King Saud University

Mechanical Engineering Department

Lab Notes

Manufacturing Processes ME-311

By

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Mechanical Engineering Department

Lab Notes

Manufacturing Processes

ME-311

Student Name:……..

Student ID……

Academic Year……

Table of Contents

Manufacturing Processes ME-311 Lab

Lab Report # 1

Metal Cutting Workshop Overview

Recognize the main machines in metal cutting workshop

#	Machine Name	Type	Sketch
1	Turning Machine	Center Lathe	
2	Milling Machine	Vertical Milling Machine	
3	Milling Machine	Horzental Milling Machine	

4	Milling Machine	Universal Milling Machine	
5	Drilling Machine	Bench Drilling Machine	
6	Drilling Machine	Radial Drilling Machine	

7	Grinding Machine	Surface Grinding	
8	Grinding Machine	Cylindrical Grinding	
9	Grinding Machine	Hand Grinder	

10	Reciprecoating Machine	Shaper Machine	
11	Reciprecoating Machine	Slotting Machine	
12	Reciprecoating Machine		

Lab Report # 2

Measurements

- Measurement means to compare something with standard.
- E.g. measuring length of a wire, diameter of a cylinder, depth of any object.

Measurement Units:

Meter and its sub-multiple

Prefix	Symbol	Relationship with Meter (base unit)
meter	m	1m = 1 m
deci	dm	1dm = 10^{-1} m
centi	cm	1cm = 10^{-2} m
milli	mm	1mm = 10^{-3} m
micro	μm	1 μm = 10^{-6} m
nano	nm	1nm = 10^{-9} m
pico	pm	1pm = 10^{-12} m

Measuring Tools:

- Meter Tape
- Steel Scale
- Vernier Calipers
- Micrometers

Vernier Caliper:

Vernier caliper is a measuring device used to measure precise increments between two points.

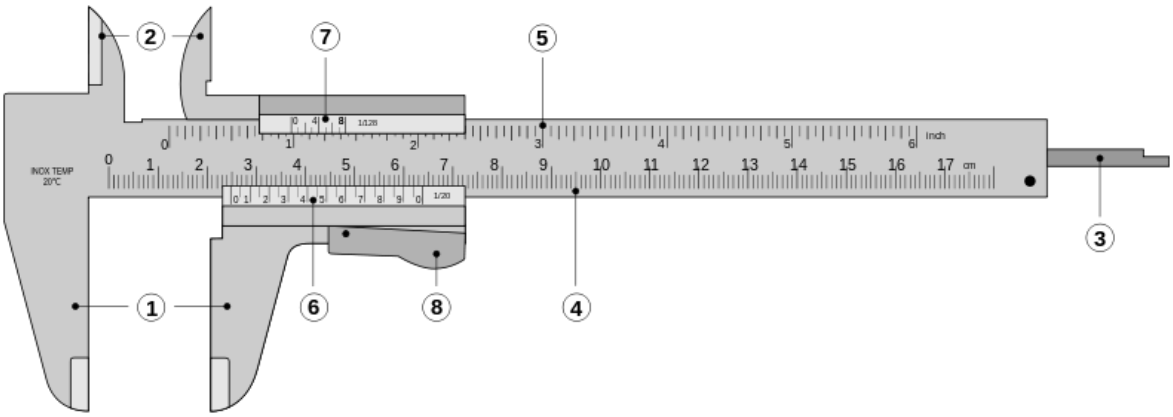
Function:

- To measure smaller distances.
- Can measure up to 0.01 mm.

Features:

- Larger, lower jaws are designed to measure outer points e.g. diameter of a rod.
- Top jaws are designed to measure inside points e.g. size of a hole.
- A rod extends from the rear of the caliper and can be used to measure the depth.

Structure of the Caliper

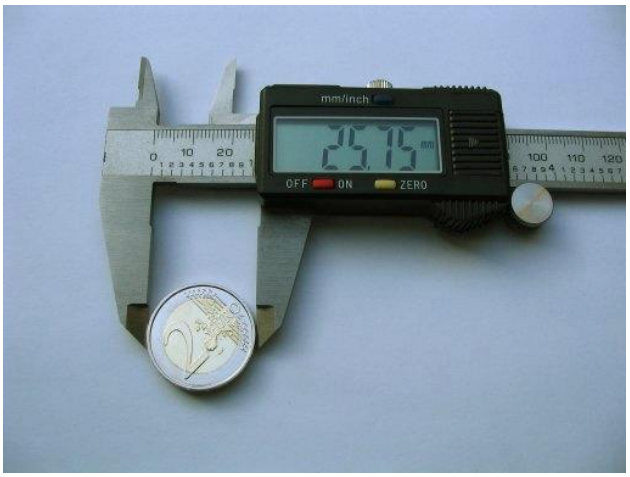


Parts of a Vernier caliper:

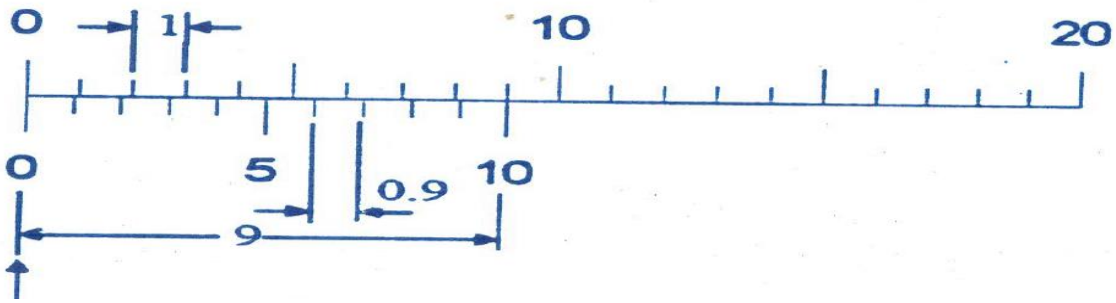
1. **Outside jaws**: used to measure external diameter or width of an object
2. **Inside jaws**: used to measure internal diameter of an object
3. **Depth probe**: used to measure depths of an object or a hole
4. **Main scale**: scale marked every mm
5. **Main scale**: scale marked in inches and fractions
6. **Vernier scale** gives interpolated measurements to 0.1 mm or better
7. **Vernier scale** gives interpolated measurements in fractions of an inch
8. **Retainer**: used to block movable part to allow the easy transferring of a measurement

Dial caliper

Digital Caliper

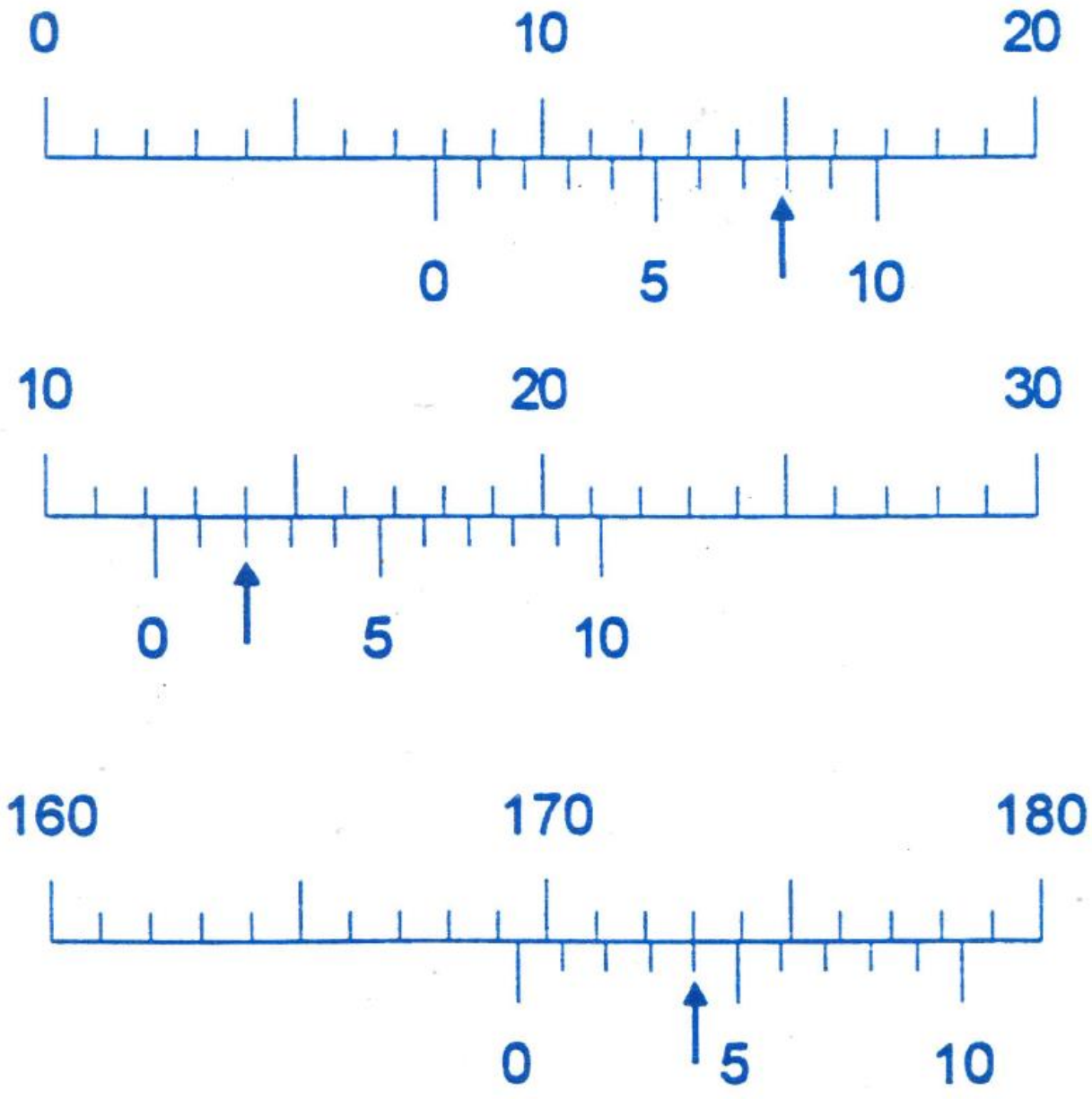


Accuracy of the Veriener Caliper:



How to Use the Veriner Caliper :

Examples:



- Recognize and revise the main parts of Veriner Caliper and try to take some measurements from the available workpieces:

#	Dimension	Drawing
Workpiece-1		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Workpiece-2		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Micrometrs:

A **micrometer** is a device incorporating a calibrated screw used widely for precise measurement of small distances in mechanical engineering and machining.

Types of Micrometers

- **Outside micrometer**, typically used to measure wires, spheres, shafts and blocks.
- **Inside micrometer**, used to measure the diameter of holes.
- **Depth micrometer**, measures depths of slots and steps.

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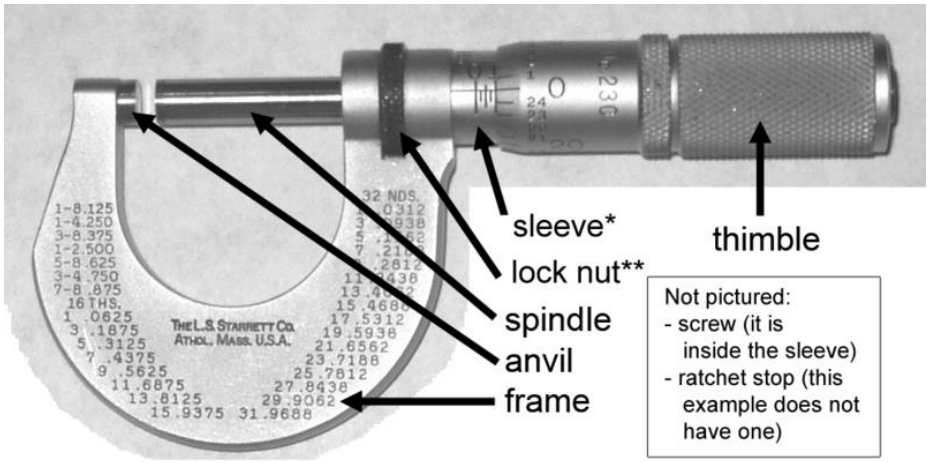
Construction of Micrometer:



Sleeve is the most prevalent name. May also be called the *barrel* or *stock*.
**Aka *lock-ring*. Some mics have a *lock lever* instead.

A micrometer is composed of:

Frame: The C-shaped body that holds the anvil and barrel in constant relation to each other.

Anvil: The shiny part that the spindle moves toward, and that the sample rests against.

Sleeve: The stationary round part with the linear scale on it.

Lock nut: The knurled part (or lever) that one can tighten to hold the spindle stationary, such as when momentarily holding a measurement.

Screw (not seen): The heart of the micrometer. It is inside the barrel.

Spindle: The shiny cylindrical part that the thimble causes to move toward the anvil.

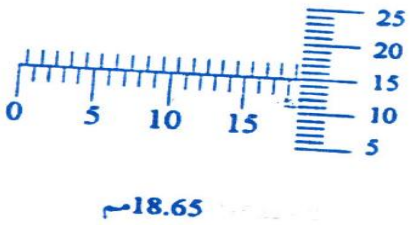
Thimble: The part that one's thumb turns. Graduated markings

Ratchet stop: (not shown in illustration)
Device on end of handle that limits applied pressure by slipping at a calibrated torque

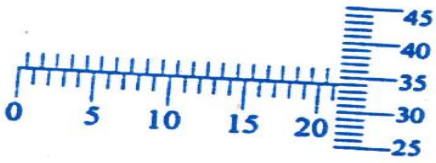
How to Use the Micrometer :

Reading 5.78 mm

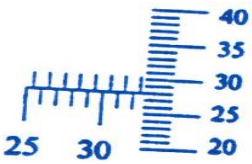
Examples:



18.65



21.34



32.78

- Recognize and revise the main parts of Micrometer and try to take some measurements from the available workpieces:

#	Dimension	Drawing
Workpiece-1		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Workpiece-2		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Lab Report # 3

Marking and Benching Operations

- Recognize on the marking tools available in the workshop

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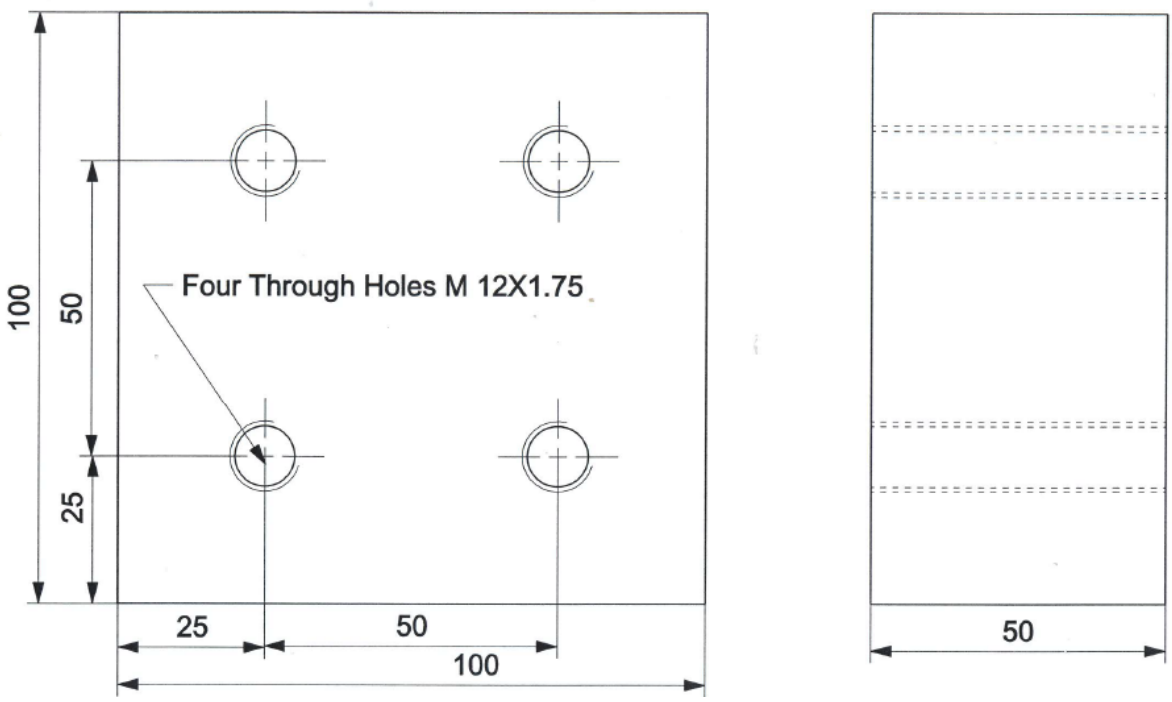
Exercise-1

- Mark the block as shown below
- Use the Bench drill to create holes as specified in the Design Drawing
- Use the Tap Set to create thread in the holes as specified in the Design Drawing.
- Check the Thread Size



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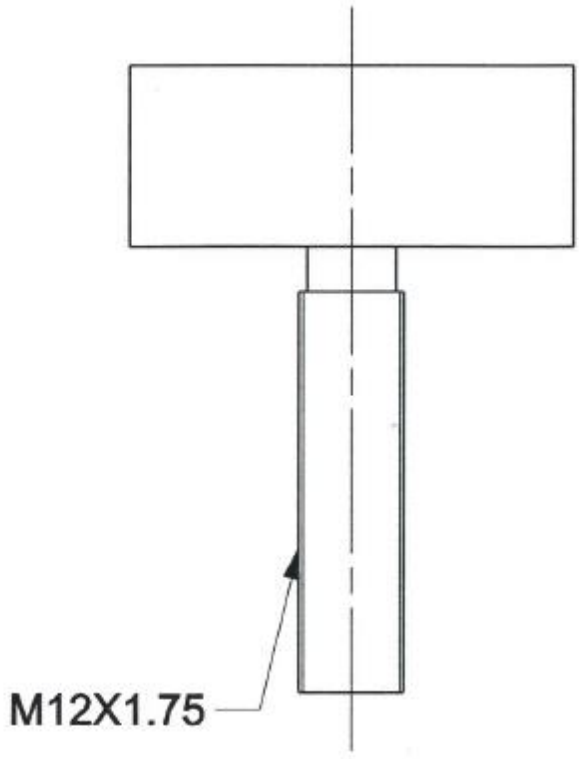
Exercise-2

- Recognize the Die Thread Construction
- Use the Die Thread M12X1.75 to create thread on the bar according to design drawing
- Check the Thread size



Remark:

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THREADS
Metric Threads, Coarse & Fine

MACHINE DESIGN
TRD-68-03

Metric Coarse Threads

Metric coarse threads		
Size designation	Minor diameter, mm.	Pitch in mm.
M 1.4	1.01	0.3
M 1.7	1.25	0.35
M 2	1.48	0.4
M 2.3	1.78	0.4
M 2.5×0.45	1.92	0.45
M 2.6	2.02	0.45
M 3	2.35	0.5
M 3 ×0.6	2.22	0.6
M 3.5	2.72	0.6
M 4	3.09	0.7
M 4 ×0.75	3.03	0.75
M 4.5	3.53	0.75
M 5 ×0.75	4.03	0.75
M 5	3.96	0.8
M 5 ×0.85	3.9	0.85
M 5 ×0.9	3.83	0.9
M 5.5	4.33	0.9
M 6	4.7	1
M 7	5.7	1
M 8	6.38	1.25
M 9	7.38	1.25
M 10	8.05	1.5
M 11	9.05	1.5
M 12	9.73	1.75
M 14	11.4	2
M 16	13.4	2
M 18	14.75	2.5
M 20	16.75	2.5
M 22	18.75	2.5
M 24	20.1	3
M 27	23.1	3
M 30	25.45	3.5
M 33	28.45	3.5
M 36	30.8	4
M 39	33.8	4
M 42	36.15	4.5
M 45	39.15	4.5
M 48	41.5	5
M 52	43.5	5

Extract from DIN 13, Sheet 1.

Metric Fine Threads

Metric fine threads		Metric fine threads		Metric fine threads	
Size designation	Minor diameter, mm.	Size designation	Minor diameter, mm.	Size designation	Minor diameter, mm.
M 2 ×0.25	1.68	M 18×1	16.70	M 38×1	36.70
M 2.3×0.25	1.98	M 18×1.5	16.05	M 38×1.5	36.05
M 2.6×0.25	2.28	M 20×1	18.70	M 38×2	35.40
M 2.6×0.35	2.15	M 20×1.5	18.05	M 39×1	37.70
M 3 ×0.35	2.55	M 22×1	20.70	M 39×1.5	37.05
M 3.5×0.35	3.05	M 22×1.5	20.05	M 39×2	36.40
M 4 ×0.33	3.55	M 24×1	22.70	M 39×3	35.10
M 4 ×0.5	3.35	M 24×1.5	22.05	M 40×1	38.70
M 4.5×0.5	3.85	M 24×2	21.40	M 40×1.5	38.05
M 5 ×0.5	4.35	M 25×1	23.70	M 40×2	37.40
M 5.5×0.5	4.85	M 25×1.5	23.05	M 42×1	40.70
M 6 ×0.75	5.03	M 26×1	24.70	M 42×1.5	40.05
M 7 ×0.75	6.03	M 26×1.5	24.05	M 42×2	39.40
M 8 ×0.75	7.03	M 27×1	25.70	M 42×3	38.10
M 8 ×1	6.70	M 27×1.5	25.05	M 45×1	43.70
M 9 ×0.75	8.03	M 27×2	24.40	M 45×1.5	43.05
M 9 ×1	7.70	M 28×1	26.70	M 45×2	42.40
M 10 ×0.75	9.03	M 28×1.5	26.05	M 45×3	41.10
M 10 ×1	8.70	M 30×1	28.70	M 48×1	46.70
M 11 ×0.75	10.03	M 30×1.5	28.05	M 48×1.5	46.05
M 11 ×1	9.70	M 30×2	27.40	M 48×2	45.40
M 12 ×1	10.70	M 32×1	30.70	M 48×3	44.10
M 12 ×1.25	10.38	M 32×1.5	30.05	M 50×1	48.70
M 12 ×1.5	10.05	M 33×1	31.70	M 50×1.5	48.05
M 14 ×1	12.70	M 33×1.5	31.05	M 50×2	47.40
M 14 ×1.25	12.38	M 33×2	30.40	M 52×1	50.70
M 14 ×1.5	12.05	M 35×1	33.70	M 52×1.5	50.05
M 15 ×1	13.70	M 35×1.5	33.05	M 52×2	49.40
M 15 ×1.5	13.05	M 35×2	32.40	M 52×3	48.10
M 16 ×1	14.70	M 36×1	34.70		
M 16 ×1.5	14.05	M 36×1.5	34.05		
M 17 ×1	15.70	M 36×2	33.40		
M 17 ×1.5	15.05	M 36×3	32.10		

Extract from DIN 13, Sheet 12.

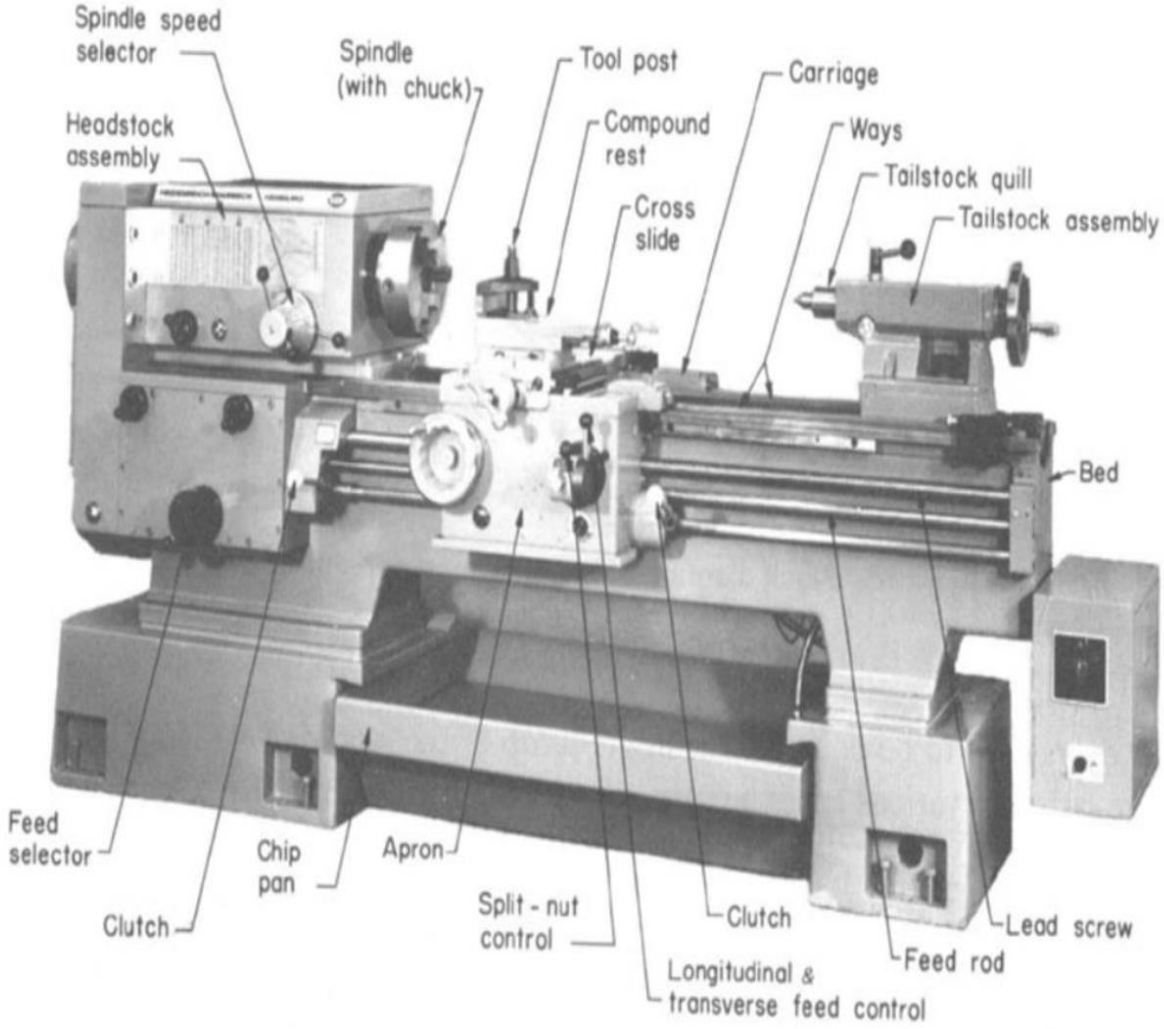
Extract from DIN 13.

Lab Report # 4

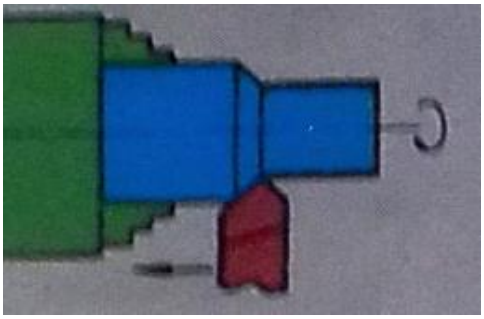
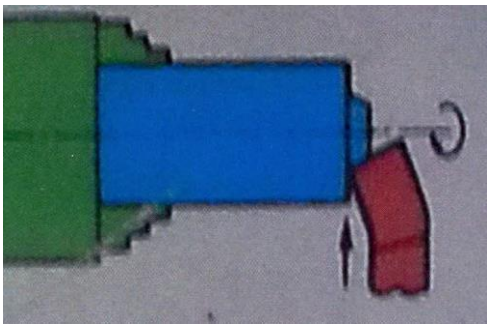
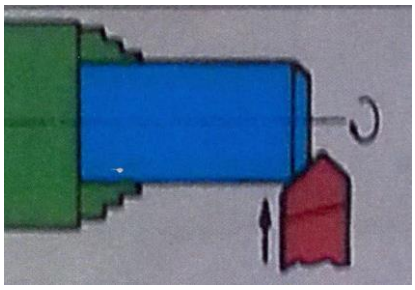
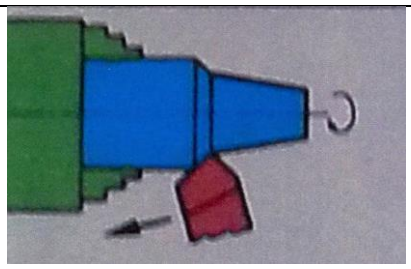
Turning Machine

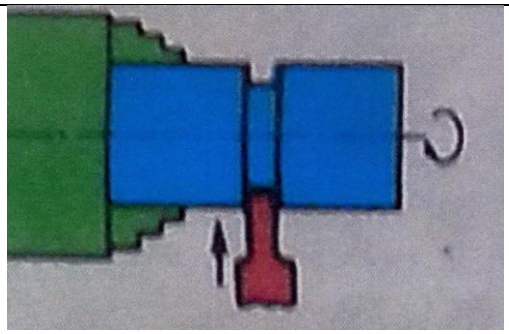
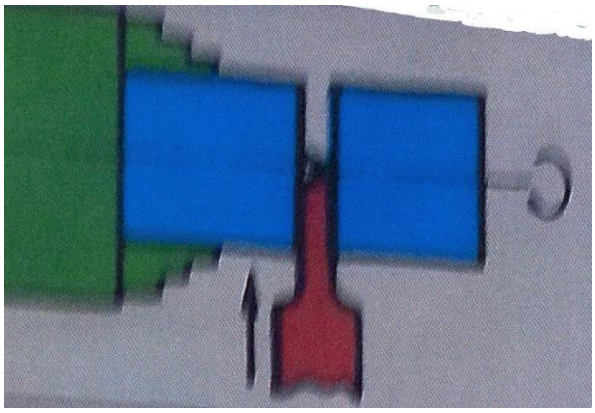
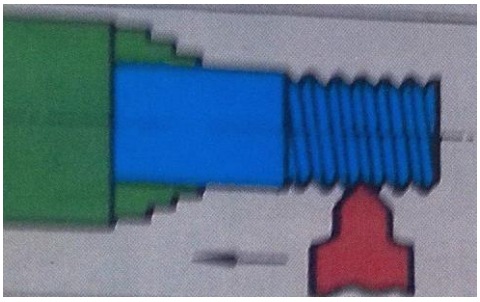
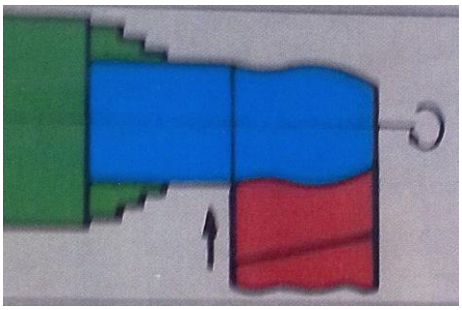
Construction, Turing Operations, Turning Tools and Threading

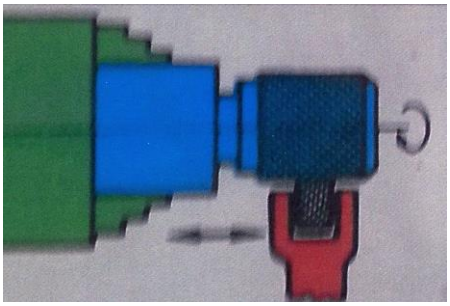
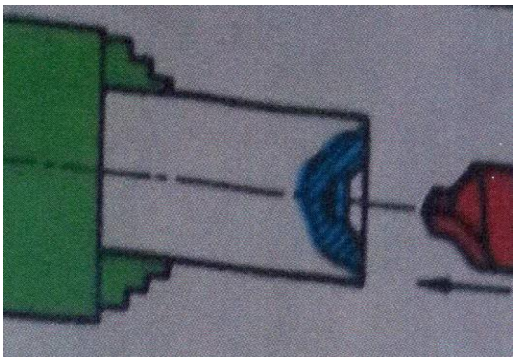
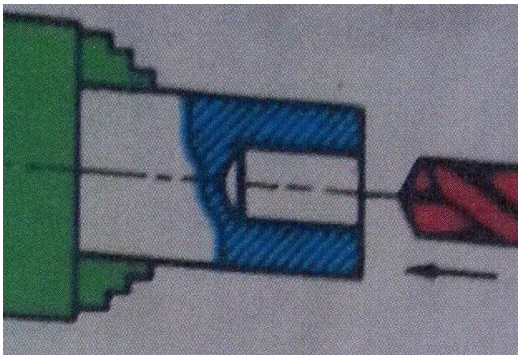
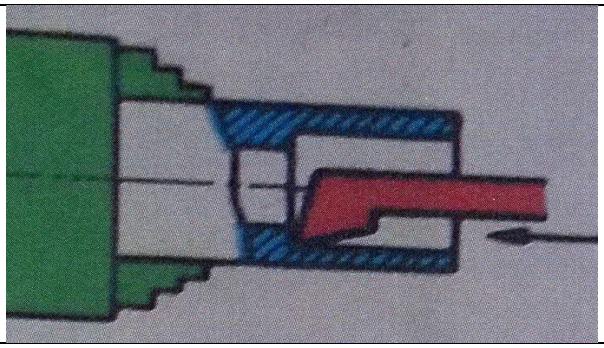
- Recognize the main parts in the Turning Machine

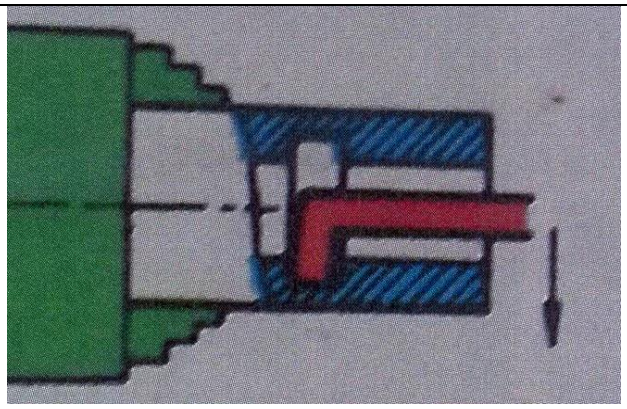
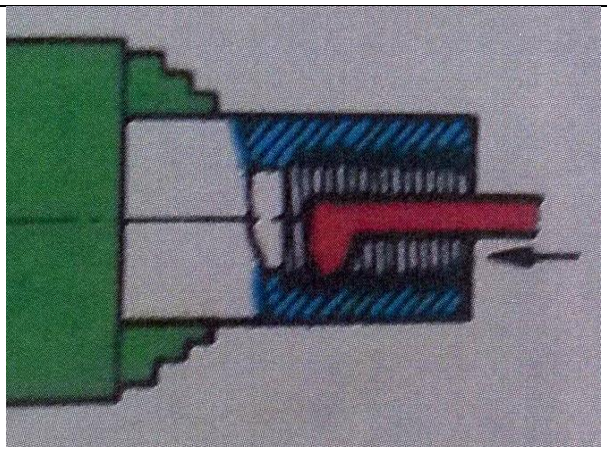
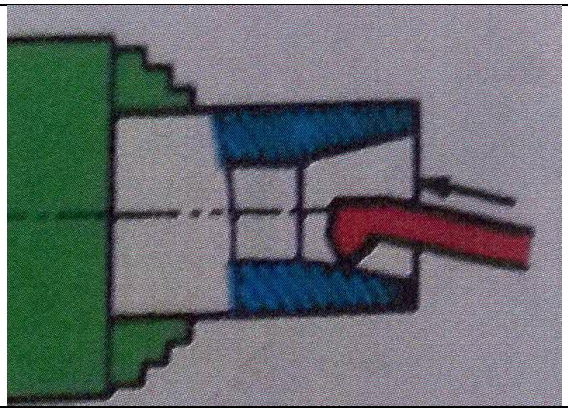


Define the type of cutting tool and operation name for the following Turning Operations

#	Drawing	Cutting Tool	Operation Name
1			
2			
3			
4			

#	Drawing	Cutting Tool	Operation Name
5			
6			
7			
8			

#	Drawing	Cutting Tool	Operation Name
9			
10			
11			
12			

#	Drawing	Cutting Tool	Operation Name
13			
14			
15			
Remarks:			

- State the available spindle speed (rpm) in your Turning Machine

#	N = RPM		#	N = RPM
1			11	
2			12	
3			13	
4			14	
5			15	
6			16	
7			17	
8			18	
9			19	
10			20	

- State the available Feed rate (mm/rev) in your Turning Machine

#	Feed rate (mm/rev)		#	Feed rate (mm/rev)
1			11	
2			12	
3			13	
4			14	
5			15	
6			16	
7			17	
8			18	
9			19	
10			20	

- State the available Pitch (mm) in your Turning Machine

#	Pitch (mm)		#	Pitch (mm)
1			11	
2			12	
3			13	
4			14	
5			15	
6			16	
7			17	
8			18	
9			19	
10			20	

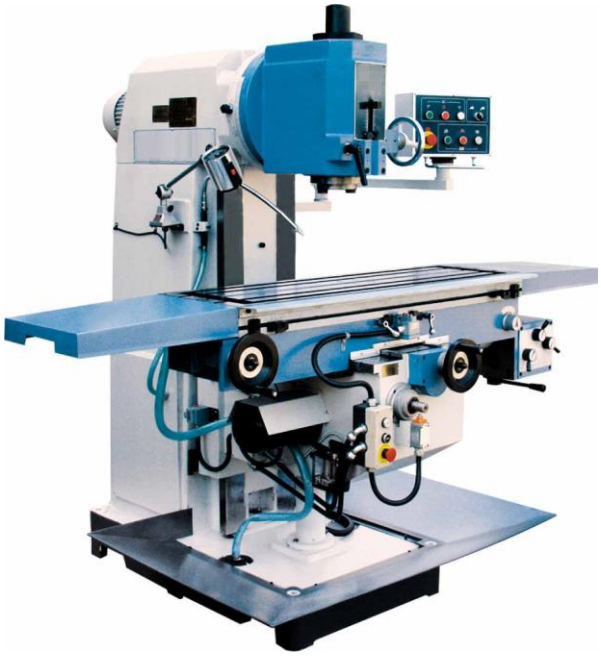
- Study the effect of Feed Rate on the surface finish – Demonstrate this relation by some experimental values.

#	Feed mm/rev	Value of Surface Finish R_a
1	0.1	
2	0.2	
3	0.3	
4	0.4	

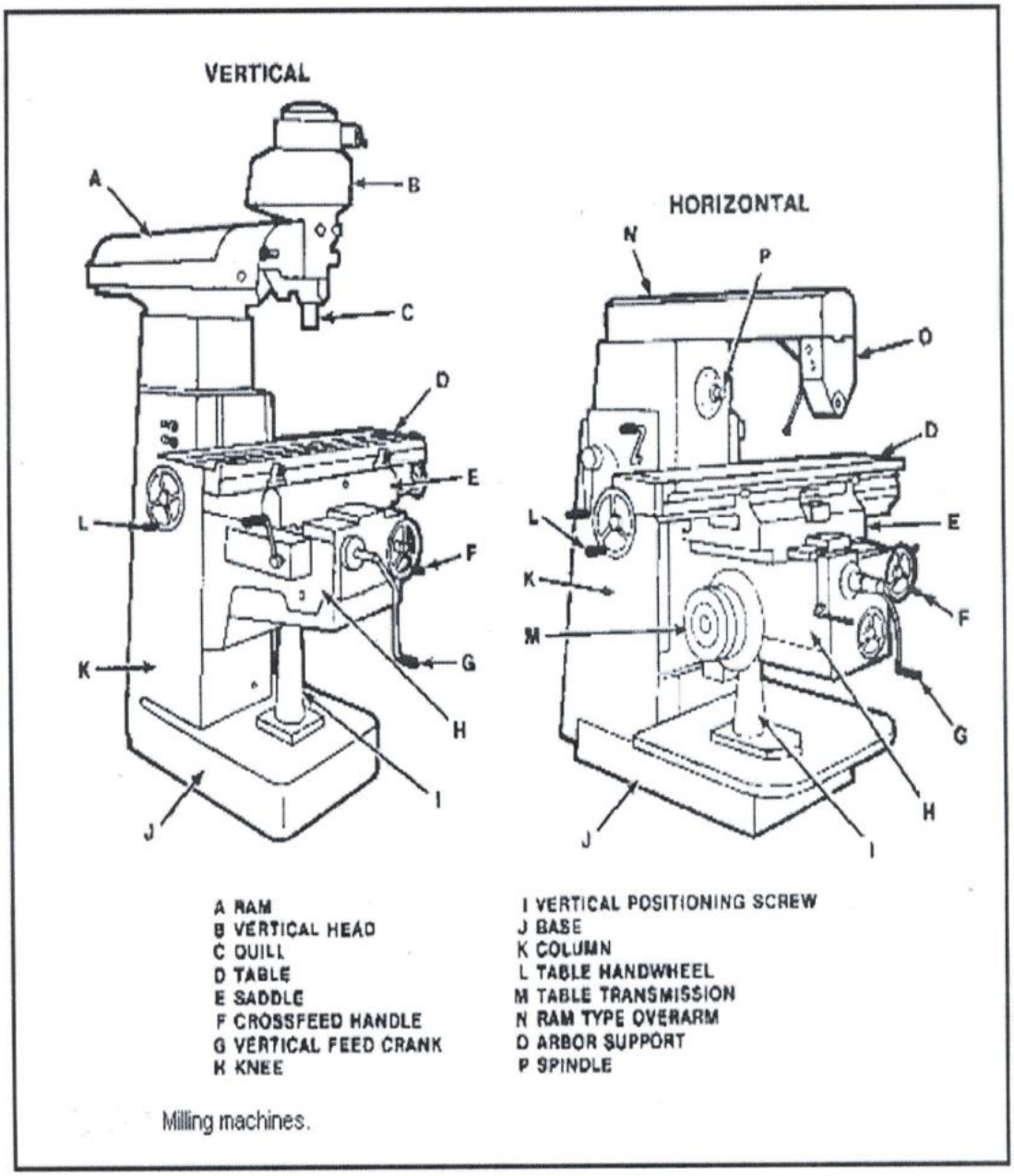
Remark:

Lab Report # 5

Milling Machines



1- Recognize the main parts of milling machines



Milling machines.

2- State the different types of milling machines

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3- Recognize and draw some tools are be used with milling machines

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4- Draw the construction features of vertical milling machine

5- Draw some operations can be done on vertical milling machine

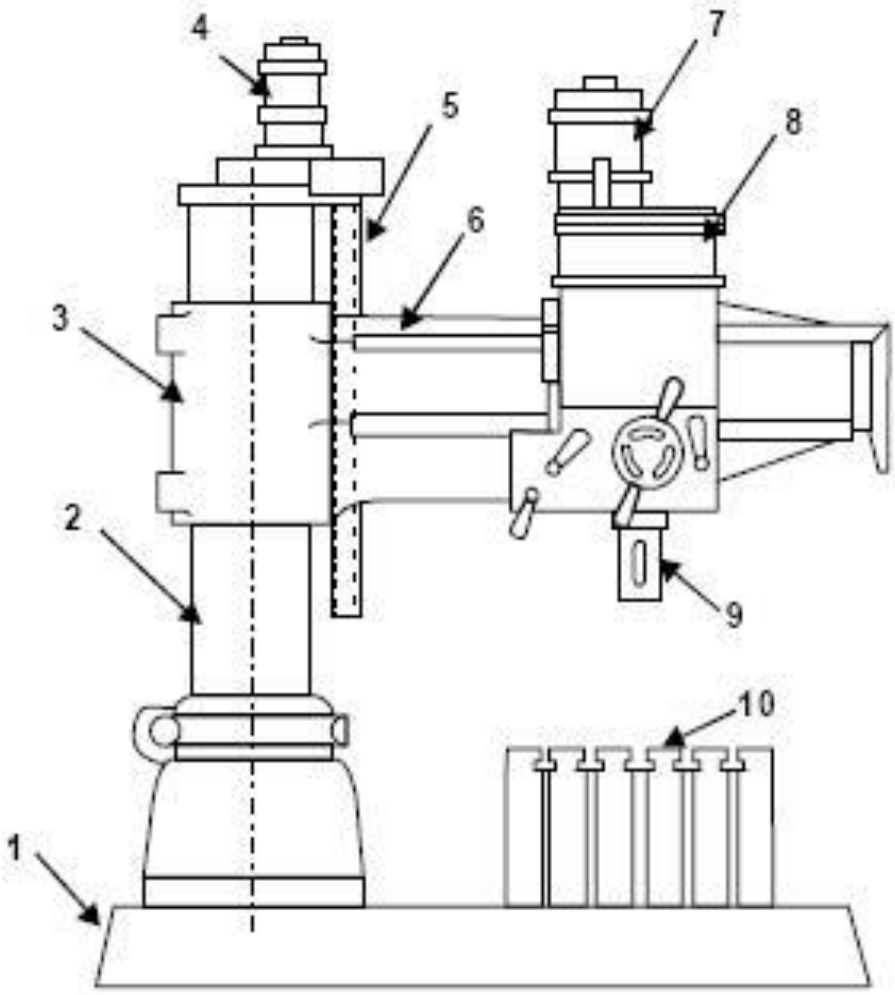
6- Draw the construction features of horizontal milling machine

7- Draw some operations can be done on horizontal milling machine

Lab Report # 6

Radial Drilling Machine

1- Recognize the main parts of radial drilling machines



Parts name

1. Base
2. Column
3. Radial arm
4. Motor for elevating arm
5. Elevating screw
6. Guide ways
7. Motor for driving drill spindle
8. Drill head
9. Drill spindle
10. Table

- State the available spindle speed (rpm) in your Radial Drilling Machine

#	N = RPM		#	N = RPM
1			11	
2			12	
3			13	
4			14	
5			15	
6			16	
7			17	
8			18	
9			19	
10			20	

- State the available Feed rate (mm/rev) in your Radial Drilling Machine

#	Feed rate (mm/rev)		#	Feed rate (mm/rev)
1			11	
2			12	
3			13	
4			14	
5			15	
6			16	
7			17	
8			18	
9			19	
10			20	

2- Recognize and draw some tools are be used with drilling machines

3- Draw the construction features of radial drilling machine

4- Draw some operations can be done on radial drilling machine

Lab Report # 7

Grinding Machines

1- State the different types of grinding machines.

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2- Draw the construction features of cylinderical grinding machine

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3- Draw the construction features of surface grinding machine

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4- Draw the different shapes of grinding wheels which are be used with grinding machines

5- State the different types of abrasive materials

6- Draw the dressing system for grinding wheels