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Topic: Notes (Block 1) Date ¨ / ¨ / 2020

Physics

1.1 Chapter 1 : Measurments

- Area = $\frac{1}{2} \times b \times h$ or length × breath or πr^2
  ↖ All units should be same ($unit^2$)
- Volume = $l \times b \times h$ or $\frac{4}{3} \pi r^3$ or $\pi r^2 h$
  unit = ($unit^3$)
  → Volume of liquid could be obtained by pouring it in measuring cylinder and reading the level perpendicular to the "meniscus". "meniscus". This way
- Measuring Distance:
  Rules - To the nearest mm. (Small objects)
  Tape - Larger object.
  Trudle - Huge distance
  ✱ Micro meter screw gauge - Main scale + Fractional (mm)
  - least count is 0.01mm / 0.001 cm
  - Most accurate.
  ✱ Vernier Callipers - Main scale (mm) + Vernier scale /10 (mm)
  - least count is 0.0 0.1 mm / 0.01 cm
- Time
  - The SI unit is seconds
  - Can be measured by stop watch, Analogue and digital clock.
  - hours to seconds is $\times 60^2 = \times 3600$
- ✱ Measuring by displacement
  - Measure a large amount of the object or event.
  - Divide the value by the number of object or event.
  - For eg. Period can be measured the time taken for 20 swings and divide by 20. $\frac{20 s}{20} = 2 s$

✱ U can Increase accuracy by measuring multiple times and taking an average.

1.2 Motion

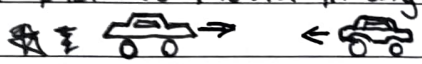
Speed = Distance / Time ∴ Average speed = Total Distance / Total time

Velocity = Displacement / Time taken - (Distance moved in a single direction)

☆ Units are = m/s, Km/hr, miles/hr

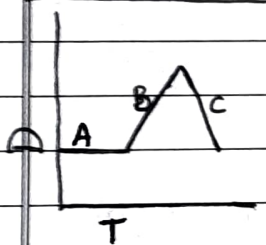
Vector - Velocity - Distance moved by the object per unit time in a particular direction.

Scalar - Speed - Distance moved in any direction.



They can have same speed but definently have opp. Velocity.

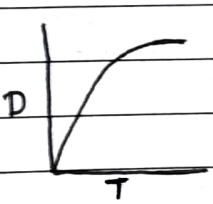
Distance-time graphs or Position-time or Displacement-time



A - Horizontal line - Stationary

B - Constant speed as constant gradient.

C - Moving Backward as negative gradient but constant.



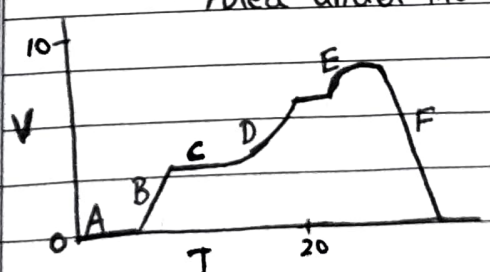
- Deceleration
- Decreasing Speed
- Gradient decreasing

- Acceleration
- Increasing Speed
- Gradient increasing

☆ Gradient of the graph shows speed

Speed-time graph or Velocity-time

- Gradient is acceleration
- Area under the graph is distance



A - At rest

B - Constant gradient so constant acceleration

C - Constant speed / No acceleration

D - Increase in gradient so increasing acceleration

E - Decrease in gradient so decreasing acceleration

F - negative acceleration / Deceleration.

Acceleration

Define - Change in Velocity per unit time
- m/s^2, Km/hr^2
- Acceleration of free fall on earth is $10 m/s^2$
- Vector quantity
- $A = \frac{v-u\ (m)}{t\ (s)} = A\ m/s^2$
- Negative acceleration is deceleration or retardation

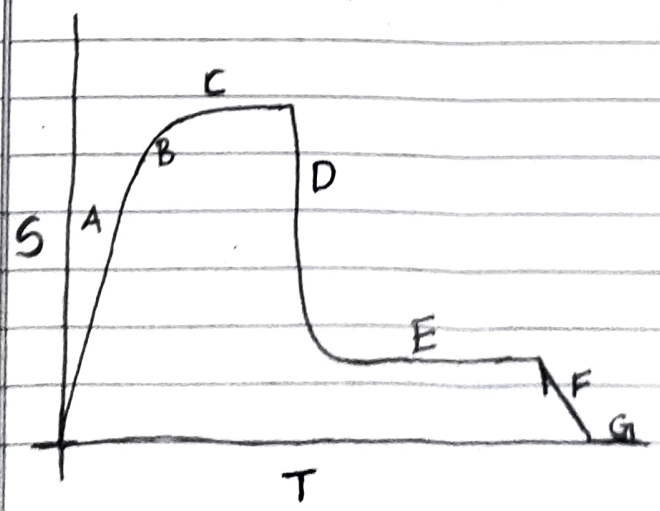
Equation

d = distance
a = acceleration
t = time
u = intial velocity
v = final velocity

$v = u + at$ (~~Finding v~~ without distance)
$d = \frac{(v+u)}{2} \times t$ (~~Finding d~~ without acceleration)
$d = u \times t + \frac{1}{2} \times a \times t^2$ (~~Finding d~~ without final velocity)
$v^2 = u^2 + 2as$ (Calculation without time)
* second is only for uniform velocity.

Free fall

1 - When a parachutist jumps, intially there is ~~only~~ weight acting downwards ~~&~~ and air resistance is ~~no~~ small.
2 - He accelerates as ~~only~~ downward force is more, this increases the speed so air resistance (upward force) increases.
3 - Resultant force favouring downwards decreases so the object decelerates.
4 - At some point ~~the~~ there is no resultant force or acceleration this point is called terminal velocity. / constant speed.
5 - After which the parachutes opens up which increases the upward force and the man slows down.



A - 1
B - 2, 3
C - 4
D - 5
E - Much slower teminal velocity
F - Downward force increases
G - R Hits ground.

1.3 Mass and Weight

Mass	Weight
• Amount of matter in something	• It is value for the pull by gravity.
• Mass cannot be zero	• Weight can be zero
• Mass does not change due to gravity.	• Weight is directly proportional to gravity.
• Scalar ; Unit = g , Kg	• Vector ; unit = N
• Measured using ~~spring~~ balance	• Measured using normal balance.

- **Weight = Mass × Gravitational attraction**

The greater the mass, the higher its resistivity against motion or we can say it has higher inertia

1.4 Density

- It is amount of mass per unit Volume.
- Density = $\frac{\text{Mass}}{\text{Volume}}$
- Unit is ~~Kg/m³~~ g/cm^3 , Kg/m^3

Measuring Density

— Regular shape	— Irregular shape
• Calculate Volume by formula	• Take measuring cylinder with known amount of liquid. (V_1)
• Measure mass by a balance	• Drop the object and measure the new volume (V_2)
• Use $D = \frac{M}{V}$	• Volume of object = $V_2 - V_1$
— Liquid	• Measure mass by balance.
• Measure mass of cylinder (m_1)	• Use $D = \frac{M}{V}$
• pour liquid then measure mass (m_2) ; Mass = $M_2 - M_1$	A object with less density can float
• Volume is found by Measuring cylinder	
• Use $D = \frac{M}{V}$	

1.5 Forces

1.51 - Effects

- It can change shape and size of object
- It can make a object accelerate or decelerate.
- It can change the direction of motion.
- It can stop a object.

- Force is amount needed to increase acceleration of 1kg object by $1 m/s^2$.
- Unit is N or $kg\,m/s^2$
- It is a Vector quantity.

★ Force = Mass (kg) × acceleration (m/s^2) | Resultant force is found.

★ Newtons Laws

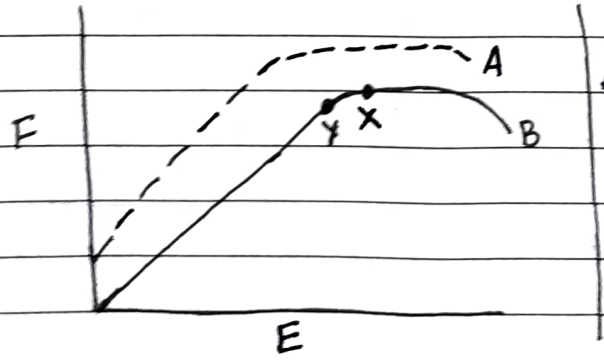
1. Object remains ~~constant~~ at rest or continues uniform speed unless external force ~~is~~ acts on the object.
2. $F = m \times a$
3. Every action has equal and opposite ~~re~~ reaction. (Ship)

~~Resultant~~ Friction

- It is force caused due to rubbing of 2 objects.
- It opposes the direction of any object.
- It produces heat as waste energy.
- Air resistance is Friction as air particles oppose.

★ Hooke's law

- It states extention is propotional to the load ~~eg~~ (N) applied ~~until the~~ as long as they are under limit of propotionality
- F = constant × extention (kx)



A- Linear spring ; B- propotional
X- Limit of propotionality -
- Point where k is not constant.
Y- Limit of elasticity - Point from which spring will not return back to shape.

★ Circular motion

- Centripetal force is which acts towards the centre and is needed ~~no~~ and not caused by circular moment ; ~~Eg: Car~~
- Centrifugal force is acting away from centre and is a reaction to centripetal force. (opp. direction, same magnitude)

→ The speed is constant but the velocity changes as direction changes so acceleration also changes.

■ The force required depends on numerous factors.
- Greater the mass greater force required.
- Greater speed requires greater force.
- Smaller radius require stronger pull (force).

1.5.2 Turning Effect

- Moment is the turning effect around a point. (pivot)

■ The size of moment depends on:
- Greater the force greater the moment
- Greater the perpendicular distance greater the moment

∴ M = Force × Perpendicular distance (M = Fd)

- Unit is Newton meter ; Nm, Ncm.

1.5.3

★ - Equilibrium is when: total clockwise equals to anticlockwise moment. or Upward = Downward.
- There is also no resultant force.

1.5.4 Centre of mass

- An imaginary point at which the total mass is concentrated.
- At this point weight exerts downward force.

■ How to find?
- Regular objects have uniform mass so the perfect middle is centre of mass.
- Irregular (Lamina - 2d object) ∴ Punch two holes and insert a pin in one hole then take a plumb line and tie it to the pin and hange the object with the help of a stand. Trace the line plumb line indicates. Do the same with other hole and the point of intersect is ....
- plumbline is String and a weight.

★ The object with bigger base is more stable.
- The centre of mass inside base will not topple as clockwise moment is produced.
- The centre of mass outside base area will topple due anti-clockwise moment.

1.5.5 Scalars and Vectors

- Scalar have only magnitude
- Vectors have magnitude and direction.

Scalar	Vectors
Distance ; Energy	Displacement ; Velocity
Speed ; Time	Acceleration ; Force
Time ; Temperature	Weight ; Momentum

1.6 Momentum

- It is a product of mass and velocity.
- It shows how much force is required to stop or change velocity a moving object
- $p = m\,(kg) \times v\,(m/s)$ unit = kg m/s or Ns

☆ Conservation - The total moment before collision is equal to total momentum after collision.

$\therefore mu = mv$

$\therefore m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Impulse - Change in momentum

Ft = impulse ; $m(v-u)$ = impulse

$\therefore Ft = m(v-u)$

$\therefore$ resultant force $= \frac{m(v-u)}{\Delta t}$

☆ The greater the momentum the greater force over a short period of time require to stop or smaller force over a huge amount of time to stop object in motion. Eg. Oil tanker.

☆ Cars have crumple zone which increase the time so lower deceleration.
$M = F \times t$ $\therefore$ M is constant so if t increases the force (impact) decreases.

1.7 1.7.1 Energy.

- It is the capacity to do work.
- Unit is J ; Nm

☆ - 'Energy cannot be created or destroyed only transfered from one form to another' This is law of ~~conversa~~ Conservation of energy

☆ - ~~Various~~ During an event 100% of energy is not transfered and some is wasted ~~as~~ as it gets spread in the enviroment.

☆ It can be in form of heat, sound, light mostly but sometimes kinetic.

Kinetic energy

- Formula: $E = \frac{1}{2} \times mass \times velocity^2$

Gravitational potential Energy

- Formula: GPE = mass x acceleration of freefall x hieght.

☆ During climbing up ~~or down~~ The kinetic energy is transfered to G.P.E and vice versa.

1.7.2 Effiency.

~~It~~ - It is ~~ra~~ ~~an~~ ratio of useful energy / Total energy.

- Formula: $\frac{\text{Useful}}{\text{Input}} \times 100$ or $\frac{\text{Useful power}}{\text{Input power}} \times 100$

☆ The Sun released energy through Neuclear fussion the combining of hydrogen molecules.

1.7.3 Work.

- Work done is total energy transfered
- Formula : ΔE = Force x distance (single direction)
- Unit : Nm; Joules

1.7.4 Power

- It is the rate at which work is done
- Formula : Power = $\frac{\Delta \text{Energy (J)}}{\text{time (s)}}$
- Unit : ☆ Watt (W) ; J/s

☆ Sun is Source of all energy except:

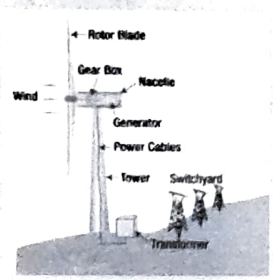
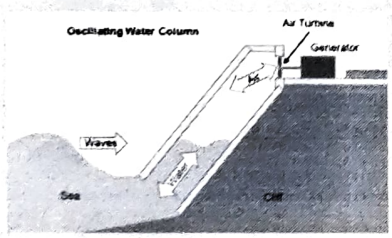
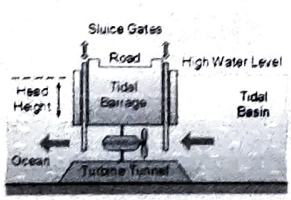
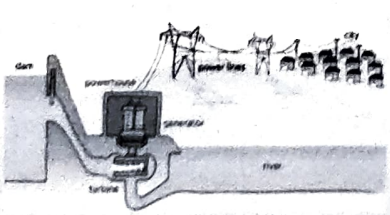
- Neuclear
- Tidal
- Geothermal

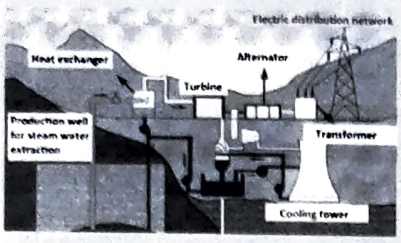
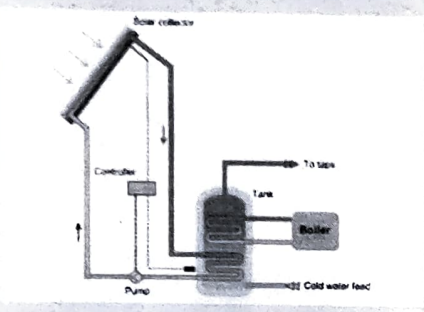
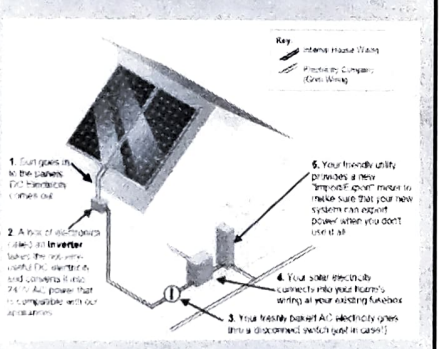
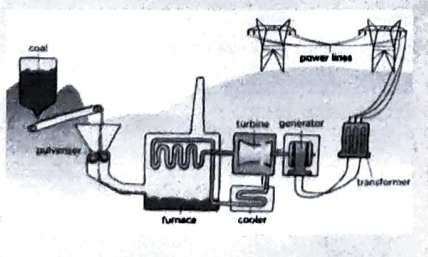
Energy	Description
Store Chemical (potential)	Energy that is stored (potential) in food or batteries which can be transferred into other forms of energy. It is the energy stored in chemical bonds.
Internal Transfer	Also known as heat energy. The wasted energy in many energy transfers is usually this. Most energy is wasted by turning into this. Thermal energy refers to the transfer of heat energy. e.g. thermal energy is transferred from a Bunsen burner flame to increase the internal energy of a beaker of water.
Sound Transfer	A series of longitudinal waves detected by our ears (more later). Can also be another example of wasted energy. e.g. the hum from a fridge freezer.
Light Transfer	A series of electromagnetic waves detected by the eye. Light bulbs emit this energy.
Electrical Transfer	Arguably our most useful form of energy. Most devices we use transfer this form of energy to other useful forms. e.g. the light bulb described in the previous example.
Gravitational Potential (GPE) Store	A form of stored energy that varies depending on where you are in a gravitational field. The higher up you are, the more GPE you have.
Kinetic (KE) Transfer	The energy of a moving object. Electrical motors transfer electrical energy to kinetic energy in devices such as hairdryers, food mixers etc.
Elastic Potential Store	The energy stored in an object such as a spring that is stretched, squashed or bent. It is sometimes referred to as strain energy or, simply, elastic energy
Nuclear Store	Nuclear energy is energy in the nucleus (core) of an atom. This energy can be released when unstable uranium atoms in a nuclear reactor split apart in a process known as nuclear fission.

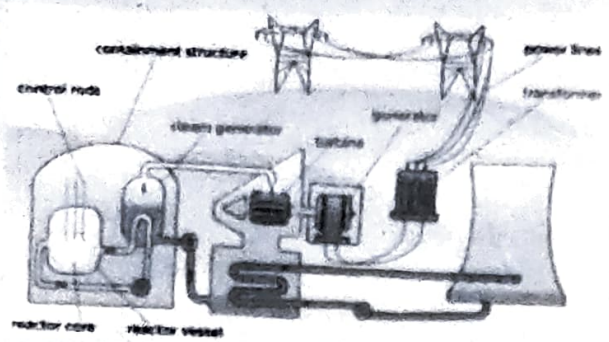
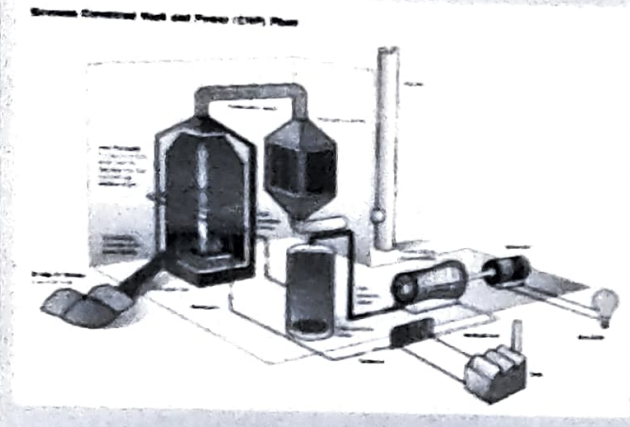
Energy resources

Energy resources are the starting point for generating electricity.

- A **renewable** source of energy can be used over and over again – there is an unlimited supply, e.g. wood is renewable because more trees can be grown.
- A **non-renewable** source of energy will eventually run out and cannot be replaced, e.g. coal is non-renewable because it takes millions of years to form and we are using it a far faster rate.

Resource	Description	Energy Transfers & Advantages / Disadvantages
Wind 	Wind is caused by huge **convection currents** in the Earth's atmosphere, driven by heat energy from the Sun. This moving air has huge amounts of kinetic energy which can be transferred into electrical energy using wind turbines.	KE → Electrical Energy Ads: **renewable**, no carbon dioxide (CO_2) produced DisAds: noisy, ugly, wind level varies
Waves 	Waves are caused by the action of the wind upon the sea. Wave machines use the up and down movement of waves to work electricity generators.	KE → Electrical Energy Ads: **renewable**, no greenhouse gases DisAds: difficult to build, expensive to maintain (salt corrosion)
Tides 	Tidal barrages are built across the mouths of rivers entering the sea. As water moves in or out of the river mouth when the tide turns, the kinetic energy in the water is used to work electricity generators.	KE → Electrical Energy Ads: **renewable**, no CO_2 DisAds: expensive to build, harm wildlife, require specific geography
Hydroelectric 	Hydroelectric power (HEP) schemes store water high up behind dams. The water has gravitational potential energy. As the water rushes down through pipes, this GPE is transferred to kinetic energy, which turns electricity generators.	GPE → KE → Electrical Energy Ads: **renewable**, no CO_2 DisAds: ugly, disrupt wildlife, expensive

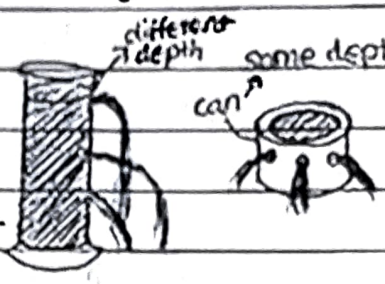
Geothermal 	In some places, the rocks underground are hot because of **radioactive decay**. Deep wells can be drilled and cold water pumped down to be heated by the rocks. It returns to the surface as hot water and steam, where its energy can be used to drive turbines and electricity generators.	Thermal Energy → KE → Electrical Energy Ads: **renewable** DisAds: deep drilling is difficult and expensive
Solar Heating 	Solar panels do not generate electricity. Instead, the sun is used to heat up water directly. A pump pushes cold water from a storage tank through pipes in the solar panel to be heated.	Thermal Energy → Electrical Energy Ads: **renewable** DisAds: sun's heat energy varies
Solar Cells 	Solar cells are devices that convert **light** energy directly into electrical energy. You may have seen small solar cells on calculators. Larger arrays of solar cells are used to power road signs, and even larger arrays are used to power satellites in orbit around Earth.	Light Energy → Electrical Energy Ads: **renewable** DisAds: sunshine varies, expensive, not very efficient
Fossil Fuels 	**Coal**, **oil** and **natural gas** are called fossil fuels. Chemical energy from the remains of plants and dead sea creatures that lived millions of years ago is stored within these. This energy is transferred to thermal energy and light energy when the fuels burn.	Chemical Energy → Heat Energy → KE → Electrical Energy Ads: efficient, reliable supply of energy DisAds: **non-renewable**, causes pollution (greenhouse gases such as CO_2, acid rain gases such as sulphur dioxide)

Nuclear Power 	The heat from the **chain reaction** caused by the **fission** of unstable uranium nuclei is used to boil water which produces steam that turns turbines.	Nuclear Energy → Thermal Energy → KE → Electrical Energy Ads: efficient, reliable, very little greenhouse gases DisAds: **non-renewable**, radioactive waste
Biomass 	Biomass fuels come from living things such as wood. Chemical energy stored in these when burned is released as heat energy which heats up water into steam. The steam is then used to turn turbines which generate electricity.	Chemical Energy → Heat Energy → KE → Electrical Energy Ads: **renewable** **carbon neutral** (only emit CO_2 that originally absorbed when the plant was growing) DisAds: Huge areas of land are needed

Pressure

Pressure is the force acting on unit area. Unit of pressure is pascal (Pa) = $1 N/m^2$

$$\text{Pressure} = \frac{\text{force}}{\text{area}}$$



Liquid Pressure 1) Pressure in a liquid increases with depth.

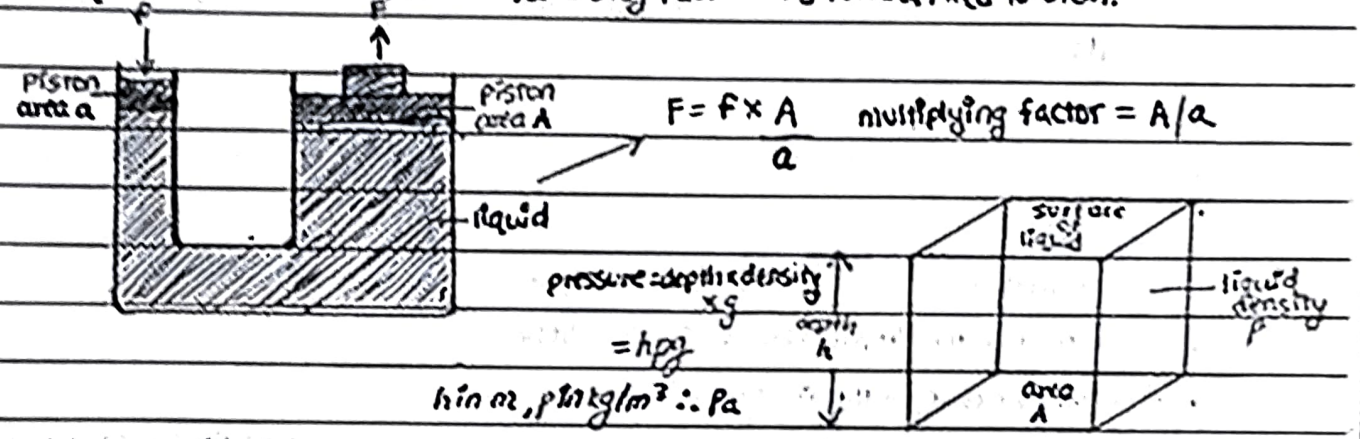
2) Pressure at one depth acts equally in all directions.

3) Pressure depends on the density of the liquid.

The lower the place, the greater the water pressure, that's why reservoirs are located in mountainous regions, so that the water flow quickly and can be pumped to high-rise buildings. It must be thick at the bottom due to large water pressure.

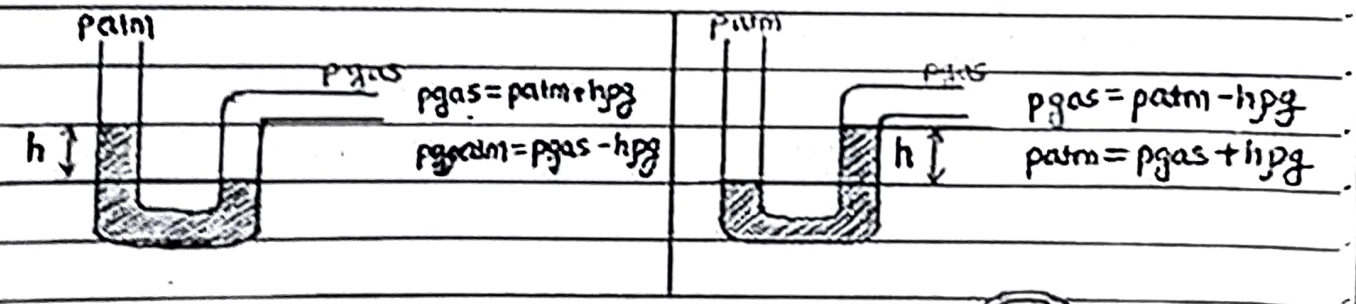
Hydraulic machines

Liquids are almost incompressible, and they pass on any force applied to them.



U-tube manometer

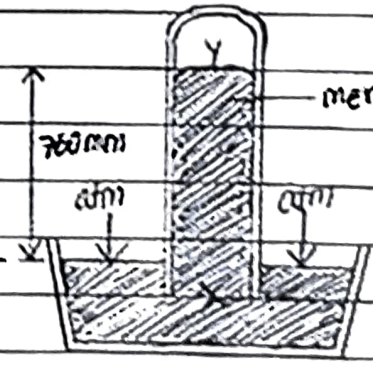
Used to measure pressure difference.



Mercury barometer

Used to measure atmospheric pressure.

Pressure at X due to the weight of the column of mercury XY equals the atmospheric pressure on the surface of mercury on the tray. XY measures the atmospheric pressure in mm of mercury (mmHg). Diameter does not affect it, nor does the shape.



Typo