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10 Std

Physics

7 marks

unit - I

1) State Newton's law of Motion

(i) Newton's First Law :-

States that "everybody continues to be in its state of rest or the state of uniform motion along a straight line unless it is acted upon by some external force".

(ii) Newton's Second Law :-

States that the force acting on a body is directly Proportional to the rate of change of linear momentum of the body and the change in momentum take place in the direction of the force."

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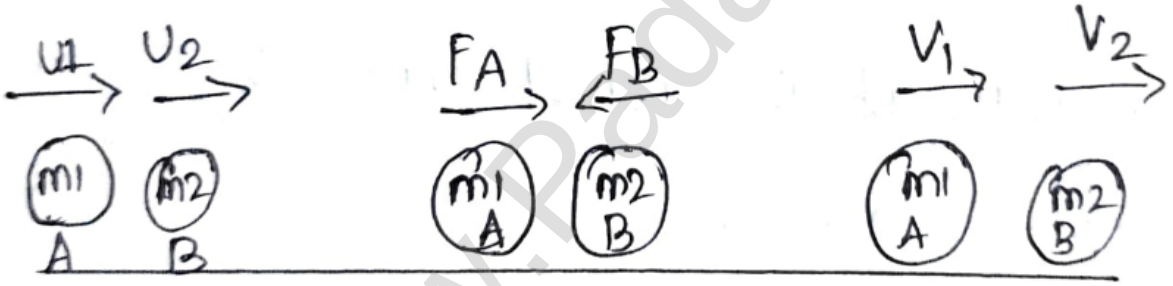
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(iii) Newton's third law :-

states that "for every action, there is an equal and opposite reaction. The always act on two different bodies."

2) State and Prove the law of conservation of linear momentum



* Let two bodies A and B having masses m_1 and m_2.

* Move with inital velocity u_1 and u_2 in a straight line.

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*Let the velocity of the first body be higher than that of the second body

$u_1 > u_2$.

* Doring an interval of time t second they tend to have a collision.

* After the impact both of them move along the same straight line with a velocity v_1 and v_2.

Force on body B due to A,

$$F_B = m_2 (v_2 - u_2)/t$$

Force on body A due to B,

$$F_A = m_1 (v_1 - u_1)/t$$

By Netwon's III law of Motion.

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④

$$F_A = -F_B$$

$$m_1 (v_1 - u_1) / t = m_2 (v_2 - u_2) / t$$

$$m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$$

* The above equation confirms in the absence of an external force.

* the Algebraic Sum of the momentum after collision is Numerically equal to the algebraic Sum of the momentum Before Collision

* Hence the law of Conservation of linear momentum is Proved.

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3) Describe rocket Propulsion :-

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(5)

* Propulsion of rockets is based on the law of conservation of linear momentum as well as Newton's III law of Motion.

* Rockets are filled with fuel (either liquid or solid) in the Propellant tank.

* When the rocket is fired, this fuel is burnt and hot gas is ejected with high speed from the Nozzle of the rocket, Producing a huge momentum

* To Balance this momentum, an equal and opposite reaction force is Produced in the combustion chamber which makes the rocket Project forward.

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* While in motion the mass of the rocket gradually decreases until the fuel is completely burnt out.

* Since there is no net external force acting on it the linear momentum of the system is Conserved

* The mass of the rocket decreases with altitude, which results in the gradual Increase in the velocity of the rocket.

* At one stage it reaches a velocity which is sufficient to just escape from the gravitational pull of the Earth. This velocity is called escape velocity.

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4) Give the application of universal law gravitation.

* Dimensions of the heavenly bodies can be measured using the gravitation law.

* Mass of the Earth the radius of the earth acceleration due to gravity etc ... can be calculated with higher accuracy.

* Helps in discovering New stars and Planets.

* one of the irregularities in the motion of stars is called 'wobble' lead to the disturbance in the motion of a plant Nearby.

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* In this condition, the mass of the star can be calculated using the law of gravitation.

* Helps to explain germination of roots is due to the Property of geotropism which is the Property of a root responding to the gravity

* Helps to Predict the path of the astronomical bodies.

5) What are the the types of inertia ? Give an example for each type.

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* Inertia of rest
* Inertia of motion
* Inertia of Direction.

Inertia of rest :-

The resistance of a body to change its state of rest is called inertia of rest.

Example :-

When you vigorously shake the branches of a tree some of the leaves and fruits are detached and they fall down (Inertia of rest)

Inertia of motion :-

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The resistance of a body to change its state of motion is called inertia of motion

Example

An Athlete runs some distance before jumping. Because this will help him jump longer and higher (Inertia of motion)

Inertia of direction :-

The resistance of a body to change its direction of motion is called inertia of direction.

Example

When you make a sharp turn while driving a car you tend to lean sideways (Inertia of direction)

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(11)

6) Deduce the equation of a force using Newton's Second law of motion.

* Let 'm' be the mass of a moving body, moving along a straight line with an initial speed v.

* After a time interval of 't' the velocity of the body change to v due to the impact of a unbalanced external force F.

Initial momentum of the body $P_i = mv$

Final momentum of the body $P_f = mv$

Change in momentum $\Delta p = P_i - P_f - mv - mu$

By Newton's Second law of Motion

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Force, F $\propto$ rate of change of momentum

F $\propto$ change in momentum / time

$$F \propto \frac{mv - mu}{t}$$

$$F = \frac{km(v-u)}{t}$$

Here, k is the Proportionality Constant

k = 1 in all System of units. Hence

$$F = \frac{m(v-u)}{t}$$

Since

acceleration = change in velocity / time

$$a = (v-u)/t$$

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Hence we have $F = m \times a$ (13)

Force = mass × acceleration.

7) State the universal law of gravitation and derive its mathematical expression.

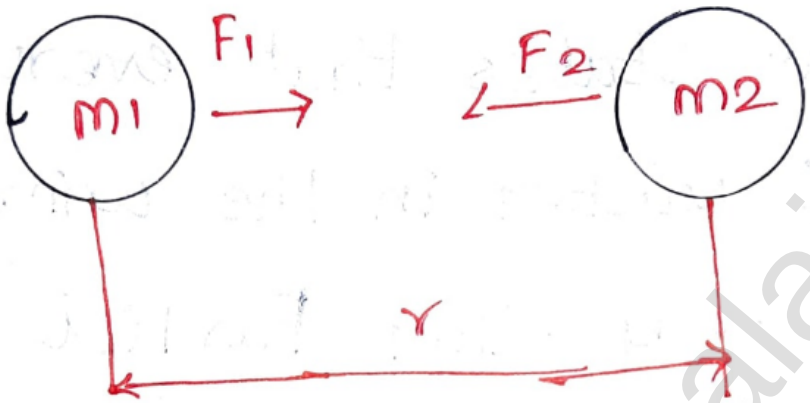
* This law states that every Particle of matter in the universe attracts every other Particle with a force.

* This force is directly Proportional to the Product of their masses and ~~uni~~ inversely Proportional to the square of the distance between the centers of these masses.

* The direction of the force acts along the line joining the masses.

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Force between the masses is always attractive and it does not depend on the medium where they are placed.



Gravitational force between two masses.

Let m_1 and m_2 be the masses of two bodies A and B Placed r metre apart in space.

Force $F \propto m_1 \times m_2$

$F \propto 1/r^2$

On combining the above two expressions

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$$F \propto \frac{m_1 \times m_2}{r^2}$$

$$F = \frac{G m_1 m_2}{r^2} \quad \text{---} \quad (1.10)$$

Where G is the universal gravitational constant. Its value in SI unit is $6.674 \times 10^{-11}\ Nm^2 kg^{-2}$.

Unit - 2

Optics

1) List any five Properties of light

* Light is a form of energy.
* Light always travels along a straight line.
* Light does Not Need any medium for its Propagation. It can even travel through vaccum.

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* The speed of light in vaccum or air is $C = 3 \times 10^8 \ ms^{-1}$

* Since light is in the form of waves it is characterized by

✓ a wave length (λ)

✓ a frequency (ν)

which are related by the following equation

$$C = \nu\lambda$$

C - velocity of light

* Different coloured light has different wavelength and frequency.

* Among the visible light :-

* Violet light

* lowest wave length

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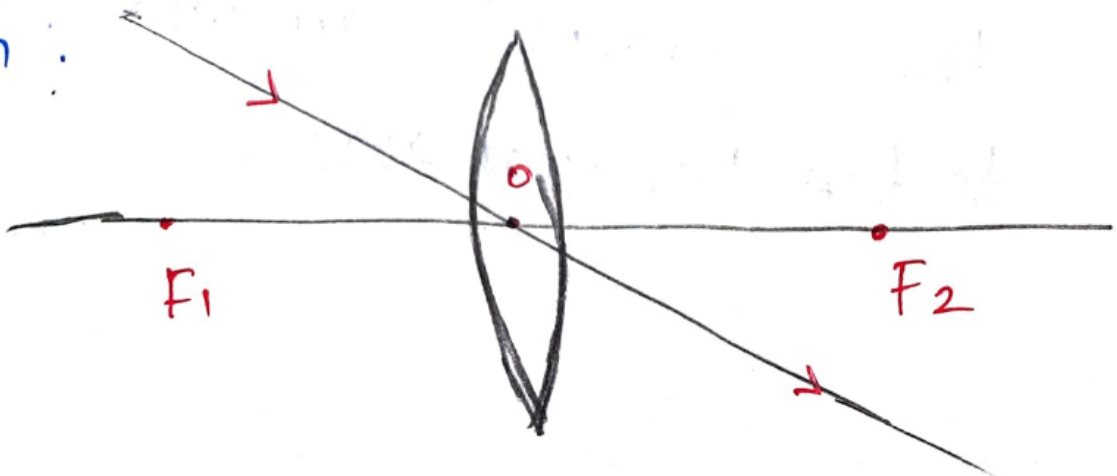
* red light
* highest wave length.

* When light is incident on the interface between two media it is partly reflected and partly refracted.

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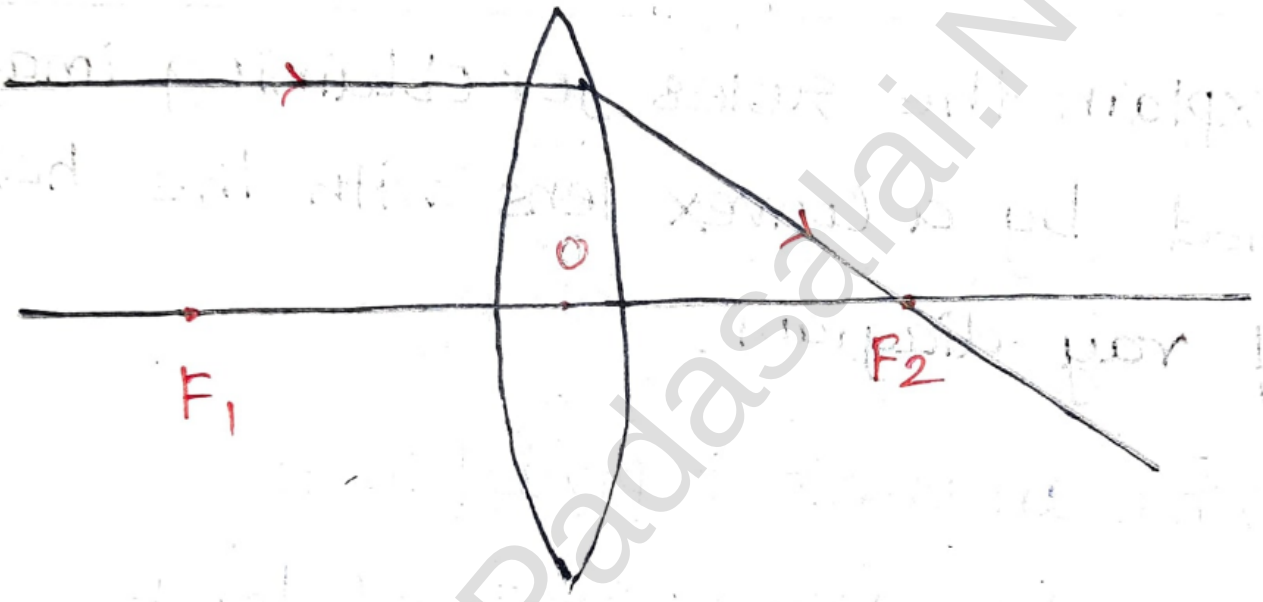
2) Explain the rules for obtaining images formed by a convex lens with the help of ray diagram.

Rule - 1 :- When a ray of light strikes the convex lens obliquely at its optical centre it continues to follow its path without any deviation.



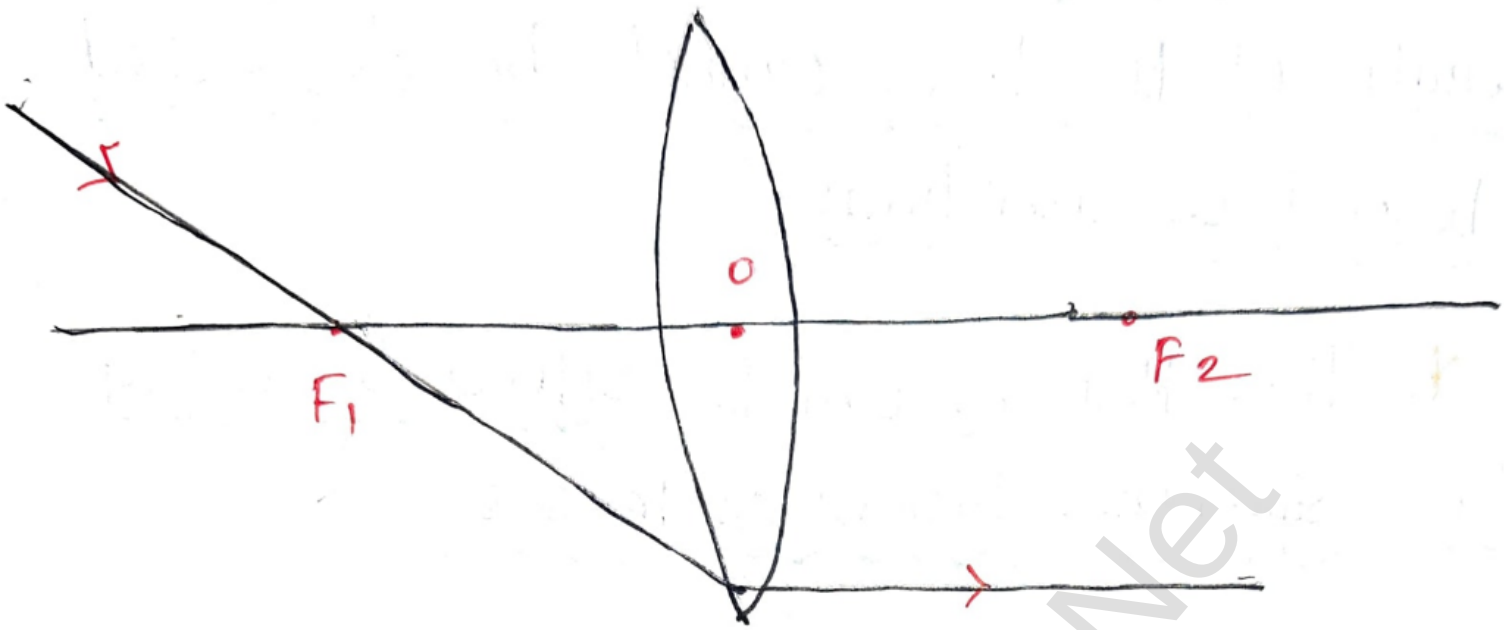
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Rule - 2 :- When rays parallel to the Principle axis strikes a convex the refracted rays are converged to (convex lens) the Principle focus.



Rule - 3 :- When a ray Passing through (convex lens) Principle focus strikes a convex lens, the refracted ray will be Parallel to the Principal axis.

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3) Explain the construction and working of a 'compound microscope'

- Compound microscope :-

* Compound microscope is also used to see the tiny objects.

* It has better magnification Power than simple microscope.

* magnification Power of microscopes can be increased by decreasing the focal length of the lens used.

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* Due to constructional limitations the focal length of the lens cannot be decreased beyond certain limit.

* This Problem can be solved by using two separate biconvex lenses.

Construction :-

A compound microscope consists of two convex lenses :-

* The lens with the shorter focal length is placed near the object and is called as "objective lens" (or) 'Objective Piece'.

* The lens with larger focal length and Large aperture placed Near the

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(21) Observer's eye is called as "eye" "lens" (or) "eye piece". Both the lenses are fixed in a narrow tube with adjustable Provision.

Working :-

*The object (AB) is placed at a distance slightly greater than the focal length of objective lens ($u > f_o$).

* A real inverted and magnified image (A'B') is formed at the other side of the objective lens.

* The image behaves as the object for the eye lens.

* The Position of the eye lens ~~for~~ is adusted in such a way that the

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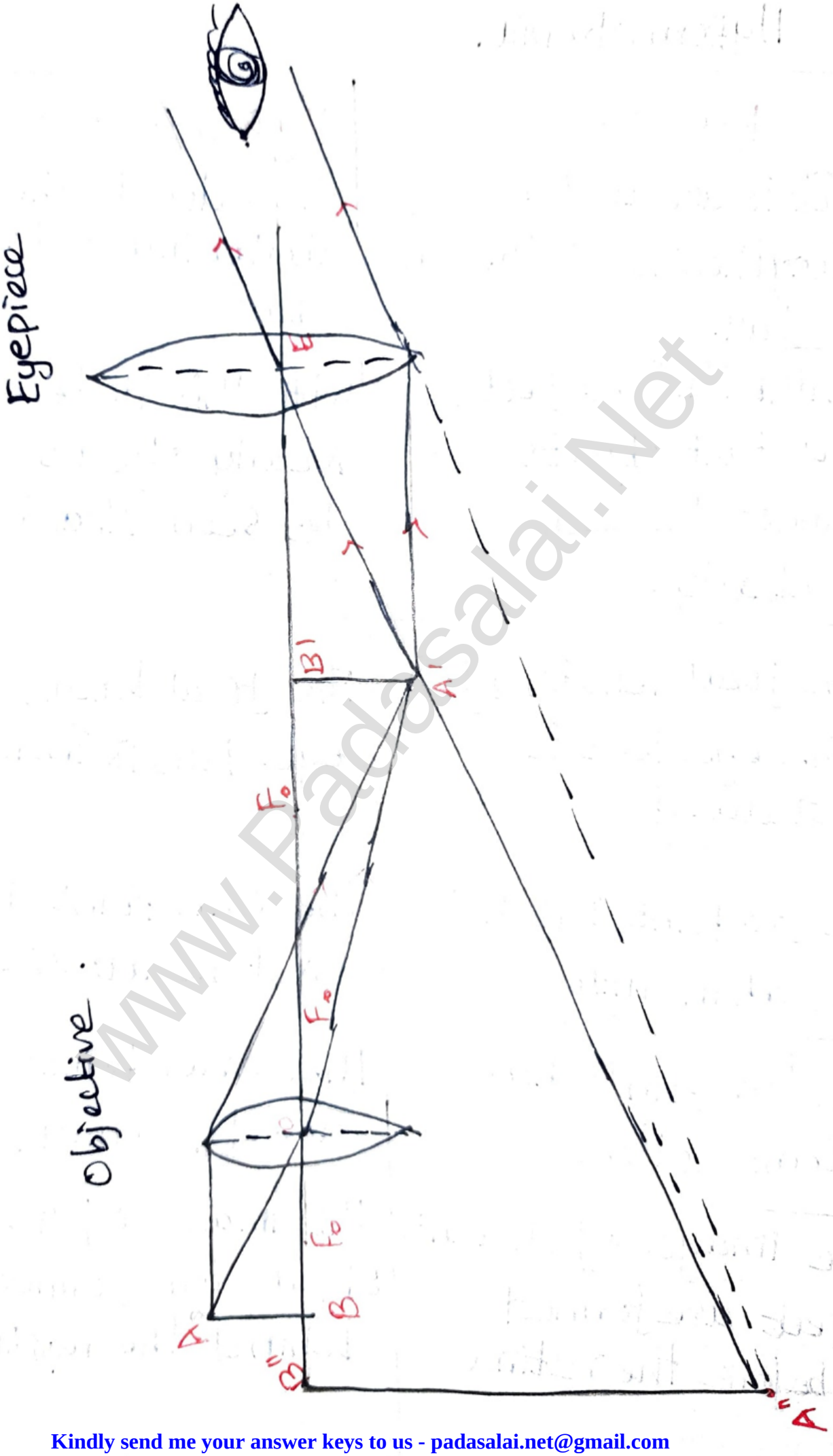
(A'B') falls within the Principle focus of the eye piece.

* This eye piece forms a virtual enlarged and erect image (A"B") on the same side of the object

* Compound microscope has 50 to 200 time more magnification Power than simple microscope.

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Image formation in compound microscope



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4) Differentiate the eye defects myopia and Hypermetropia. (2q)

Myopia	Hypermetropia
It is due to the lengthening of the eye ball.	It is due to the shortening of the eye ball
With this defect, distant objects cannot be seen clearly.	With this defect, Nearly objects cannot be seen clearly.
The focal length of the eye lens is reduced	The focal length of eye lens is increased.
The far Point will not be at infinity	The Near Point will Not be at 25cm
The far Point has come closer	The Near Point has moved further.
The image of distant object are formed before the retina	The image of nearby object are formed behind the retina.

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Myopia	Hypermetropia.
It can be corrected by using concave lens	It can be corrected by using convex lens.
This defect is known as myopia	This defect is known as hypermeteropia.

unit-3

Thermal Physics

Detail

1) Derive the ideal gas equation.

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The Ideal gas equation is an equation which relates all the Properties of an Ideal gas.

* Obeys Boyle's law
* Charles's law
* Avogadro's law

$$PV = \text{constant} \quad --(1)$$

According to Charle's law

$$V/T = \text{constant} \quad --(2)$$

According to Avogadro's law

$$V/n = \text{constant} \quad --(3)$$

Example

$$PV = V/T = V/n = \frac{PV}{nT}$$

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After combining equation (1) (2) and (3) you can get the following equation

$$PV/nT = \text{Constant} \quad \text{---} \quad (4)$$

The above relation is called the combined law of gases.

If you consider a gas which contain μ moles of the gas, the Number of atoms contained will be equal to μ times the Avogadro Number, N_A

$$n = \mu N_A \quad \text{---} \quad (5)$$

Using equation (4) equation (5) can be written as.

$$PV/\mu N_A T$$

PV/nT

$n = \mu N_A$

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The value of the constant in the above equation is taken to be K_B which is called as Boltzmann constant ($1.38 \times 10^{-23} JK^{-1}$).

Hence we have the following

$$P_V / \mu N_A T = K_B$$

$$P_V = \mu N_A K_B T$$

Here $\mu N_A K_B = R$, which is termed as universal gas constant whose value is $8.31 J mol^{-1} k^{-1}$

$$PV = RT \quad -- (6)$$

Ideal gas equation is also called as equation of state. Because it gives the relation Between that state variables and it is used to describe the state of ~~any~~ any gas.

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2) Explain the experiment of measuring the real and apparent expansion of a liquid with a neat diagram.

* To start with the liquid whose real and apparent expansion is to be determind is Poured in a container up to a level.

* Mark this level as L_1.

* Now, heat the container and the liquid using a burner as shown in the figure 3.5.

* Initially the container receives the thermal energy and it expands.

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* As a result the volume of the liquid appears to have reduced.
* Mark this reduced level of liquid as L_2.
* On the further heating, the thermal energy supplied to the liquid through the container results in the expansion of the liquid.
* Hence the level of liquid rises to L_3
* Now the difference between the levels L_1 and L_3 is called as apparent expansion and the different between the levels

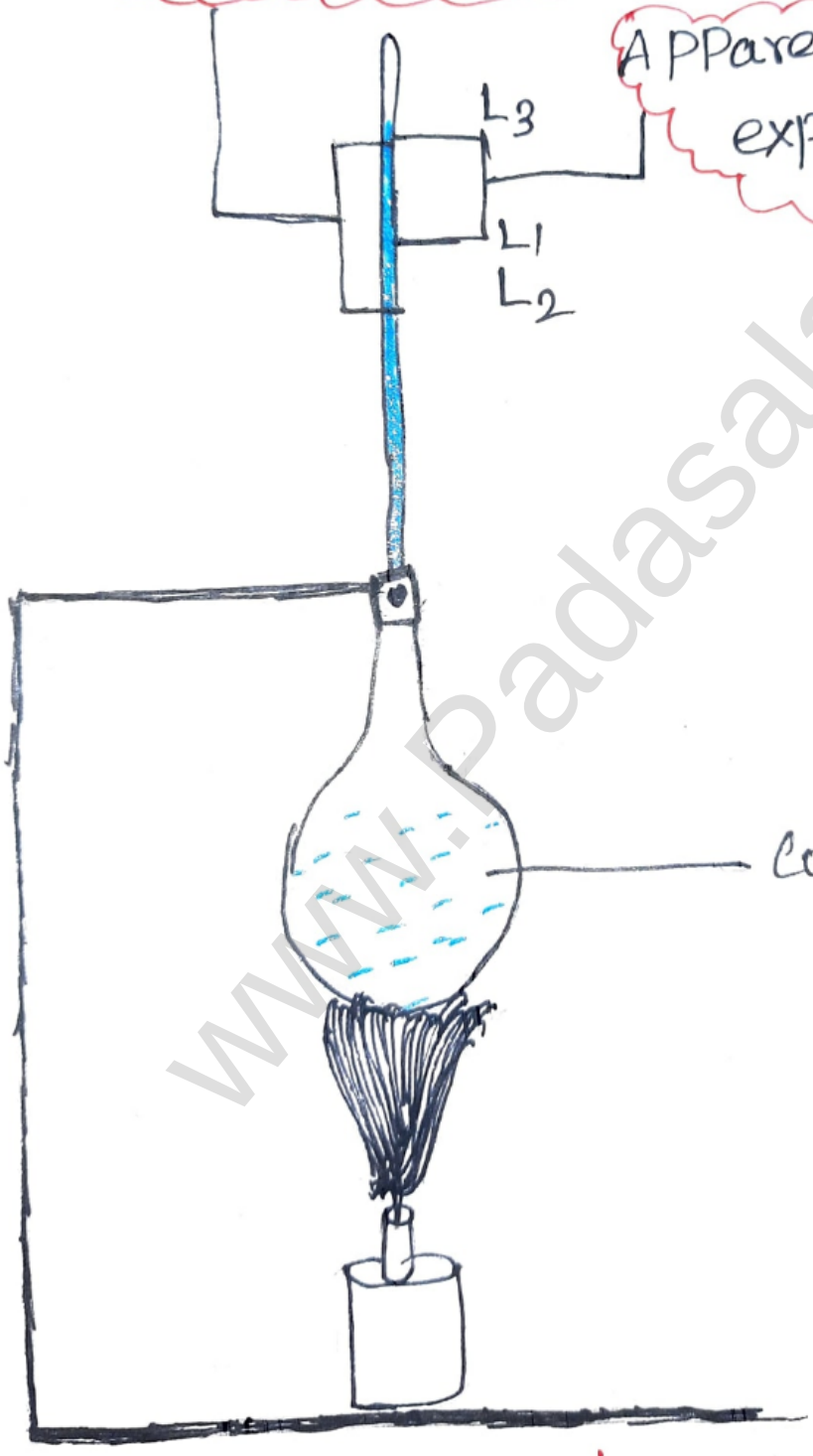
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L_2 and L_3 is called real expansion.

*The real expansion is always more than that of apparent expansions.

Real expansion = $L_3 - L_1$

Apparent expansion = $L_3 - L_2$



Real and apparent expansion of liquid.

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