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* UNIT ⇒ 1 'INDUSTRIAL SAFETY'

- Accident → It may be defined as mishap or disaster that results in some sort of injury to the man and hence a loss to the company as a whole.

- Causes of Accidents →

The causes of accidents may be classified in three categories -

(i) Human Causes
(ii) Technical Causes
(iii) Environmental Causes.

<i> Human Causes → (a) Lack of experience and interest
(b) Use of intoxicants (ex - Alcohol, drugs)
(c) Non use of safety devices.
(d) Working for long duration, shift duty etc. (e) Working with mental worries, carelessness, nervousness etc.

<ii> Technical Causes → (a) defective machine
(b) Improper maintanance of machine
(c) Inadequate Safety devices.

<iii> Environmental Causes → (a) Improper ventilation of the workplace
(b) Presence of dust.
(c) High Noice levels
(d) Too high temperature to cause headache.

(e) Too cold temperature to cause shivering

- Types of Accidents -

Various types of accidents are as follows-

(i) Near Accident - An accident with no damage or injury is called near accident.

(ii) Trivial - An accident with very less damage is called trivial.

(iii) Minor Accident - It is an accident with damage and injury more than trivial.

(iv) Serious Accident - An accident with heavy damage and lot of injury is called serious accident

(v) Fatal Accident → It is an accident which can result in loss of life.

- Sources of Accident -

(i) Revolving tools are the major sources of the accident
(ii) Driving belts is also considered as source of accident
(iii) Material handeling equipment such as conveyer is also the source of accident.
(iv) Loose clothes are also the common source of the accident.
(v) Other sources of accidents include explosives and chemicals used in the industry.

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- SAFETY CONSIDERATION →

(i) By Construction → While designing a new machine all its dangerous parts should be covered with suitable guards inorder to minimize the chance of accident.
- Proper signal board should be used for warning.

(ii) By design → The basic principle behind this consideration is that machine should be design in such a way. So, that dangerous parts are always beyond the reach of operator.

(iii) By Ergonomics consideration → The basic principle in ergonomics consideration is that men are not ment for machine reather machine should be design acc to the comfort and physical dimensions of the human being.

(iv) By Guards → @ Automatic (b) Trip (c) fixed

- FIRST AID → Even after following all the safety measures and precaution, accidents occur in the industry. So, First aid means providing the preliminary treatment given to the injured person before taking patien to the doctor. (The preliminary treatment may given to person immediately after the accident before taking patient to the doctor).

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- First Aid Kit is meant for small cut and injuries.
- First Aid box should be easily available (marked with '+' red symbol).
- First Aid box materials →

(i) Rolled bandages
(ii) Scissors
(iii) Dettol
(iv) Cotton
(v) Antiseptic Creams
(vi) Painkillers
(vii) Gloves
(viii) Thermometer
(ix) Eye drops
(x) Manual

PROPERTIES OF MATERIALS

(i) Mechanical → Strength, Stiffness, Elasticity, Plasticity, Ductility, Malleability, Brittleness, Toughness, Hardness.
(ii) Physical → Color, Density, Dimensions
(iii) Optical → Absorption, Reflection & Transmission
(iv) Electrical → Conductivity
(v) Thermal → Boiling Point, Melting Point.
(vi) Chemical → Corrosion
(vii) Magnetic → Antiferromagnetic, Paramagnetic, Ferromagnetic.

a. STRENGTH → It is defined as ability of the material to sustain loads without distortion.

b. STIFFNESS → It is the ability of the material to resist deformation.

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c° ELASTICITY → It is the property of the material by which deformation caused by applied load disappears completely on the removal of load.

d° PLASTICITY → It is the ability of the material to undergo some degree of permanent deformation

e° DUCTILITY → It is the ability of the metal to withstand elongation under tension without rupture.
It is also defined as the ability of the metal to be drawn into thin wires.

f° MULLEABILITY → It is the ability of the metal to withstand under compression without rupture. For ex → Metal bitten into thin sheets.

g° BRITTLENESS → The lack of ductility is known as brittleness that means the material will break under any force.

h° TOUGHNESS → It is the property of a material to withstand any shock or impact.

i° HARDNESS → It is defined as resistance of the material to scratching

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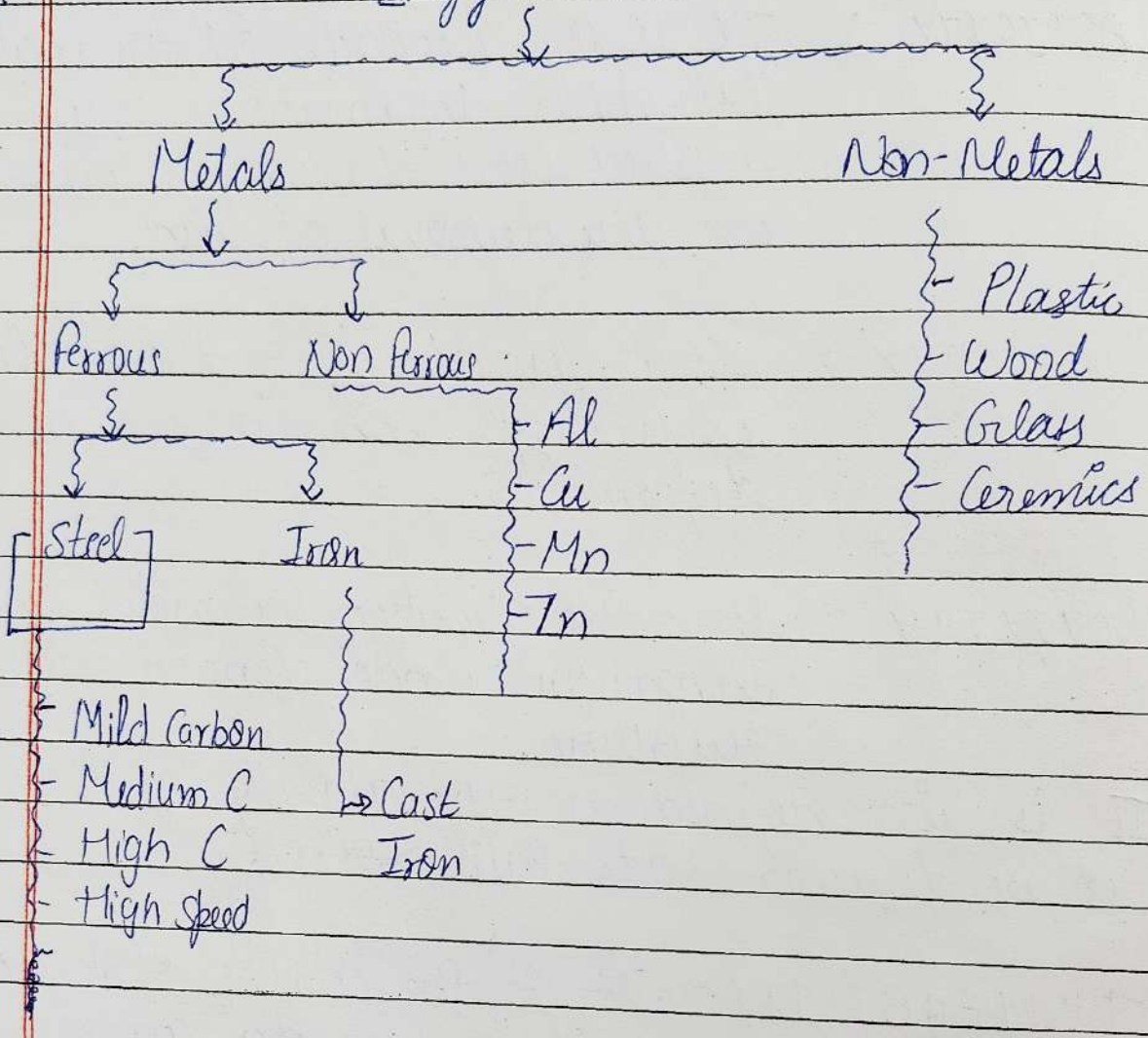
* Engg. Materials



* Type of steel →

① Mild Carbon steel (0.15 - 0.3% C)

② Medium Carbon steel (0.3 - 0.8% C)

③ High Carbon steel (0.8 - 1.5% C)

④ High Speed steel (Tungsten based)

18 : 4 : 1

- 18 → Tungsten
- 4 → Chromium
- 1 → Vanadium

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(1) MILD CARBON STEEL (0.15 - 0.3% C):- • These steels are tough and more elastic.
• These steels can easily be bended. Also, these steels are ductile and it absorbs shocks very well.
• It has application in bars, rods, tubes etc.

(2) MEDIUM CARBON STEEL (0.3 - 0.8% C):- • These are less ductile but carry more hardness and strength when compared to mild carbon steel.
• These steels has better machining qualities.
• They have better response to heat treatment.
• They have application in hammer, machine components & agricultural tools.

(3) HIGH CARBON STEEL (0.8 - 1.5% C):- • They have very high hardness. So, therefore they are suitable for wear resistant part. Therefore,
• they may be used for manufacturing of cutting tools and also in wood working tools like handfiles

(4) High SPEED STEEL (Tungsten based):- It has been given this name due to the fact that these can be operated at much higher speed when compared to other types of steel
• The typical example of high speed steel is tungsten based high speed steel
• It comprises of 18% tungsten, 4% Chromium and 1% vanadium.

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- Tungsten provides better toughness and better cutting ability.
- Chromium serves to improve harden ability
- Vanadium improves grain refinement.

- Application →

It is commenly used as cutting tool material and ite is also used in power saw blades and drill bits

* Type of Iron

① Cast Iron (1.7 - 4.5%) (carbon) -

- It primiraly consists of Iron and carbon.
- The carbon percentage varies from (1.7 to 4.5%)
- The carbon reduces the melting point. The pure iron has a melting point of 1500°C But iron with carbon has a melting point 1350°C
- It also contains of silicon ranging from (1-3%), Magnese from (0.25-0.5%) and sulphor (0.05)
- Silicon helps to reduce the shrinkage in the cast iron.
- Sulphor decreases the strength and increases the bitterness. Hence, it is desired to keep the sulphor content as low as possible.
- Magnese is added to reduce the harmful effects of sulphor.

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1.1 * Properties of Cast iron

(i) These materials are brittle.
(ii) These are weak in tension.
(iii) They have low cost.
(iv) They have good casting characteristics.
(v) They have excellent machining qualities.
(vi) They possess high compressive strength
(vii) They are used in building material and farming equipment.

Non metals

1) Ceramics - (i) They have application in tiles, bricks, cements.
- It is also used in production of capacitors, resistor, insulator for electronic components.
- They are also employed in circuit boards.

(ii)
- They have high meting point
- They have low electric and thermal conductivity.
- These are good insulator
- They are long lasting that means they are more reliable in terms of life.

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2. # Wood
- It is available in nature in form of trees.
- It is easy to work on it.
- It is easily available
- They have good response to polish and paint.
- They carries good strength

→ There are basically two types of wood-

(i) SOFT WOOD → • It is light in weight and light in colour
• It is used in window, door, furniture

(ii) HARD WOOD → • It is dark in colour and heavy in weight
• It has application in quality furniture.

(3.) PLASTIC →

- They are lighter in weight.
- They are less tough as compared to other metal material
- They can be coloured in any colour or in any shape.
- They are used for making large variety of house hold products.

(4.) GLASS →

- It is known to be hard material.
- It is an Insulator towards heat.
- It is considered to be a brittle material.
- It has an application in window, mirror, vehicle mirror, smartphone screen.

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UNIT → 3

☆ Overview

- Plant Layout
- Objective of Plant L/O
- Types of Plant L/O →

(i) Process / Functional
(ii) Product / Line
(iii) Group / Combine
(iv) Fixed Position

☆ PLANT LAYOUT → It is the systematic and functional arrangement of machines of different department in order to achieve the most effective utilization of man, machine and material.

☆ Objective of Plant Layout →

(i) It helps in the smooth flow of the production
(ii) It ensures entire space is utilized properly.
(iii) To ensure plant maintainance is simple.
(iv) To ensure working conditions gets safe and better

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✱ Types Of Plant Layout →

(i) Process Layout → In this type of Layout, similar operations are performed at one position i.e., all the lathe machine will be at one place, all the drilling at another and so on.

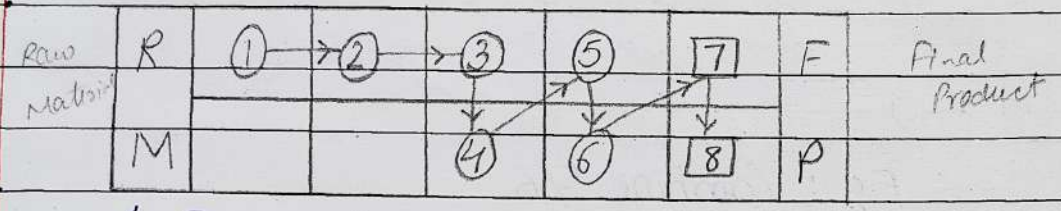
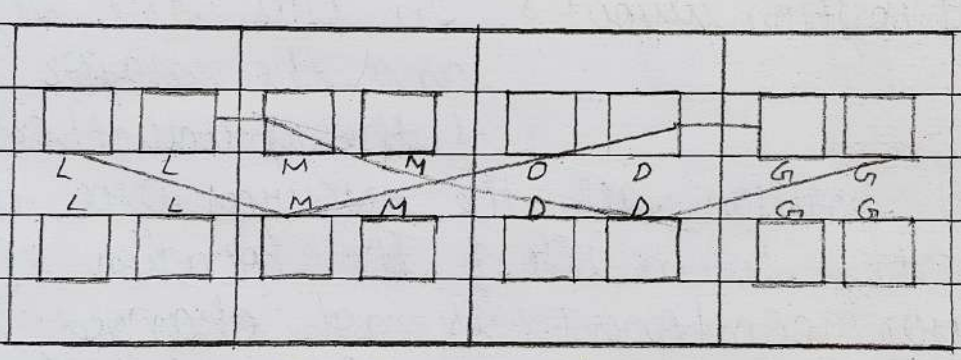


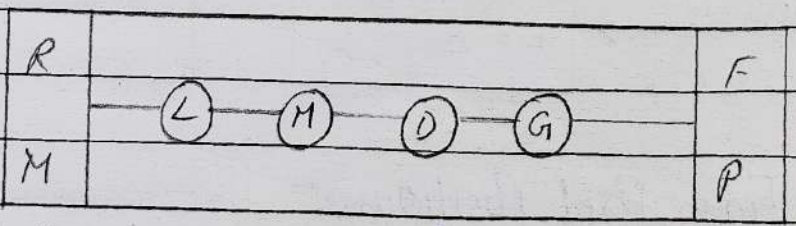
Fig: Process C/o

1-Forging, 2-Lathe, 3-Grinding, 4-Milling, 5-Drilling
6-Heat treatment, 7-Inspection, 8-Packaging



Fig=Process C/o

(ii) Product Layout → In this type of layout, all the machines are placed according to the sequence of operation needed to form a product



L=Lathe, M-Milling, D-Drilling, G-Grinding

Fig - Product C/o.

(iii) Group Layout → It is the mixture of the product and process layout if the machines are placed horizontally it gets the benefits of product layout if the machine are placed vertically it gets the benifit of process layout

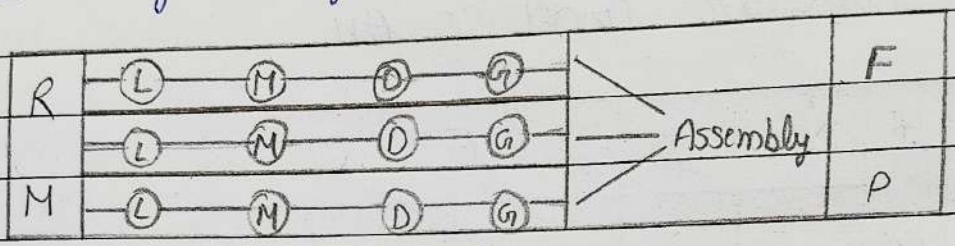


Fig : Combine C/o

(iv) Fixed Position layout → In this the biggest and the major componet of the product has a fixed position, all the resources are brought to the work site. & the location of the major component is not changed till the component is completely assembled.

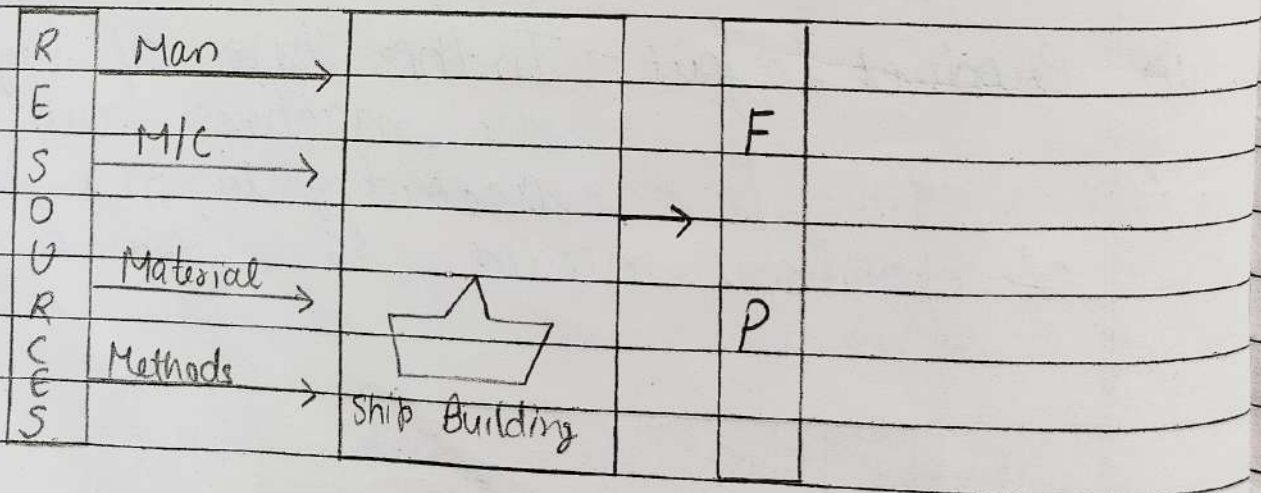


Fig: Fixed Positions

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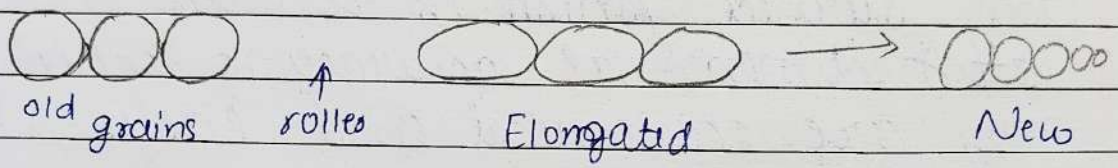
Recrystallization Temperature

It is the temp. at which new grains are formed and old grain structure is destroyed. In other words, it is that temp. where material starts to change its mechanical properties.



Recrystallization Temp. (For metals) = 0.3 MP
Recrystallization Temp. (For alloys) = 0.5 MP

Hot WORKING PROCESS

It is the plastic deformation of the metals above the recrystallization temp.
In this process, large deformation can be achieved

- Advantages -

(i) Ductility, toughness and strength is high
(ii) Less force is required to achieve the necessary deformation

- Disadvantages -

(i) The equipment and maintainance cost is high.
(ii) Poor surface finish is obtained

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COLD WORKING

It is the plastic deformation of the metals below the recrystallization temperature.

- Advantages.

(i) Good surface finish is achieved
(ii) dimensional accuracy is achieved
(iii) They are economical and easier to handle

- Disadvantages.

(i) Tooling cost is high
(ii) Ductility of the metal decreases in this process.

☆ Difference b/w Hot and Cold working

Hot Working	Cold working
(i) No hardening of metal takes place.	(i) Hardening of metal takes place
(ii) No internal stresses are set up in the metal	(ii) Internal stresses are set up in the metal.
(iii) Power require to finish the operation is more less	(iii) Power require to finish the operation is more.

(iv) Mechanical properties of the metal are improved.	(iv) Mechanical properties will not be improved
(v) The example of Hot working processes are- Rolling, extrusion, wire Drawing and forging	(v) The ex. of cold working processes are- measuring and marking, shearing, bending, Punching, blanking, piercing

Cold Working Operations / Sheet Metal Operations

- (Applications :→ Brake Pad, Plastic Parts, Packaging, Surgical Tools)

(i) Measuring & Marking - The standard size of the metal sheet is quite large but required sheet for making any component may be much smaller. So, these sizes are first decided and then they are marked. Marking & Measuring can be done by tee-square, scribber and steel scale

(ii) Shearing (Cutting) - It can be done with the help of hand shears (scissor like tool). -
It has 3 stages →

(i) Plastic deformation
(ii) Fracture
(iii) Shear

- So, in this process metal is placed b/w upper and lower blades and then pressure is applied. Ultimately, the shearing takes place

(iii) Bending → It is a metal forming process in which force is applied to a piece of sheet metal causing it to a bend and form a desire shape

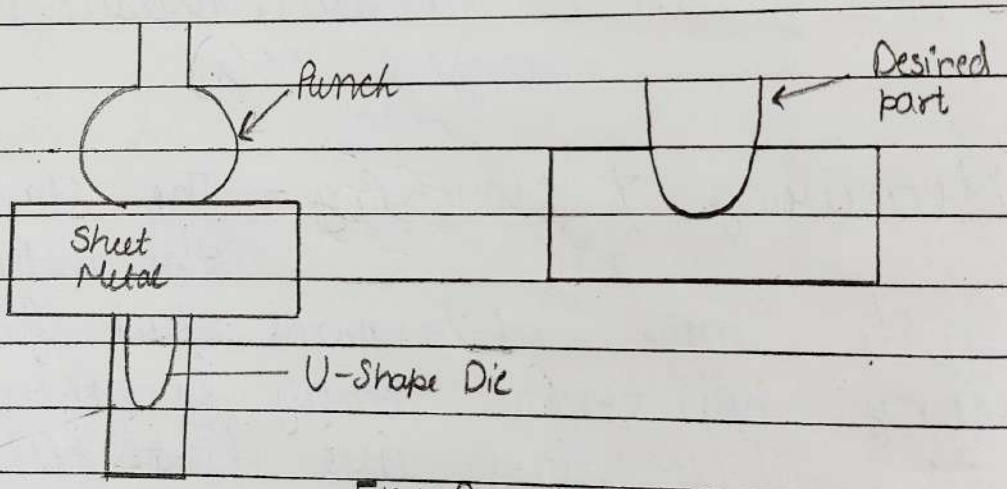


Fig: Bending

(iv) Punching → It is a process in which sheet with a hole in it is the required output
It is the operation of producing circular holes on the sheet metal with the help of punch and die

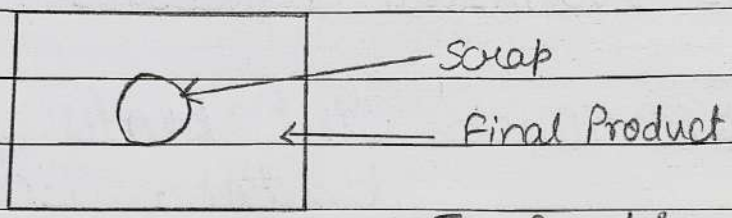


Fig: Punching

(v) Blanking → It is the same process as punching. The only difference is the punched out part is the required output.

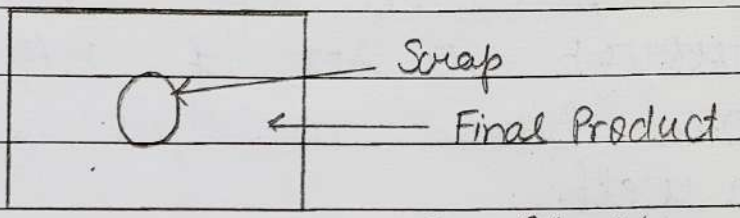


Fig: Blanking

(vi) Piercing → It is the similar process like punching. The difference is that in this process holes other than the circular shape is produced

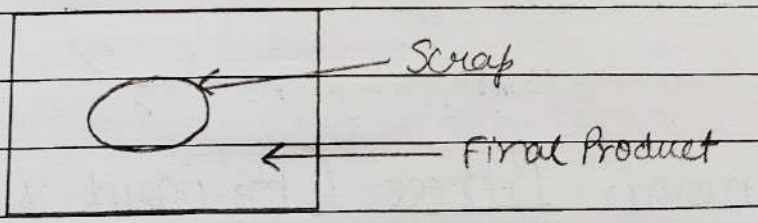


Fig: Piercing

Hot Working Processes

- Applications :- Steel plates for buildings & bridges, Kitchen Utensils, Decorative items, high strength pipelines.

(i) Rolling - It is a process of producing a thickness and increasing the length of a long workpiece by the application of compressive force through a set of rollers. This process can have multiple set of rollers as well.

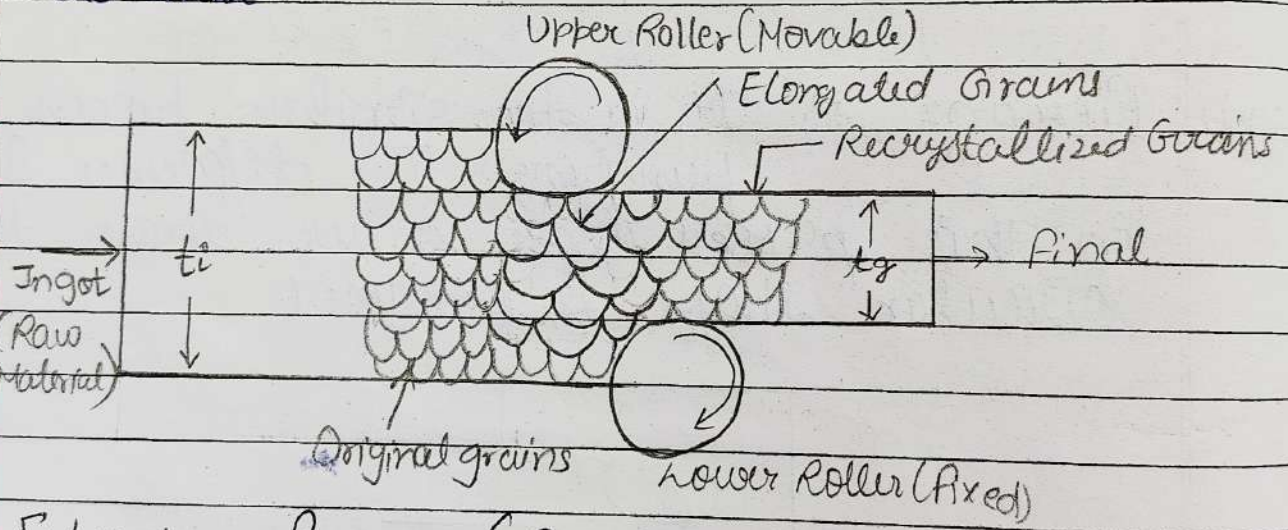


Fig - Rolling

(ii) Extrusion Process (Forward & Backward) -

It is a process in which heated billette is forced by high pressure ram provided into a dye to form the final product.

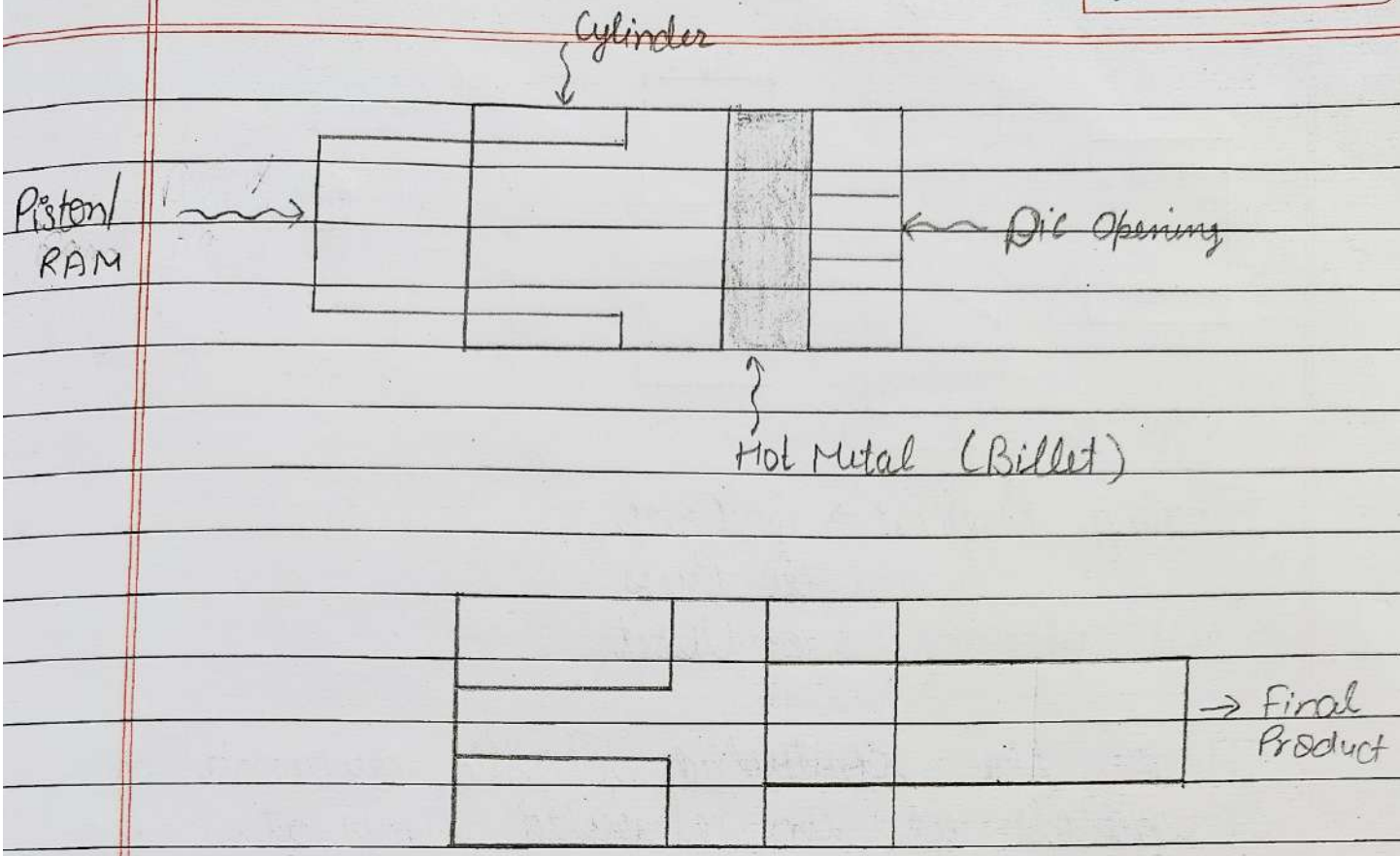
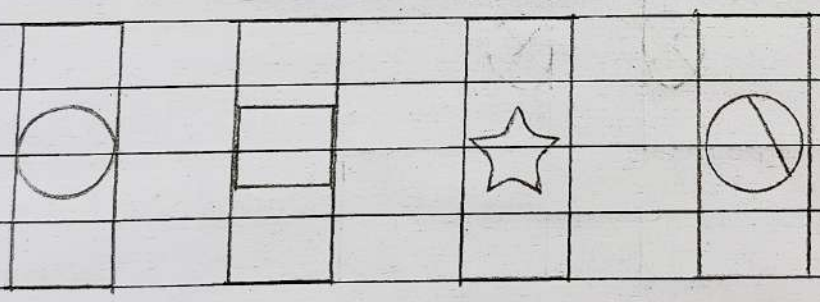


Fig : Extrusion

- Types of Die →



(iii) Wire Drawing Process → (Diameter & Thickness is decreased)

It is a metal working process used to reduce the diameter and thickness of the wire by pulling it through the series of die.

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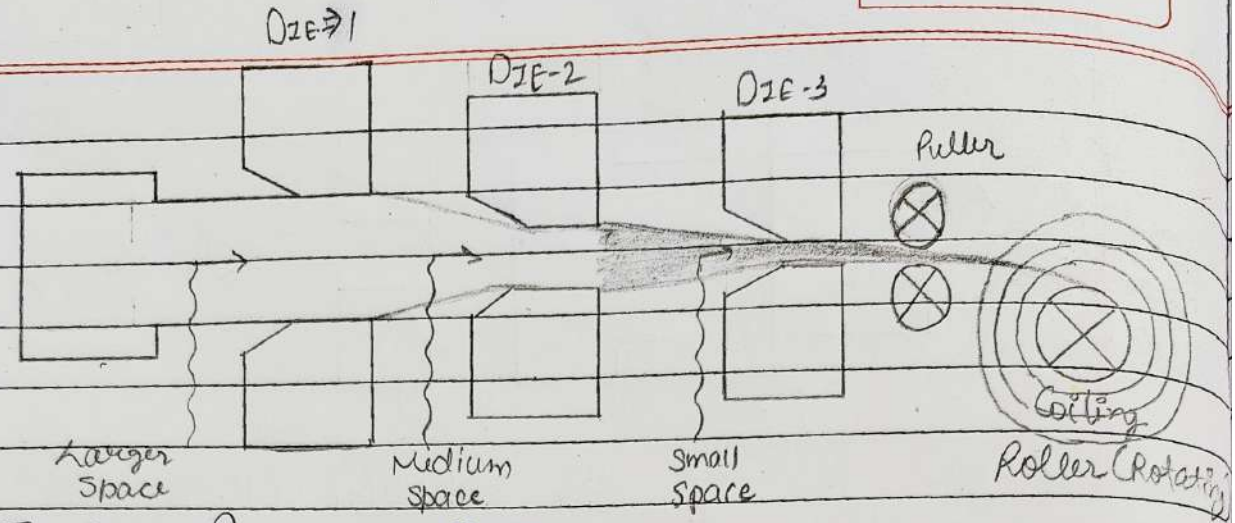
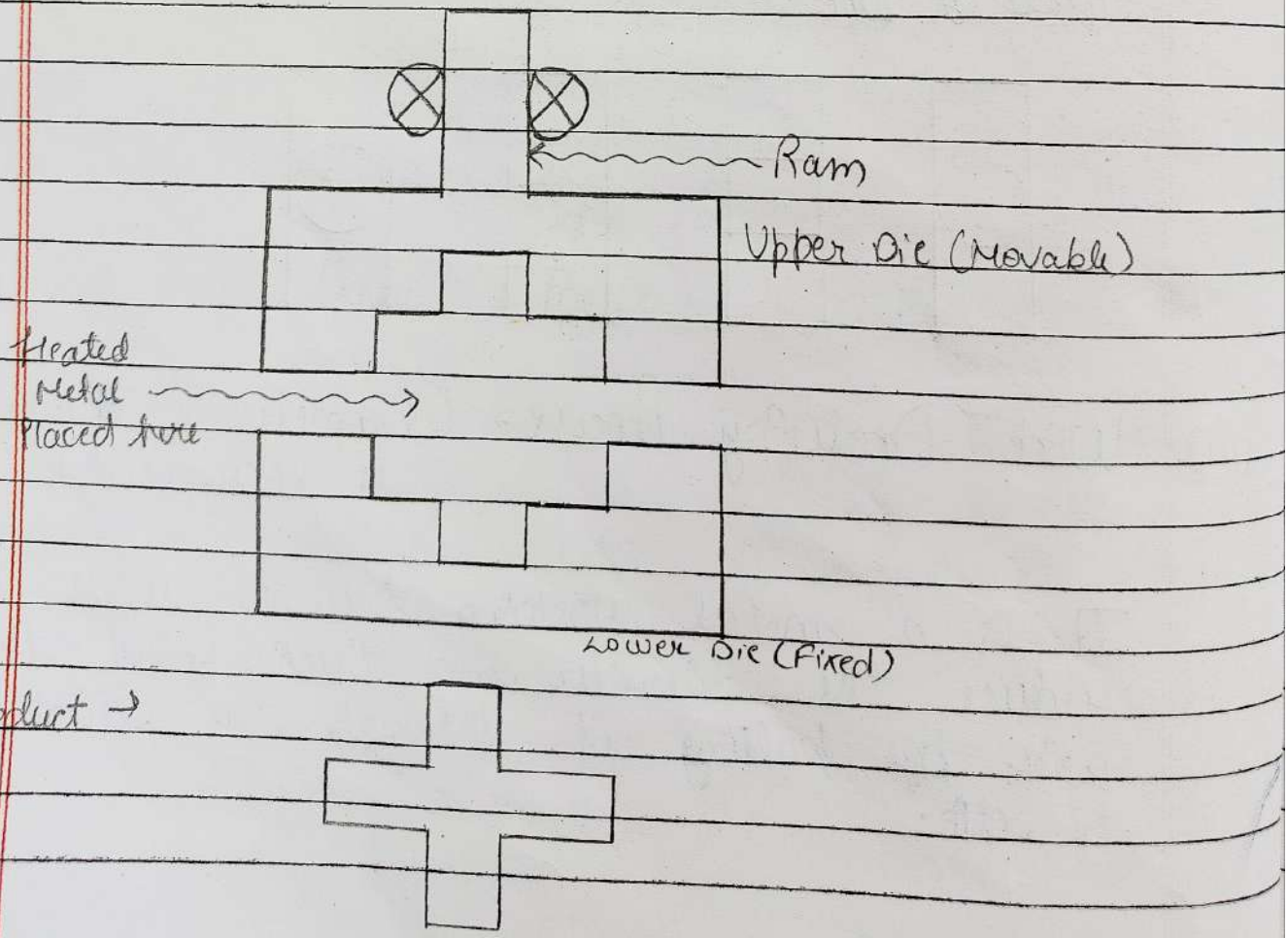


Fig: Wire Drawing

Forging Process → (1.) Drop
(2.) Press
(3.) Upset

It is the controlled plastic deformation of metals at an elevated temperature by using the external pressure and this pressure may be applied by the hand hammer or with the help of power hammer.



nal Product →