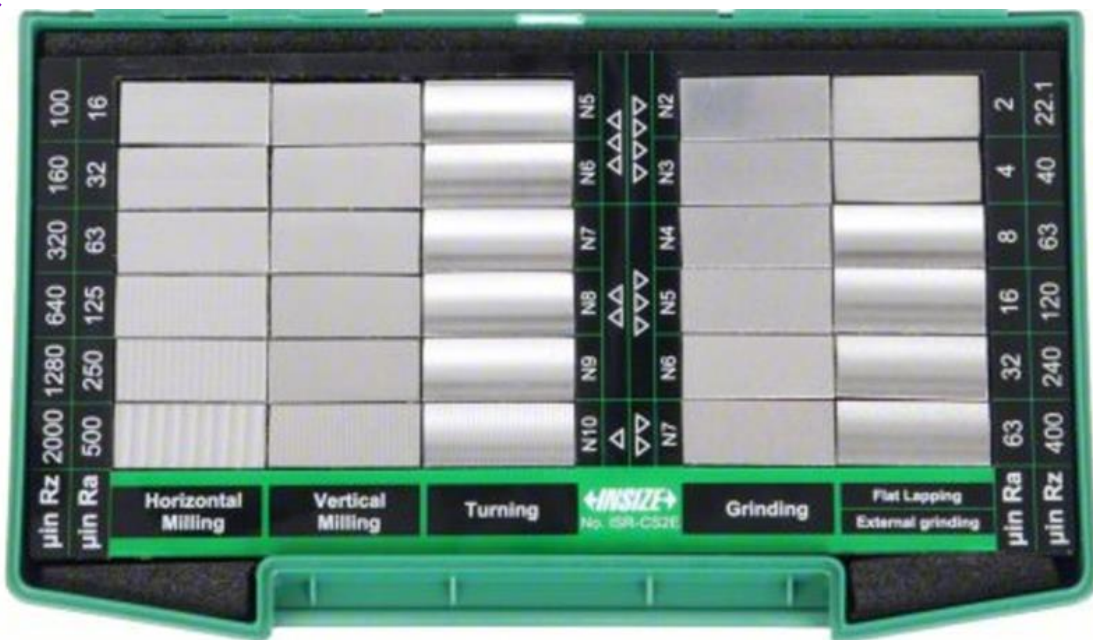
Universal  
Bevel  
Protractor



Measure & set angles in planes

## 3.4 Surface Roughness

- After it workpiece has undergone a machining process. The **final surface texture** and **appearance is identified**.
- The finish can **vary based on the machining method used, the material, and the desired end result**.

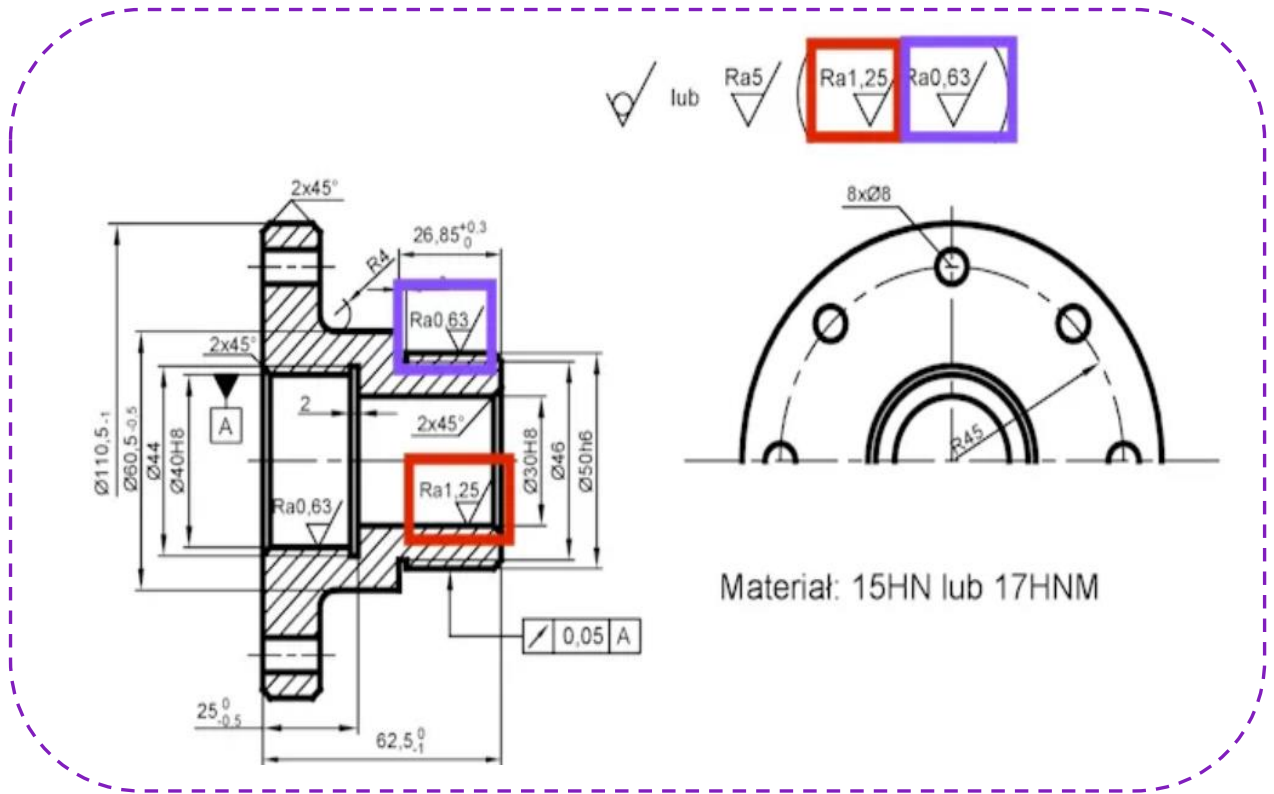


Surface Roughness Comparator Plate



Digital Surface Roughness

## Surface Roughness Symbol On Construction Drawing. [42]



Ra micrometer	Roughness Grade Number	Finish Marks
50	N12	
25	N11	▽
12.5	N10	
6.3	N9	▽▽
3.2	N8	
1.6	N7	▽▽▽
0.8	N6	
0.4	N5	▽▽▽▽
0.2	N4	
0.1	N3	▽▽▽▽▽
0.05	N2	
0.025	N1	▽▽▽▽▽▽

The Lower Ra value, the smoother surface finish

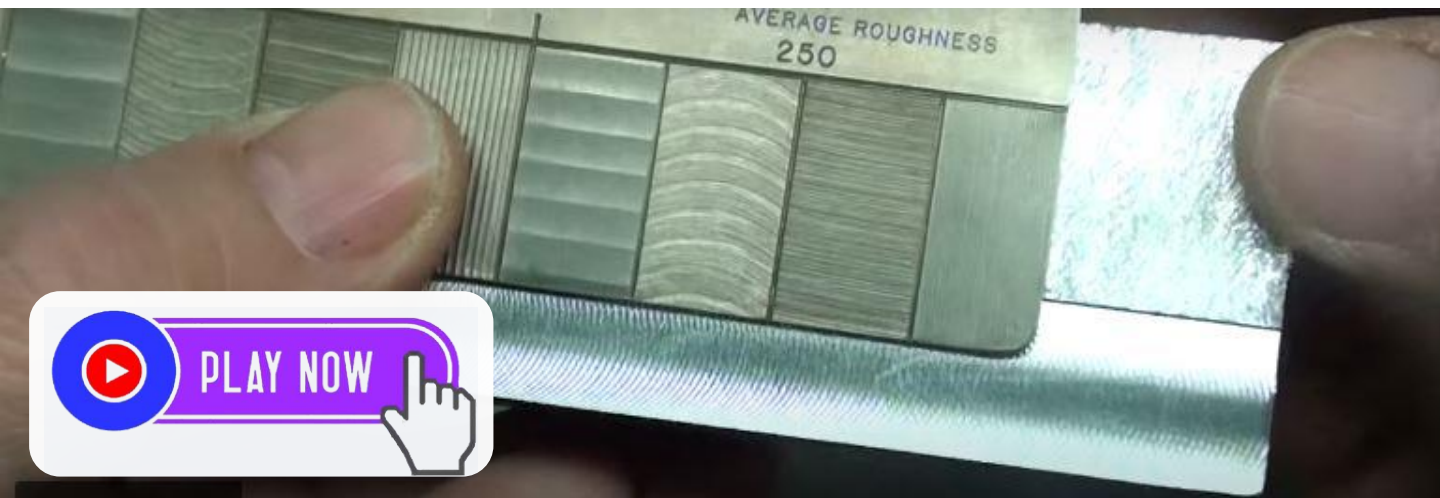






Figure 13 : How to use surface roughness comparator plate. [43]

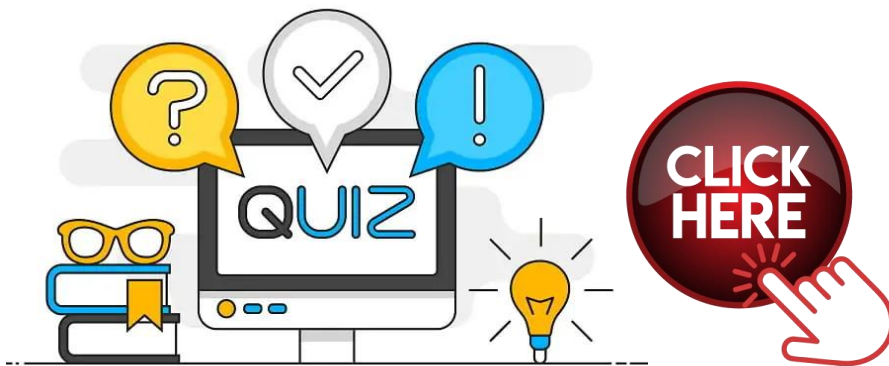
### How to Use Surface Roughness Comparator Standard.

1. Position the surface roughness comparator standard next to the workpiece.
2. Select machining method at the surface roughness comparator standard
3. Across your finger nail to each surface to compare with work piece surface.
4. Feel at the finger nail contact.
5. The measurement of surface finish on surface roughness comparator standard must be the same, identical or close then the workpiece surface roughness .
6. Read the Ra or symbol indicate surface roughness for workpiece. [44]



# EXERCISE

1. What is surface roughness?
2. Why surface roughness is important?
3. Explain 3 factors influence surface roughness of workpiece
4. What testing tool used to inspect surface finish?.
5. What is surface roughness comparator plate?
6. How to use surface roughness comparator plate?
7. What is the Ra value?
8. The \_\_\_\_\_ Ra value the smoother surface finish
9. Which finish mark symbol represent the smoother surface finish  or   
10. \_\_\_\_\_ is a unit use for surface roughness.



**ONLINE QUIZ – SURFACE ROUGHNESS**

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# PAST YEAR FINAL EXAM QUESTION

SESSION : 1 2023/2024

## QUESTION 1

a) Describe **ONE (1)** application of a chisel as shown below:

*Terangkan SATU (1) kegunaan pahat seperti yang terdapat di bawah:*

i. Flat chisel [2 marks]

*Pahat mata rata [2 markah]*

ii. Cross bit chisel [2 marks]

*Pahat mata lintang [2 markah]*

iii. Round nose chisel [2 marks]

*Pahat mata bulat [2 markah].*

b) Based on vernier caliper and micrometer in Figures 1b (i) and Figure 1b(ii), express in detail the correct reading.

*Berdasarkan angkup vernier dan mikrometer pada Rajah 1b(i) dan Rajah 1b(ii), nyatakan bacaan yang betul.*

# PAST YEAR FINAL EXAM QUESTION

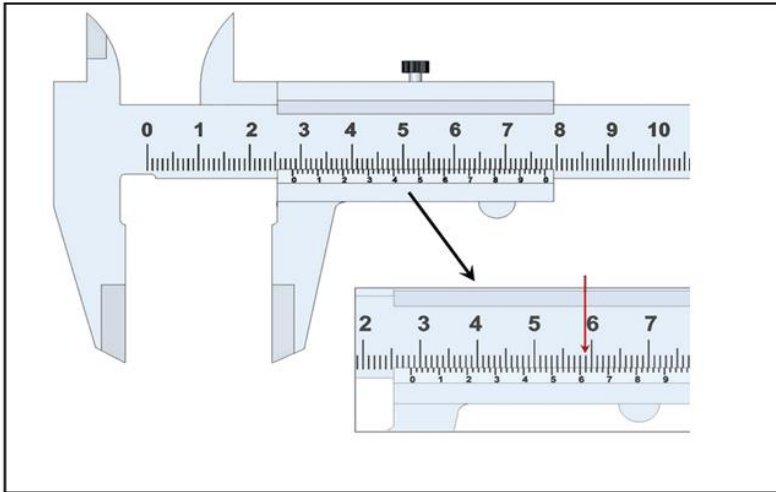


Figure 1b (i)

[3 marks]

[3 markah]

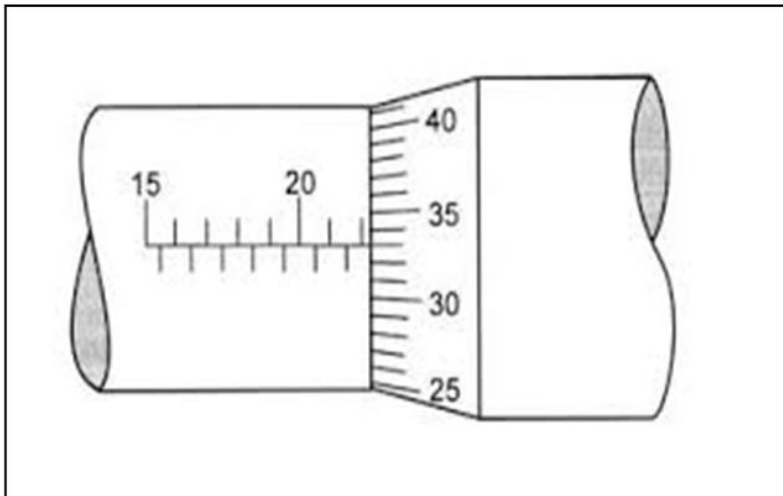


Figure 1b (ii)

[3 marks]

[3 markah]

# PAST YEAR FINAL EXAM QUESTION

SESSION : 2 2023/2024

## QUESTION 1

- a) Name the parts labelled **A, B, C, D, E** and **F** as shown in **Figure 1a**.

*Namakan bahagian yang berlabel A, B, C, D, E dan F pada Rajah 1a.*

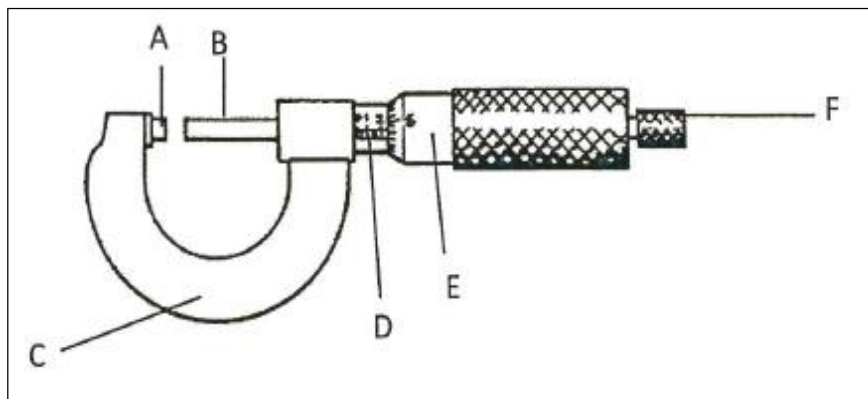


Figure 1a

[6 marks]

[6 markah]

- b) Based on the vernier caliper and micrometer in Figure 1b (i) and Figure 1b (ii), express in detail the correct reading.

*Berdasarkan angkup vernier dan mikrometer pada Rajah 1b (i) dan Rajah 1b (ii), nyatakan bacaan yang betul.*

# PAST YEAR FINAL EXAM QUESTION

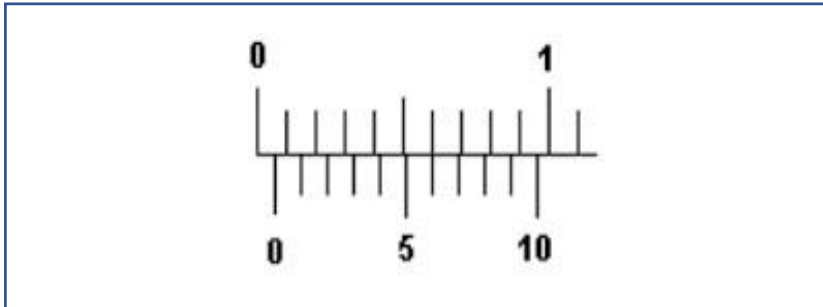


Figure 1b (i) / *Rajah 1b (i)*

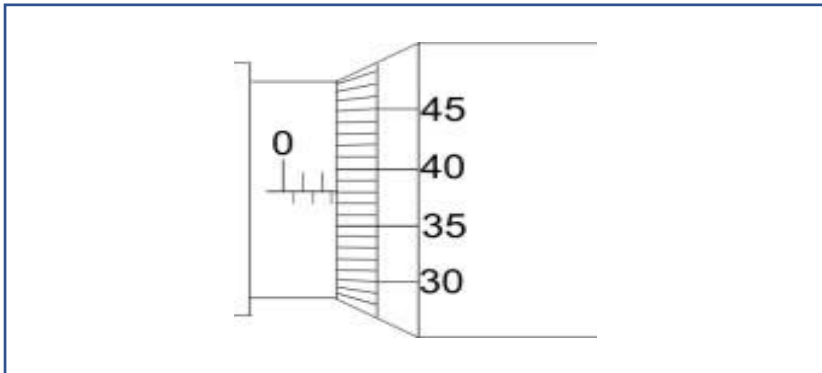
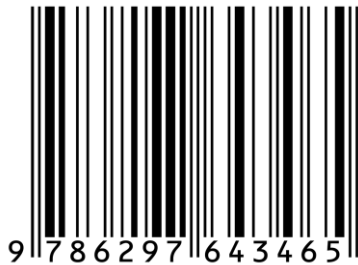


Figure 1b (ii) / *Rajah 1b (i)*



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