water has three types of energy.

1. Pressure energy
2. Kinetic energy
3. Potential energy

Acc to Bernoulli's theorm

$$\frac{p}{\rho g} + \frac{v^2}{2g} + z = \text{constant}$$

This means total energy of flowing liquid remain constant.

working Principle of Hydraulic turbine

1. water stored at height have Potential energy.
2. When water flows, it gains Kinetic energy.

This high spud, water strikes the turbine blades.

→ Blade rotates
→ Shaft rotates
→ Mechanical energy is produced

So, Hydraulic energy → Mechanical energy.

1. Pascal's Law

Pascal's law states that "Pressure applied to a confined liquid is transmitted equally in all directions"

Working :-

1. When force is applied on a small piston
2. Pressure is created in the liquid.
3. This pressure is transmitted equally.
4. A larger force is obtained on the bigger piston.

Formula $P = \frac{F}{A}$

Since, Pressure is same $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

if $A_2 > A_1$, then $F_2 > F_1$

So small force can lift heavy loads.

Used in Hydraulic lift, Hydraulic press etc

2. Conservation of Energy / Bernoulli's Principle

Hydraulic machines like turbines and pumps are works on the Principle of Energy Conservation.

Pump

Pumps works on principle to convert mechanical energy into Hydraulic energy.

→ Electric motors rotates the impeller.
→ Impeller rotates water.
→ Water moves outward due to centrifugal force.
→ Pressure increases
→ water is lifted to Higher level.

So,
Mechanical energy → Hydraulic energy

Working Principle of Compressor

We called it generally air compressor because only air is compressable water oil etc other materials are incompressible

Compressor is a device which is used to increase the Pressure of air from low pressure to high pressure by using some External energy.

Uses of compressed air:-
(i) For Filling the air in tubes of vehicles.
(ii) For Spray painting in paint industries.
(iii) Compressed air is used for starting IC engines

to the branch shaft.

The cylinder of the engine consists of many parts:-

(i) Inlet, outlet valve
(ii) Engine Head
(iii) Piston
(iv) Branch shaft
(v) Transfer port
(vi) Spark plug

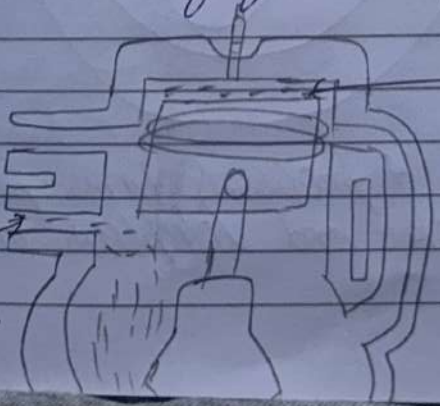
Working :-

In this engine only two strokes works that is why it is known as 2-stroke engine.

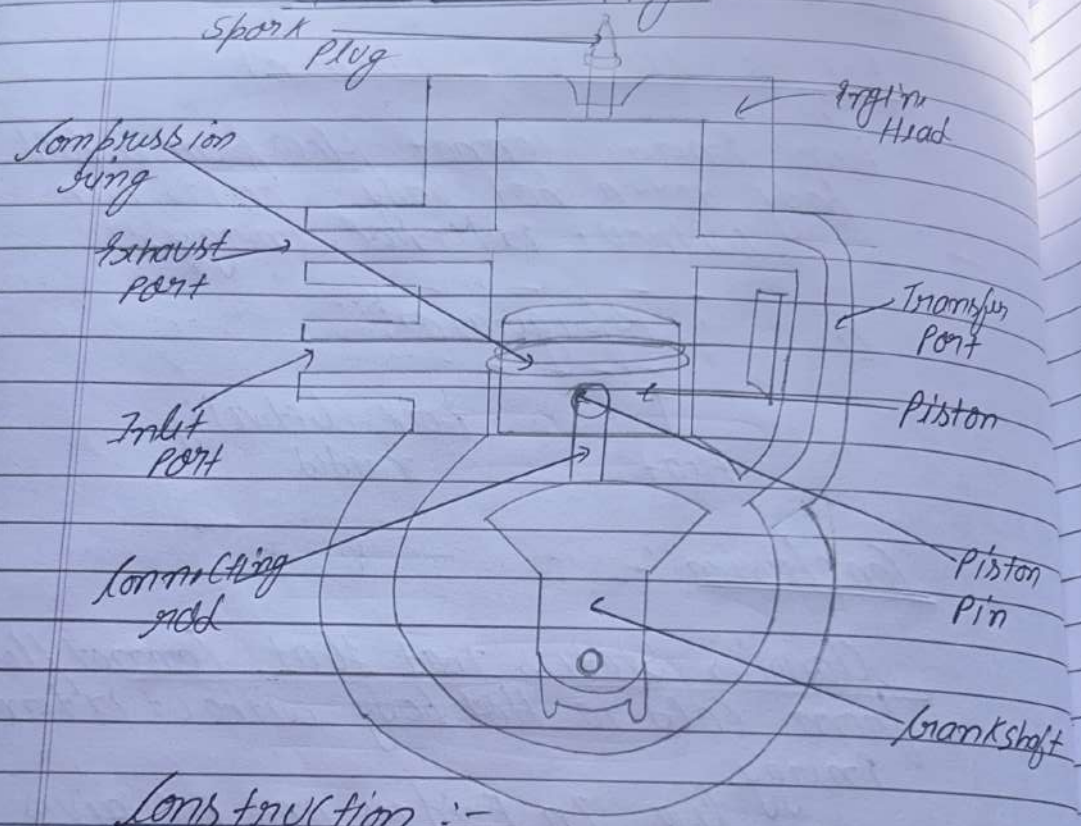
(i) Upward Stroke
(ii) Downward Stroke

In Upward Stroke :-

(i) In upward Stroke Piston goes up
(ii) Suction and intake ~~both~~ process takes place. Compression
(iii) ~~Combustion~~ of fuel takes place.



Two Stroke Engine



Construction :-

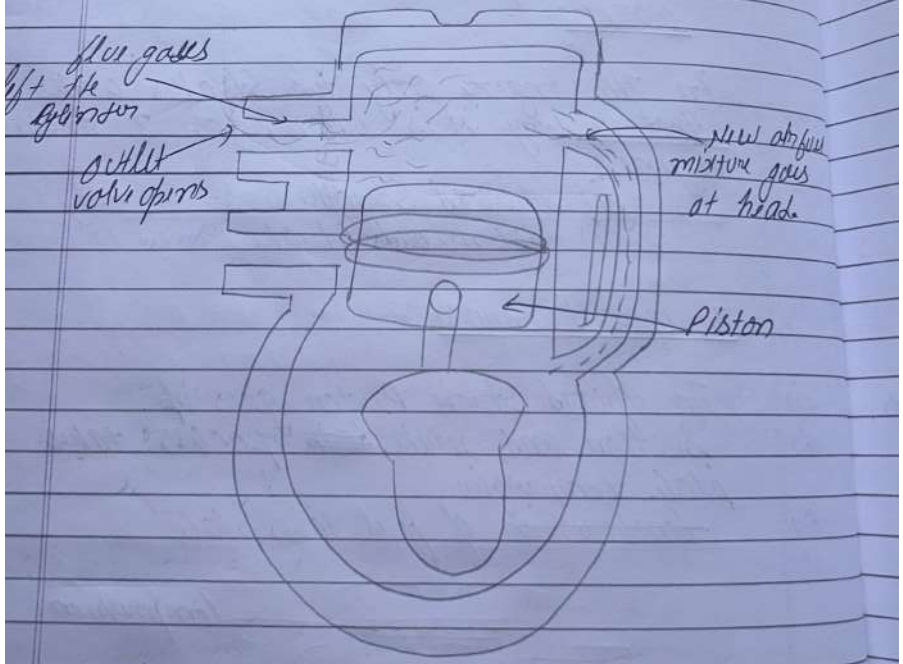
Piston - It moves upword and downword used to compress airful mixture.

Inlet outlet valve = Inlet valve use for Intaking of air or ful mixture or outlet valve is used for exit of flue gases.

Connecting rod - used to connect the piston

In downward Stroke :-

(i) Piston goes down
(ii) Power stroke and Expansion / ~~exp~~ process takes place
(iii) Exhaust of flue gases also takes place
(iv) both process takes place together.
(v) outlet valve open and inlet valve is closed.

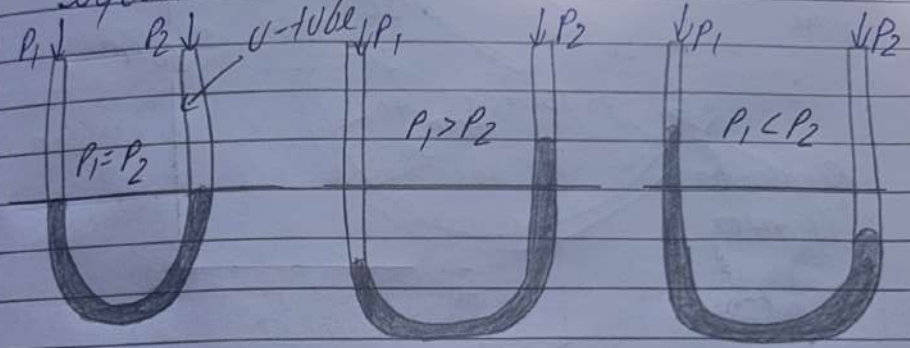


Thus all 4 processes takes place in ~~one~~ two Stroke and complete one cycle.

Devices

1. Manometer

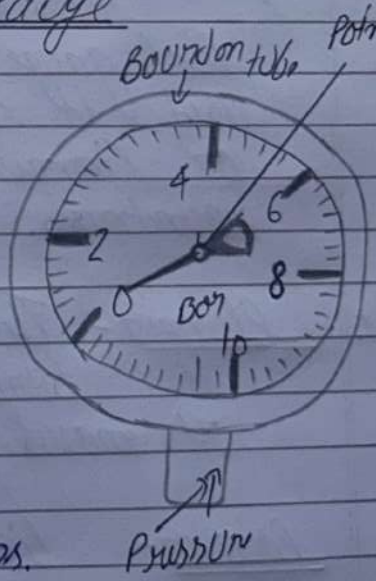
A manometer is a device that we use to measure the pressure of the pipelines (can be of gas, water, liquid etc) Also, it is usually referred to as a U-shaped tube that is filled with a liquid.



2. Bourdon Pressure gauge

A Bourdon Pressure gauge is a mechanical device used to measure and display pressure.

The gauge can be used for measuring pressure in both gas and liquid State Systems.



Slip gauges comes in different length with th, s
They are use to measure widths or lengths.

Q what is the purpose of hardning testing

Ans Hardness testing in materials is very important to check and verify their properties that how tough is the material how much strength a material can bear we can find out its breaking point fracture load, elivation, its length, Brittleness etc

So these hardning properties to check the materials are performed by different test. most common tests are :-

(i) BHN (Brinell Hardness test)
(ii) UTM (universal tensile machine)
(iii) Impact load test

1. BHN = Brinell Hardness Number

It measures hardness by pressing a hard steel ball on metal surface.

When the plunger moves. Shows the reading on the main dial gauge.

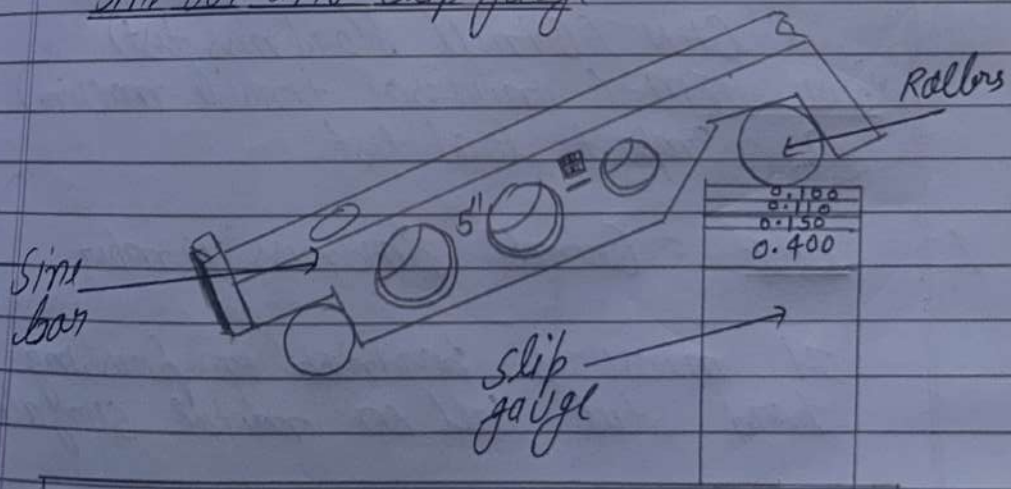
3. Dial Scale - The round dial face with numbers (0 - 100 or 0 - 120)

It shows how much displacement has happened.
one small division = 0.01mm

4. Revolution Counter - Small dial inside the main dial. It counts how many revolution a needle moves.

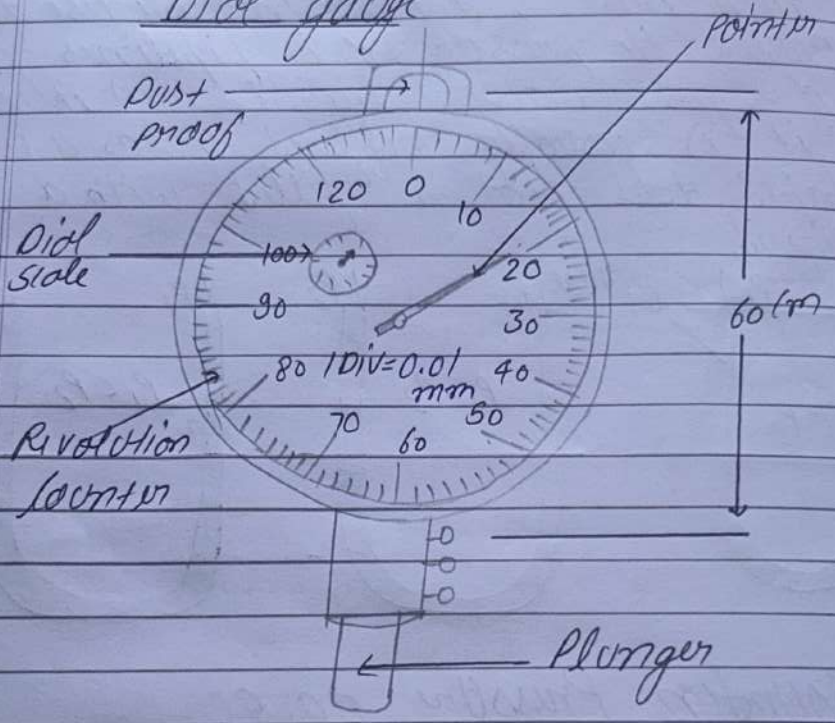
5. Dust Proof Cover - Protects the inner parts from dust.
Ensures smooth and long lasting use.

Sine bar and Slip gauge



Pressure Gauges are commonly used on the ~~petrol~~ Garages to check the pressure of tyres of vehicles.

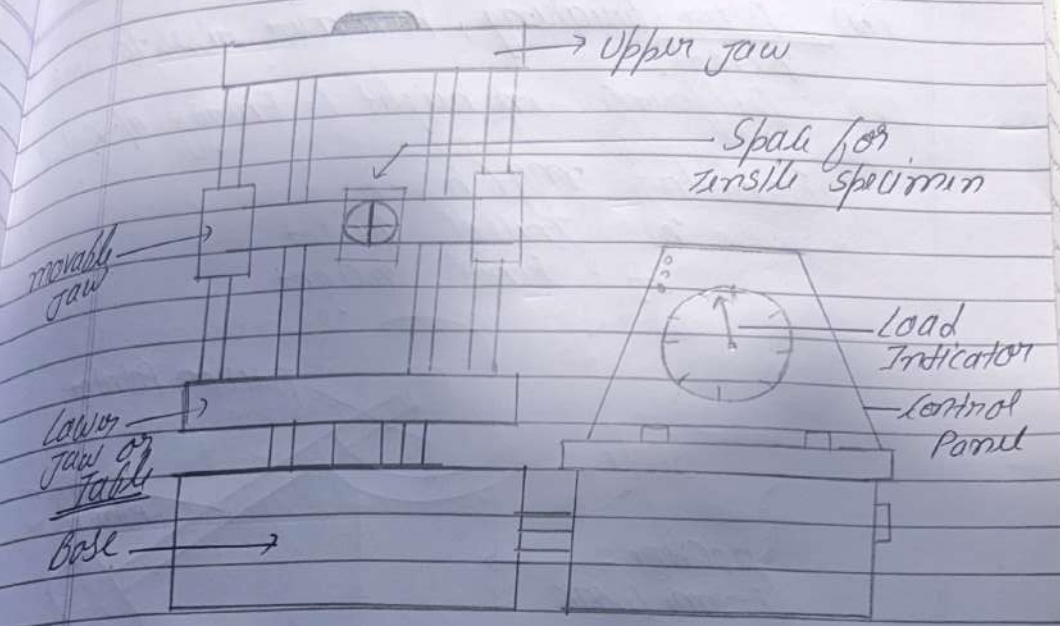
Dial gauge



Dial gauge is precision instrument used to measure very small displacements or changes in height, flatness or roundness.

1. **Plunger** - The long pin that touches the surface to be measured. It moves in and out when you press it.

2. **Pointer** - Like a clock hand - It moves



3. **Impact load test**

Impact test measures toughness of material.

Toughness - Ability to absorb shock.

Types < Charpy test
Izod test

Working - i. A Pendulum hammer is lifted to certain height.

(ii) It is released.

(iii) It Strikes the notched Specimen

Smaller dent - more hardness
Bigger dent - less hardness

2. UTM = Universal tensile machine

UTM is the machine which is used to find out at which point of load the work piece lost its strength at which point it breaks at which point it fractures and to find how much load it can bear.

The machine consists of 3 jaws
(i) Upper jaw (Fix)
(ii) Middle jaw (movable)
(iii) Lower jaw

UTM is a machine used to test :-
Tensile Strength
Compression Strength
Binding Strength.

Working :-
(i) Specimen is fixed b/w two jaws
(ii) Load is applied gradually
(iii) Material Stretches
(iv) Stress - Strain graph is obtained
(v) Breaking load is measured.

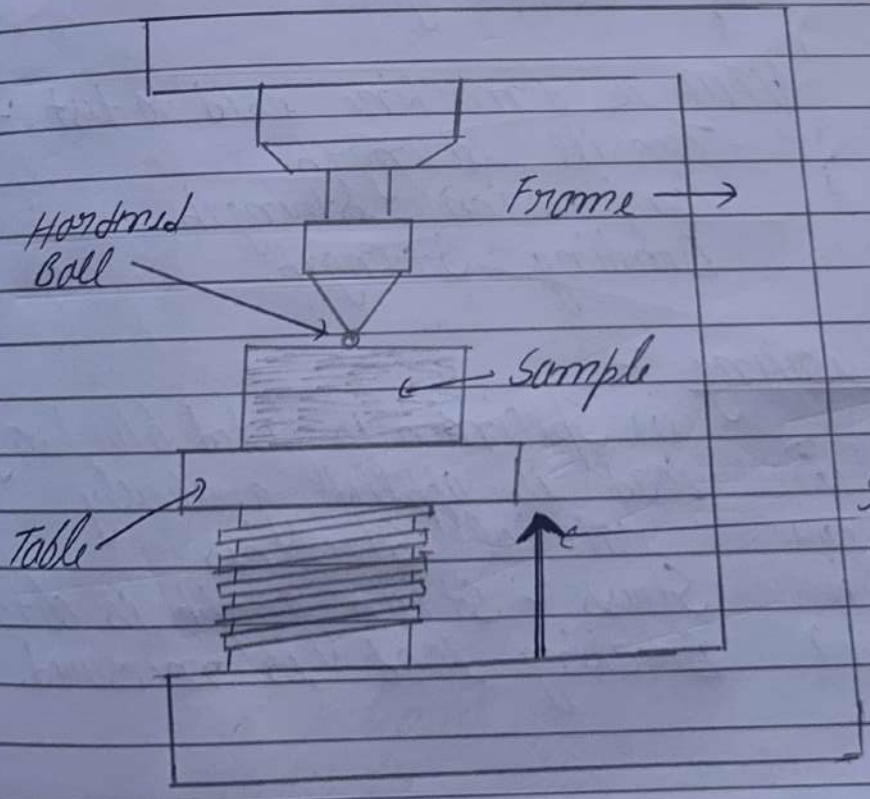
Working :-

→ A hard Steel ball (usually 10mm diameter) D
→ Pressed on metal surface.
→ With known load (P).
→ An Impression (dent) is formed.
→ Diameter of Dent (d) is formed

Then hardness is calculated.

$$BHN = \frac{2P}{\pi D\left(D - \sqrt{D^2 - d^2}\right)}$$

Where,
P = Load
D = Diameter of ball
d = Diameter of Indentation



2. Welding

Welding is a process of joining two metal pieces permanently by heating (and sometimes pressure) with or without filler material.

After welding, metals become one single piece.

Uses :- To join machine parts
To repair broken parts
Used in bridges, buildings, vehicles, pipelines.

Welding mainly is of two types

↓ Gas welding

Metal is melted by gas flame. (oxygen + Acetylene)

↓ Arc welding

Electric arc produces very high temperature (~6000°C)

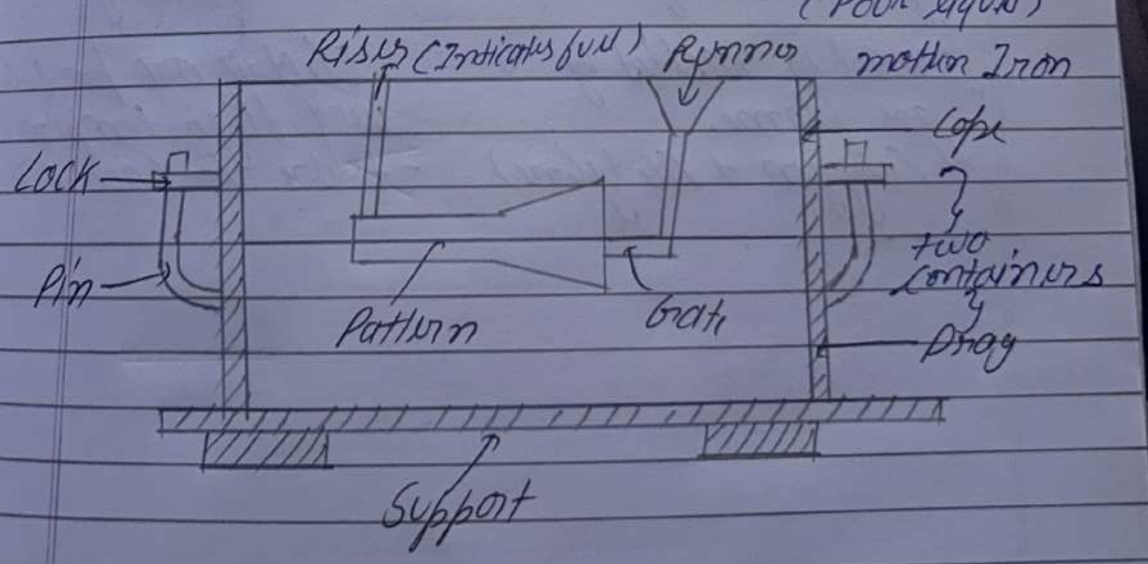
1. Casting

It is the process of making tools, engineering materials of any given shape and size.

Steps for casting :-
1. Pattern making
2. Mould preparation (Sand)
3. Pouring molten metal
4. Cooling
5. Removing casting

Types of Sand used :-
Green Sand, Dry Sand, Core Sand

Sometimes POP (Plaster of Paris) is used to make mould.



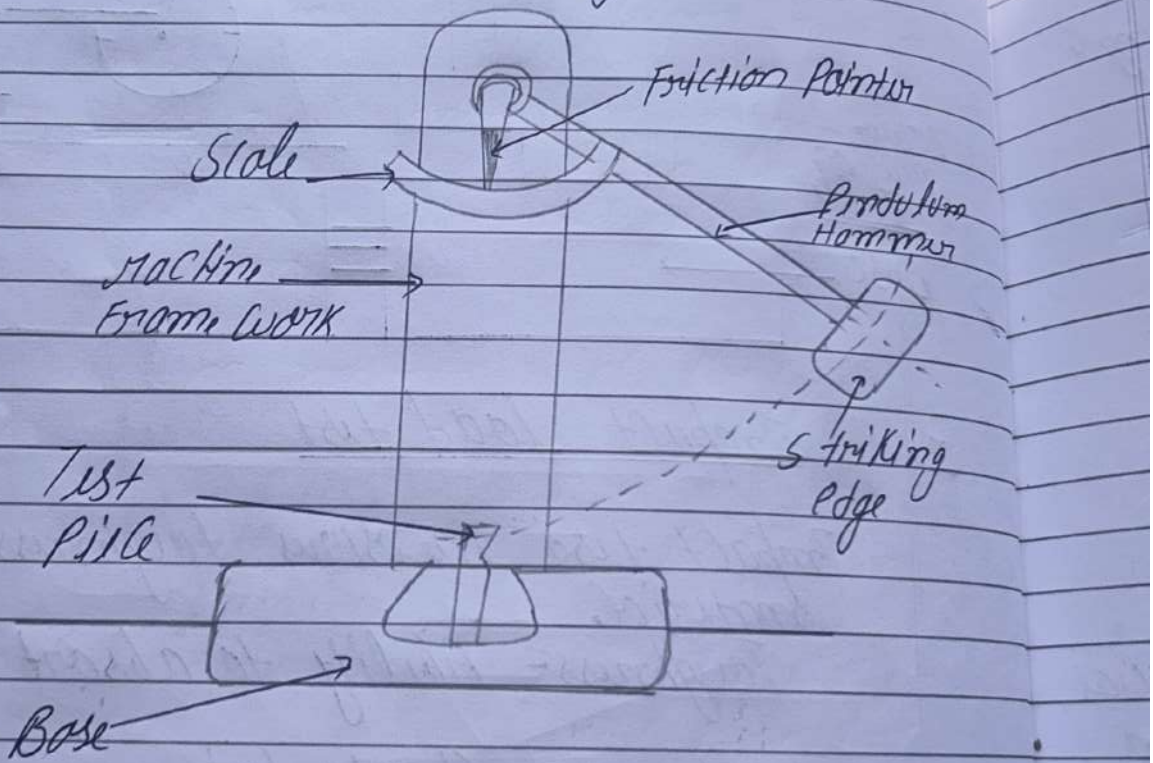
(iv) After breaking, hammer rises to small height.

(v) Difference in height = Energy absorbed

Formula = $mg(h_1 - h_2)$

h_1 = Initial height

h_2 = Final height



Alloys

- Ferrous Alloys
- Non-Ferrous Alloys

1. Ferrous alloys- These alloys contain iron as the main metal.

Ex:-
Carbon Steel
Alloy Steel
Stainless Steel

2. Non-Ferrous Alloys- These alloys do not contain iron as the main metal.

Ex:- Brass (Copper + Zinc)
Bronze (Copper + tin)

Advantages :-

1. Stronger than pure metals
2. Better corrosion resistance
3. Longer service life
4. Suitable for specific applications
5. Improved appearance.

Conclusion :- Alloys are important engineering materials that provide improved strength, durability and corrosion resistance.

Q Alloys explain?

Ans An alloy is a material formed by mixing two or more elements, where at least one is a metal, to improve properties.

Necessity of alloying

(i) To increase Strength
(ii) To improve hardness
(iii) To increase corrosion resistance
(iv) To get better mechanical properties.

Alloy Steels and Carbon Steels

Carbon Steel - Iron + Carbon only

Alloy Steel - Carbon + Iron + other elements like nickel, chromium, manganese etc.

Differing - Alloy Steels are stronger, harder and more corrosion-resistant than Carbon Steels.

Applications of alloys :-

Stainless Steel - Kitchen utensils, Surgical tools.

Bronze, Brass