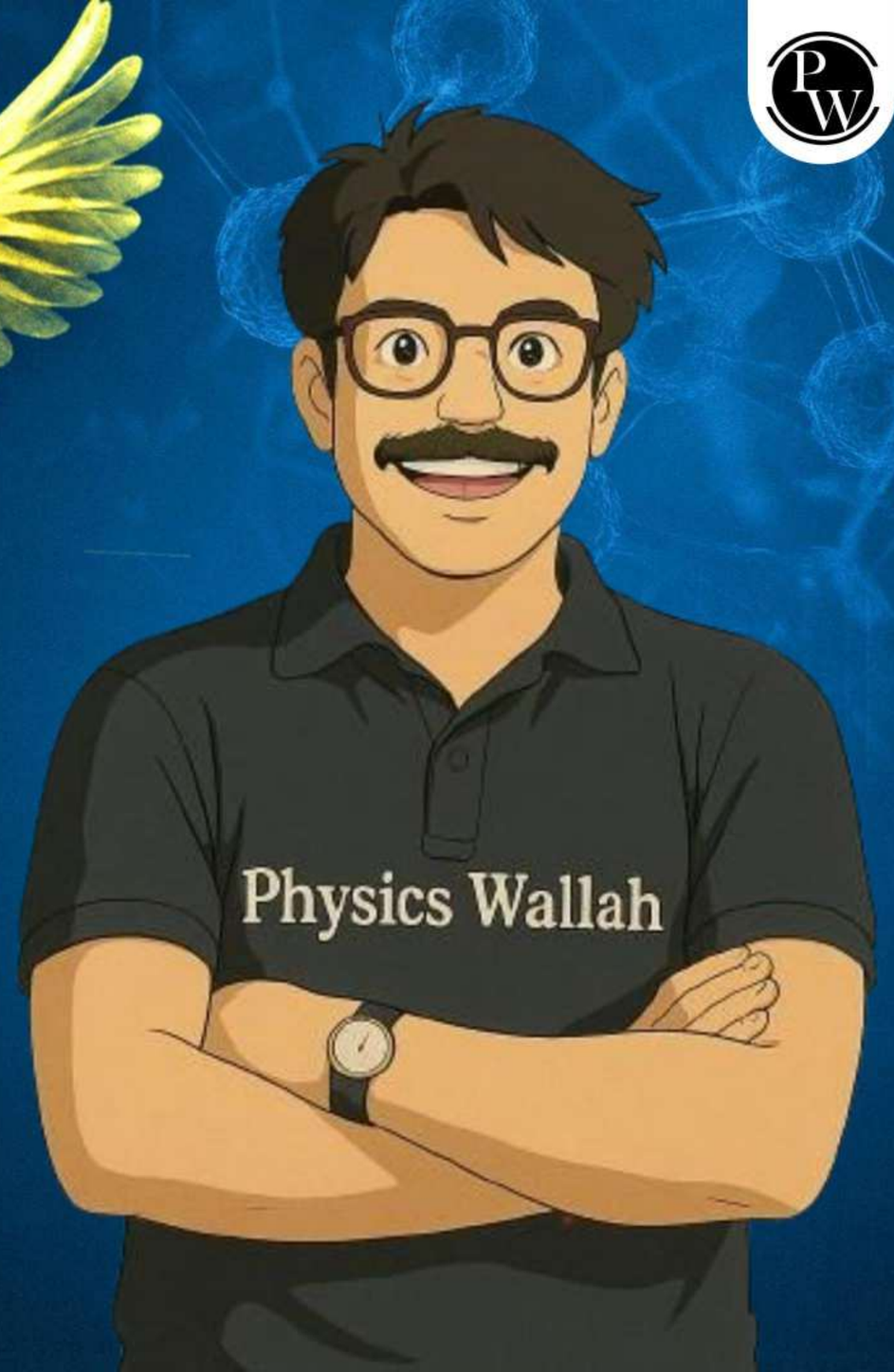
UDAAN

2026

LIGHT - Reflection & Refraction (Basics of Light)

PHYSICS | LECTURE-1



BY– Er. Rakshak Sir

Topics *to be covered*

A Basics of Light

B The Properties of Light

C Reflection of Light : Laws

SHAPATH GREHEN SAMAROH

Mai _____Shapath leta/leti hoon ki mai is saal Class 10th Board me ____% Score karunga/karungi.

Iske liye Jo Teachers advice karenge vo 100% FOLLOW karunga/karungi.

Science

CLASS 10th Theory - 80 Marks

- Physics – 25 Marks
- Chemistry – 25 Marks
- Biology – 30 Marks

Internals – 20 Marks

10th Physics v/s 9th Physics

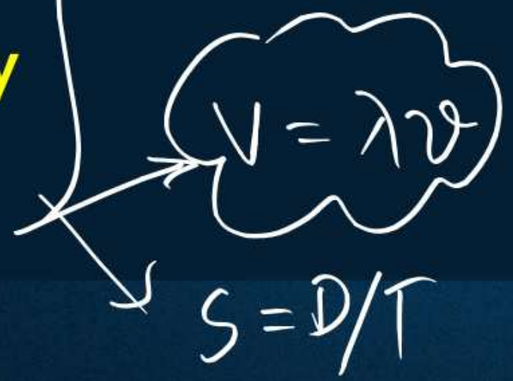
CLASS 9th

(Numerical)

- Motion
- Force & LOM
- Gravitation
- Work & Energy
- Sound

CLASS 10th

- Light – Reflection and Refraction (T+N)
- Human Eye & the Colourful World (T)
- Electricity (T+N)
- Magnetic Effects of Current (T)

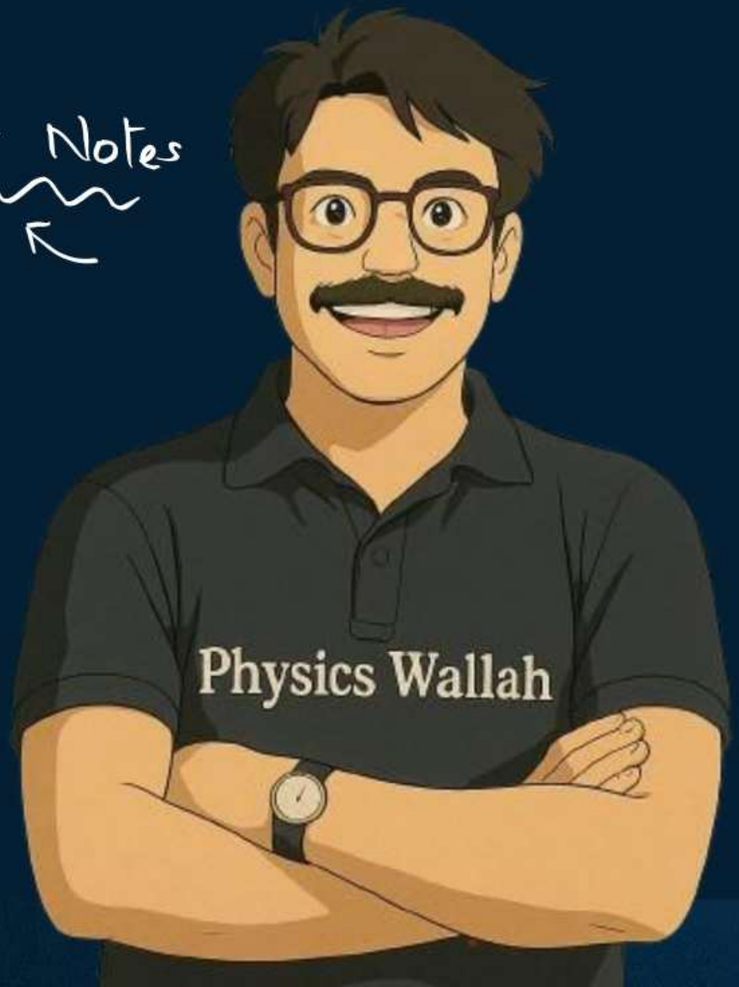


Resources to Follow

Er. Rakshak Sir

Class Notes

pdf



Reference

Book to follow

WALLAH

Topper Wali Taiyaari
Shuruat Se Karne Ki Baari

- Rakshak Dua
- Samridhi Sharma
- Sunil Vijay Hingarani

Latest 2025 Solved PYQ

Chapter-wise Concept Maps

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Mock Tests As Per The Latest Pattern

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Questions related to Mysterious Light

Q1. What is Light ?

Ans. It is a form of Energy which gives sensation of Vision

Q2. Light behaves as particle or wave ?

→ 'Photon'

Ans. It shows Dual behavior; we will study only Particle Nature.

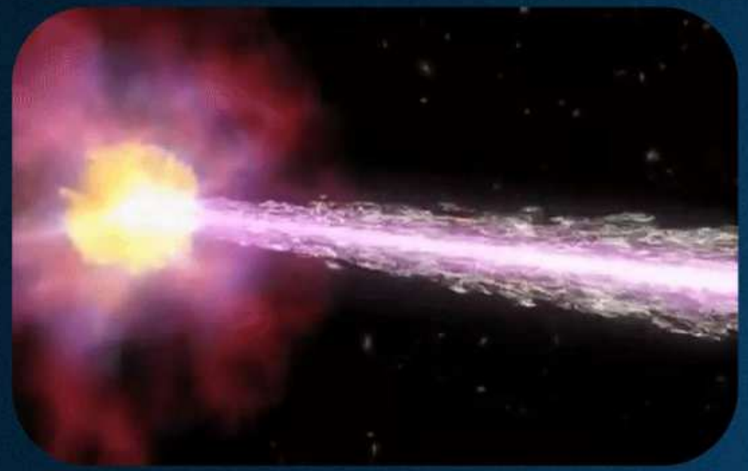
Q3. What is Light In Wave Nature?

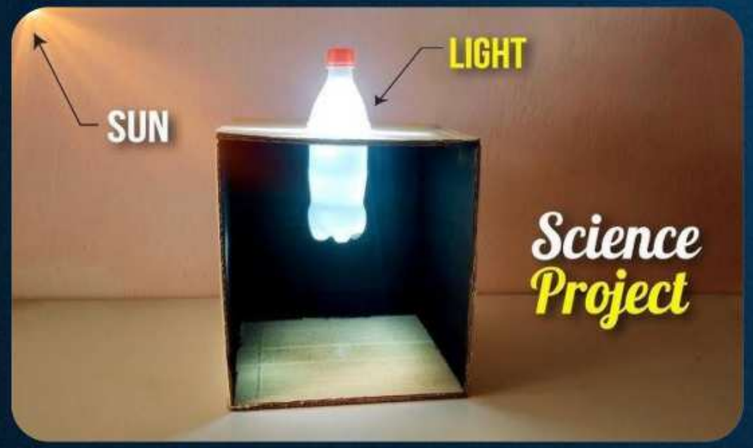
Ans. It is a Non-Mechanical Transverse Wave, that is why it travels in Vacuum

↓

Medium se Farak Nahi Padta

Properties of Light

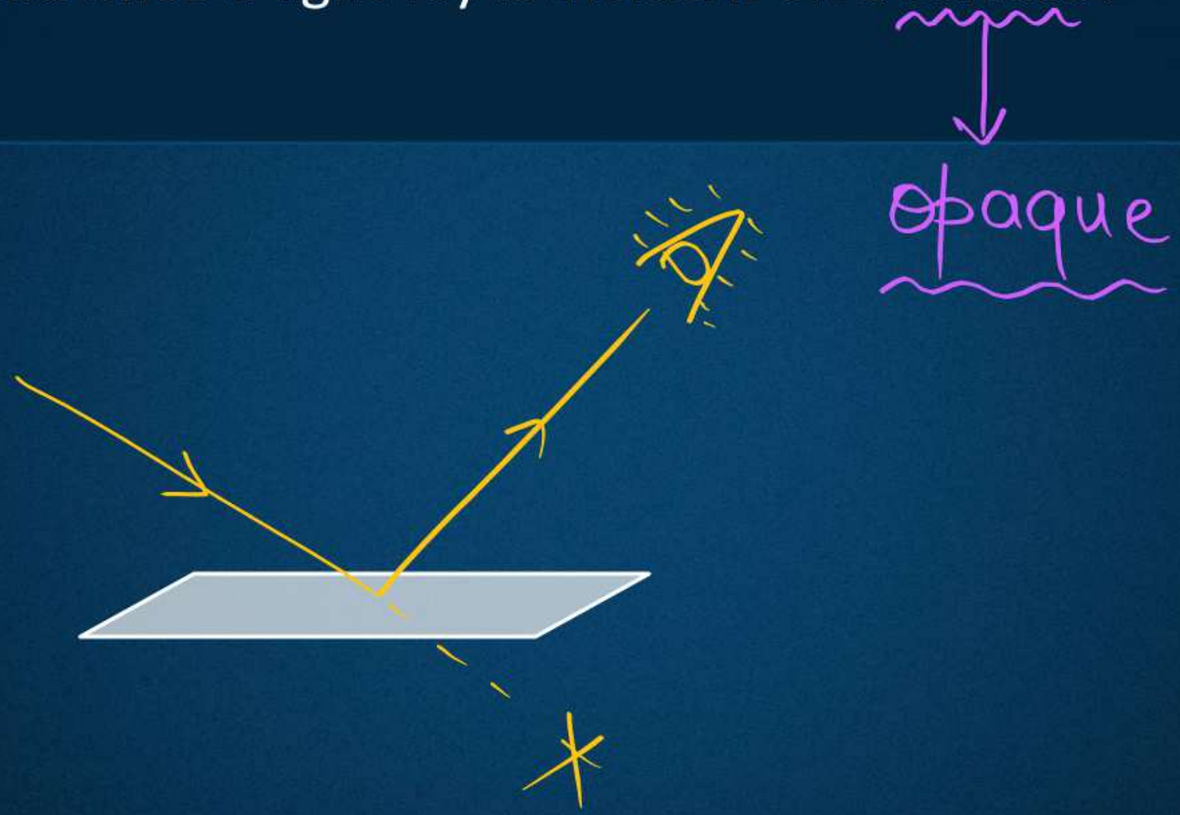




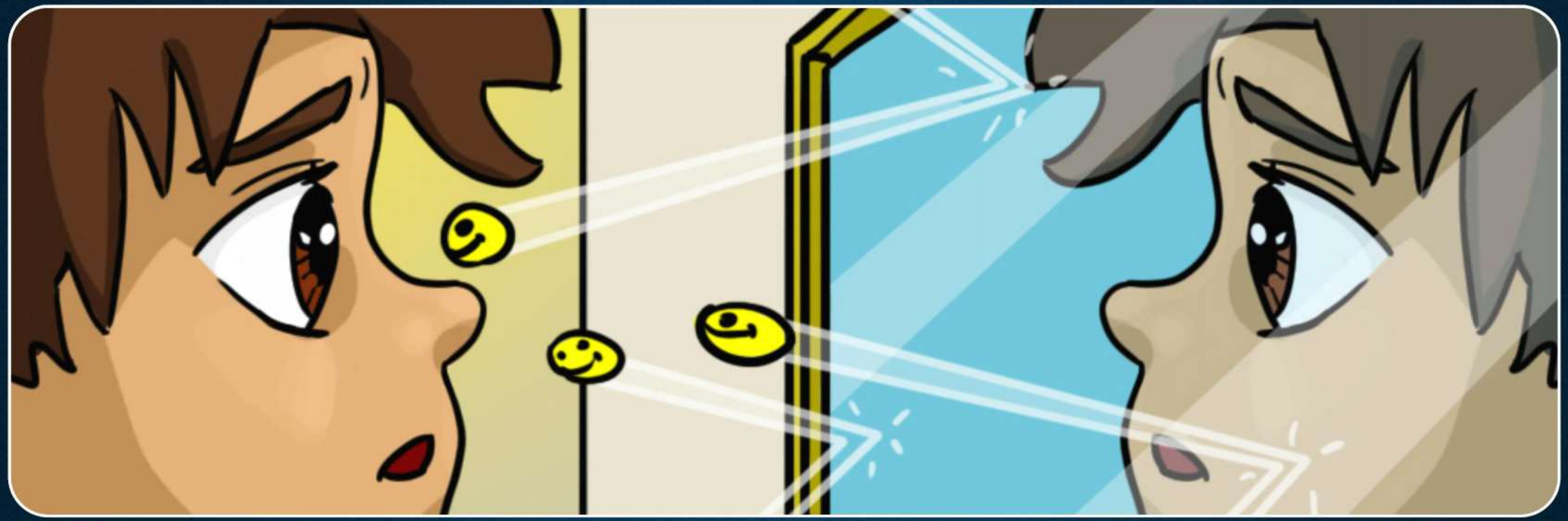
- Light has the property of a particle. These particles of light are called "Photons". Bright light has many particles while dark light has fewer particles.
- Light travels at a speed of about 30 Crore meters per second ($c = 3 \times 10^8$ m/s).
- When in a vacuum such as outer space where no matter is present, light travels straightforward, this is called "Rectilinear Propagation" of Light
- Several Photons in a single line constitute a Light Ray
- Several Light Rays constitute a Beam of Light

QUESTION

#Q. What happened once a light ray is incident on a surface?

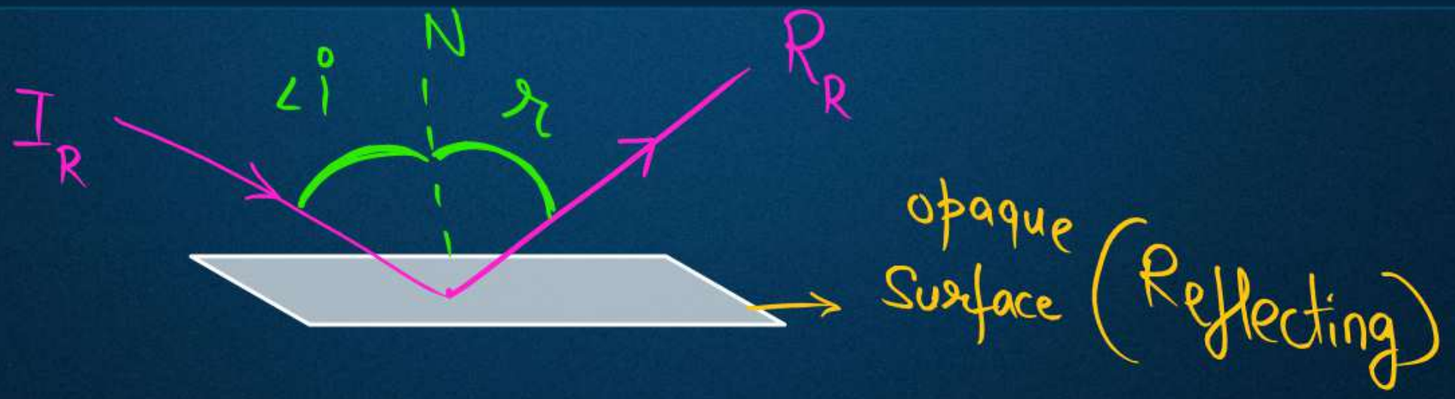


Bouncing Back of Light : Reflection



Phenomenon of Light : Reflection

- When a ray of light falls on a smooth polished surface and the light ray bounces back into the same medium, it is called the **reflection of light**.
- The **incident light ray** which lands upon the surface is said to be reflected away by the surface. The ray that bounces back is called the **reflected ray**.
- The perpendicular which is drawn on the surface is called **Normal**.



Types of Reflection

Specular and Diffuse Reflection

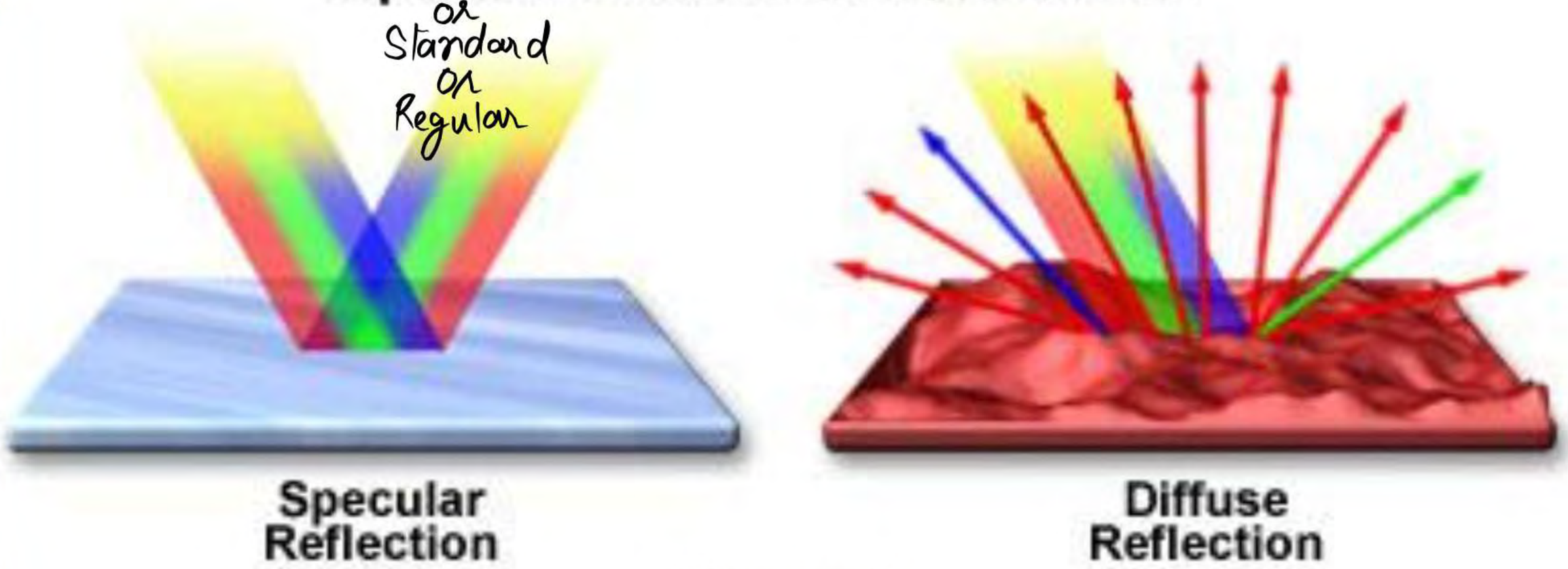


Figure 1

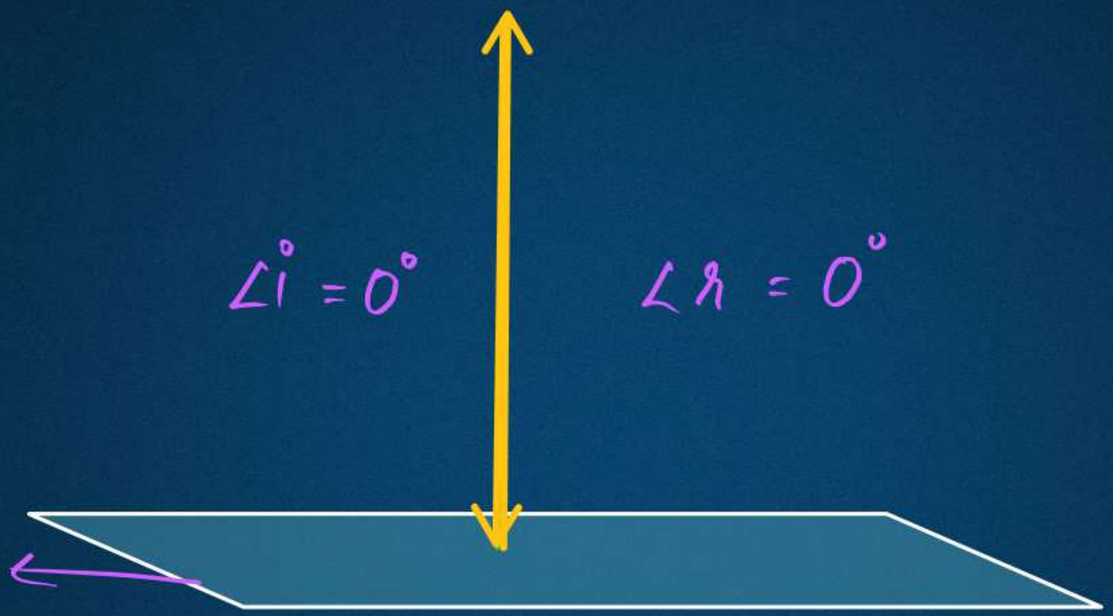
LAWS OF REFLECTION

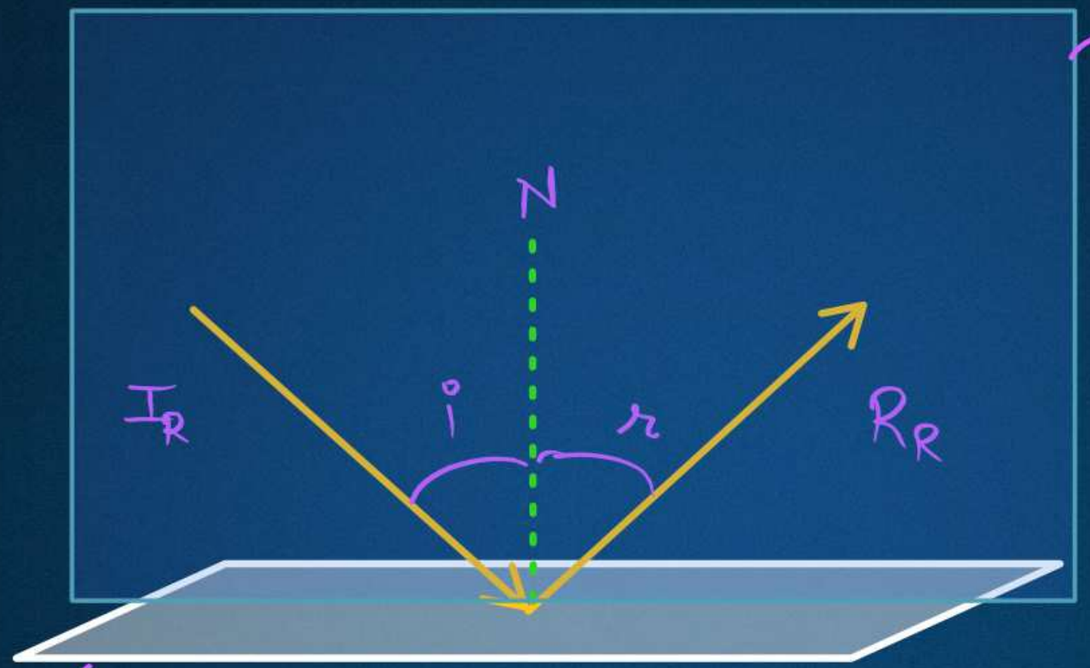
The laws of reflection determine the reflection of incident light rays on reflecting surfaces, like mirrors, smooth metal surfaces, and clear water.

The laws of reflection states that

- The Incident Ray, the Reflected Ray and the Normal all lie in the same plane
- The Angle of Incidence ($\angle i$) = The Angle of Reflection ($\angle r$)

* Normal Incidence (Spl. Case)



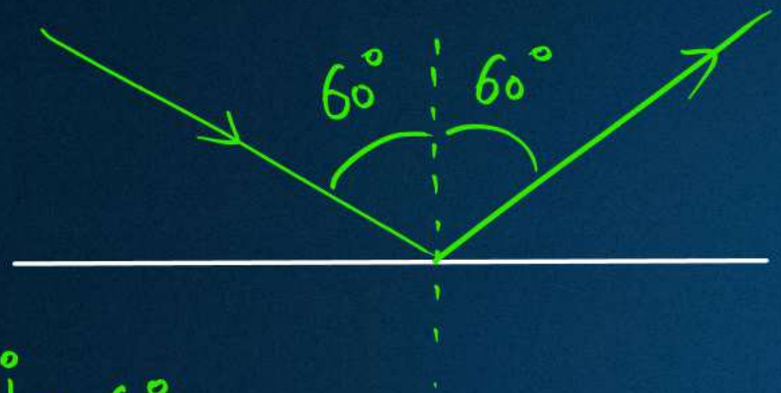


→ Imaginary plane ②

① Reflecting plane (Mirror)

Thodi si Question Practice

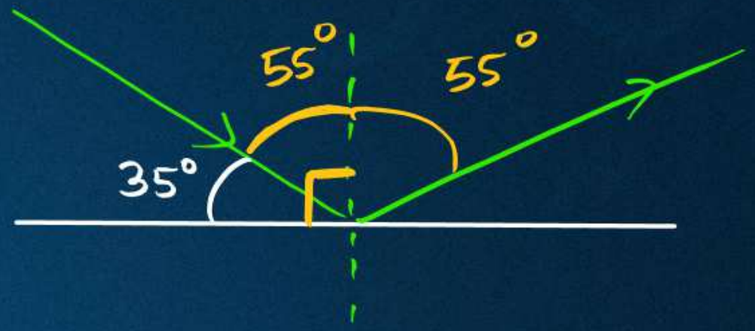
Q1



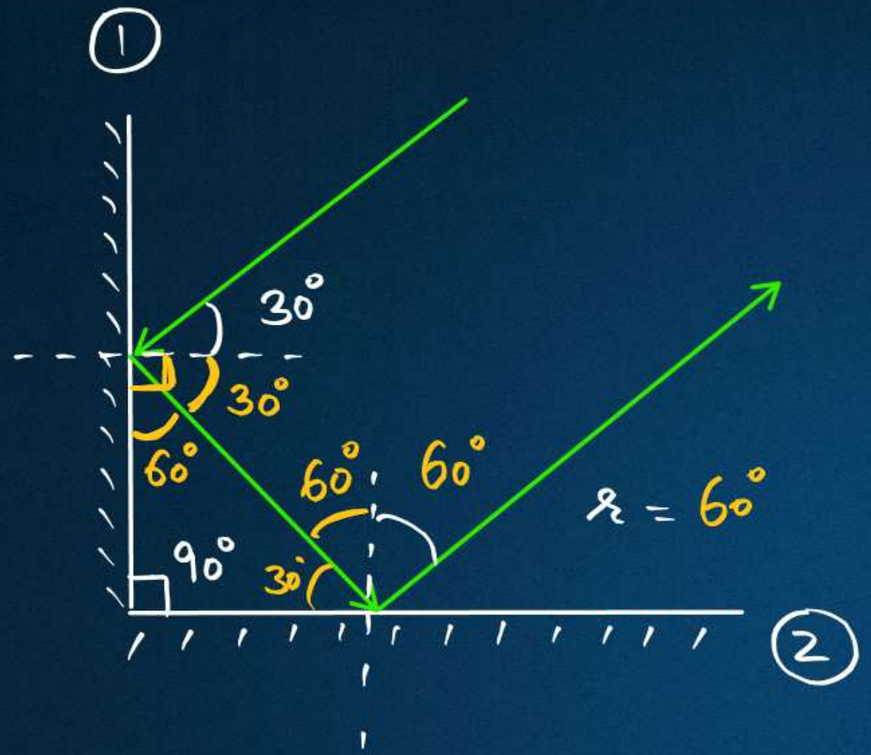
$\angle i = 60^\circ$

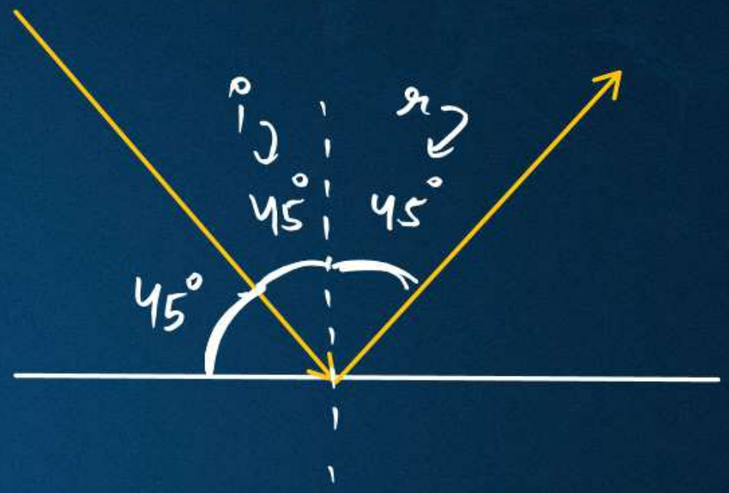
$\angle r = 60^\circ$

Q2



$\angle r = ?$





$i + r = 45 + 45 = 90°$

Thank You

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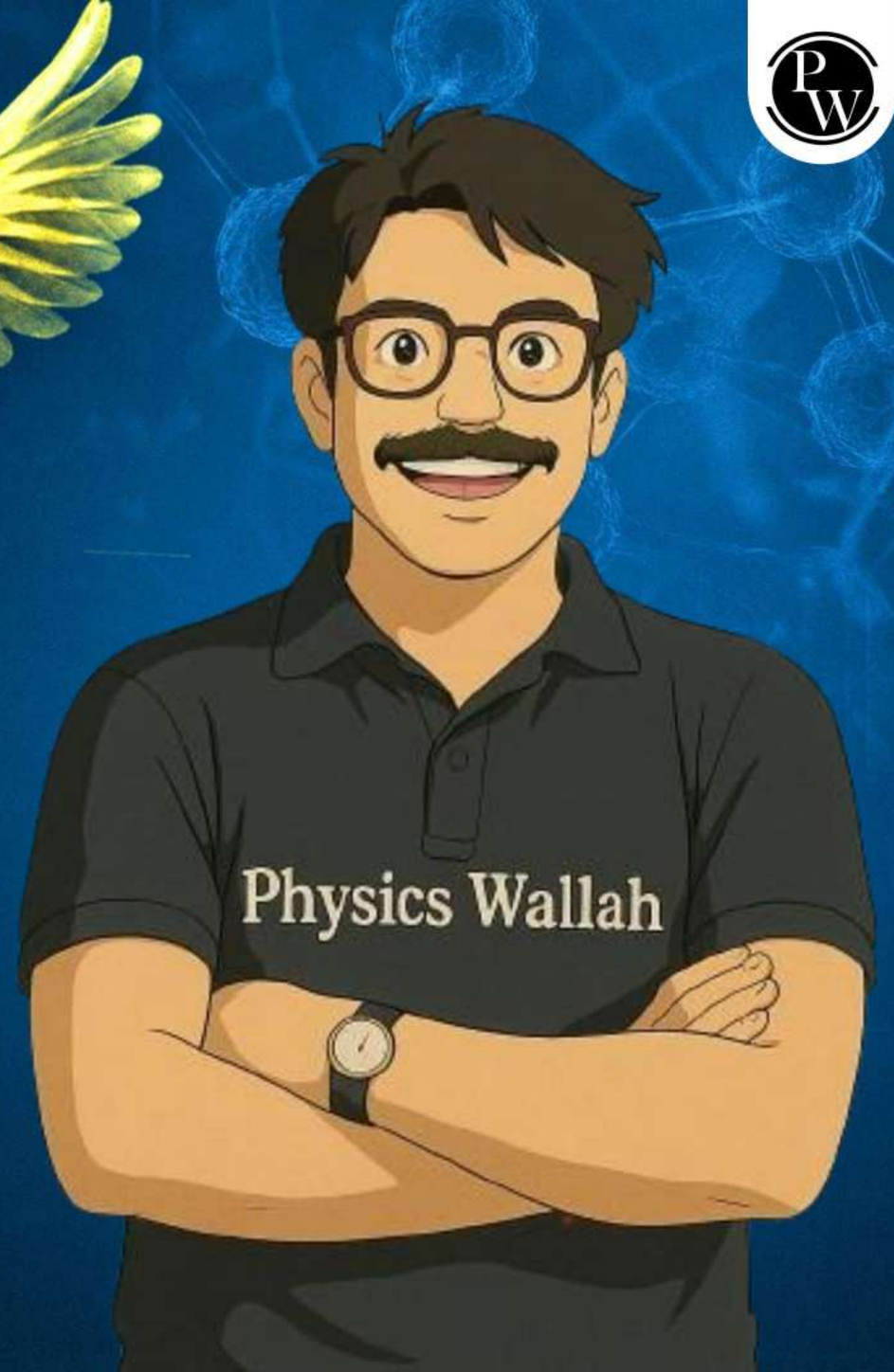
2026

LIGHT - Reflection & Refraction (Mirrors)

PHYSICS **LECTURE-2**

BY– Er. Rakshak Sir



Topics *to be covered*

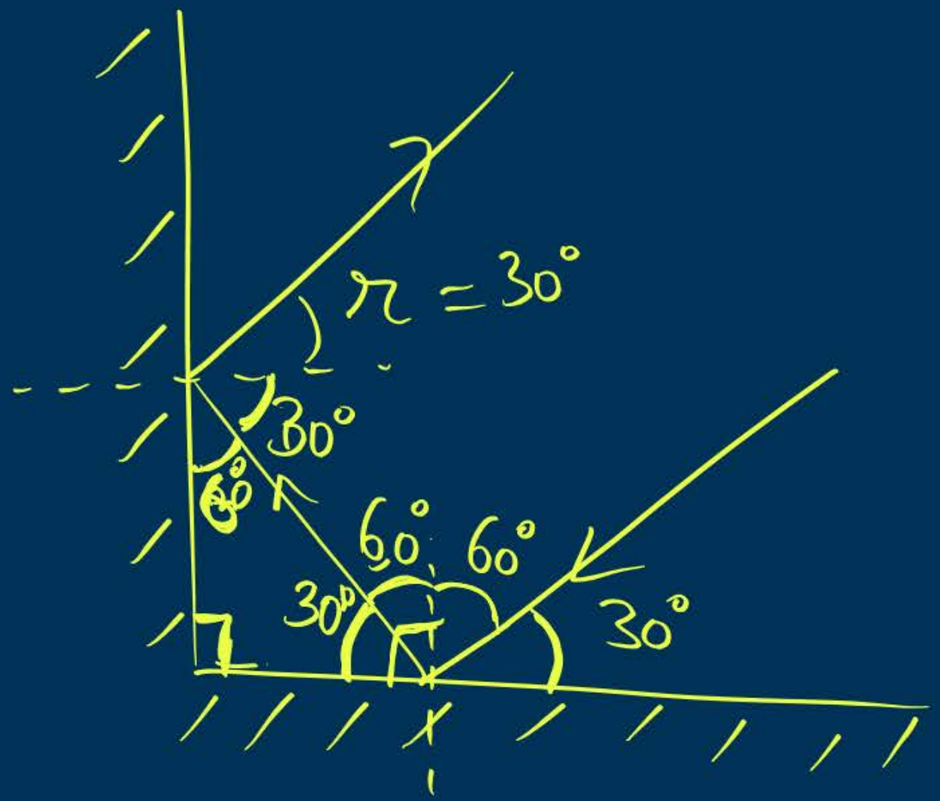
A Plane Mirror ✓

B Spherical Mirror : Concave and Convex

C Ray Diagrams ✓

D. Reflection Through Spherical Mirrors

H.W.



Source

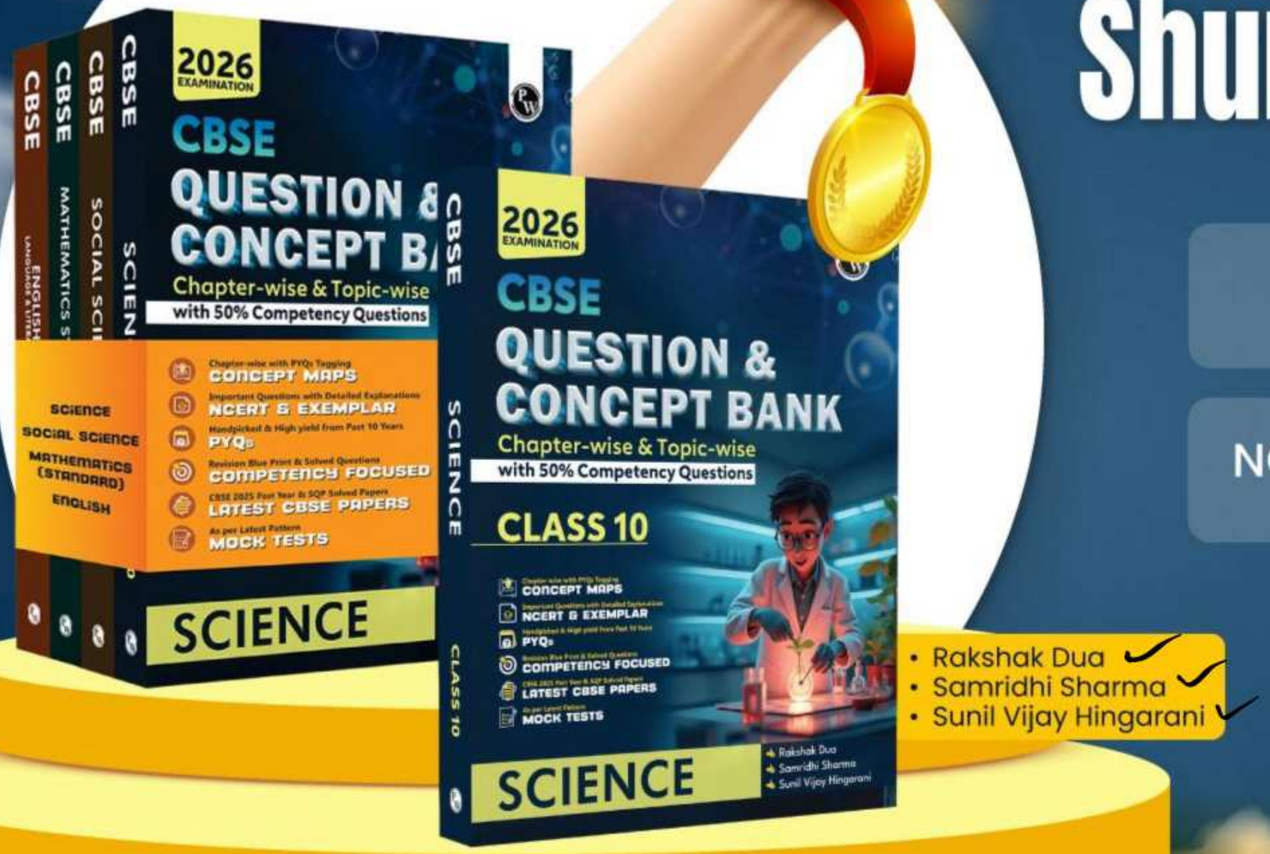
Teacher (Primary)

Book (Secondary)

- ✓ NCERT Ques
- ✓ Exemplar
- ✓ PYQs

WALLAH

Topper Wali Taiyaari
Shuruat Se Karne Ki Baari



- Rakshak Dua
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Competency-Based Questions

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PLANE MIRROR

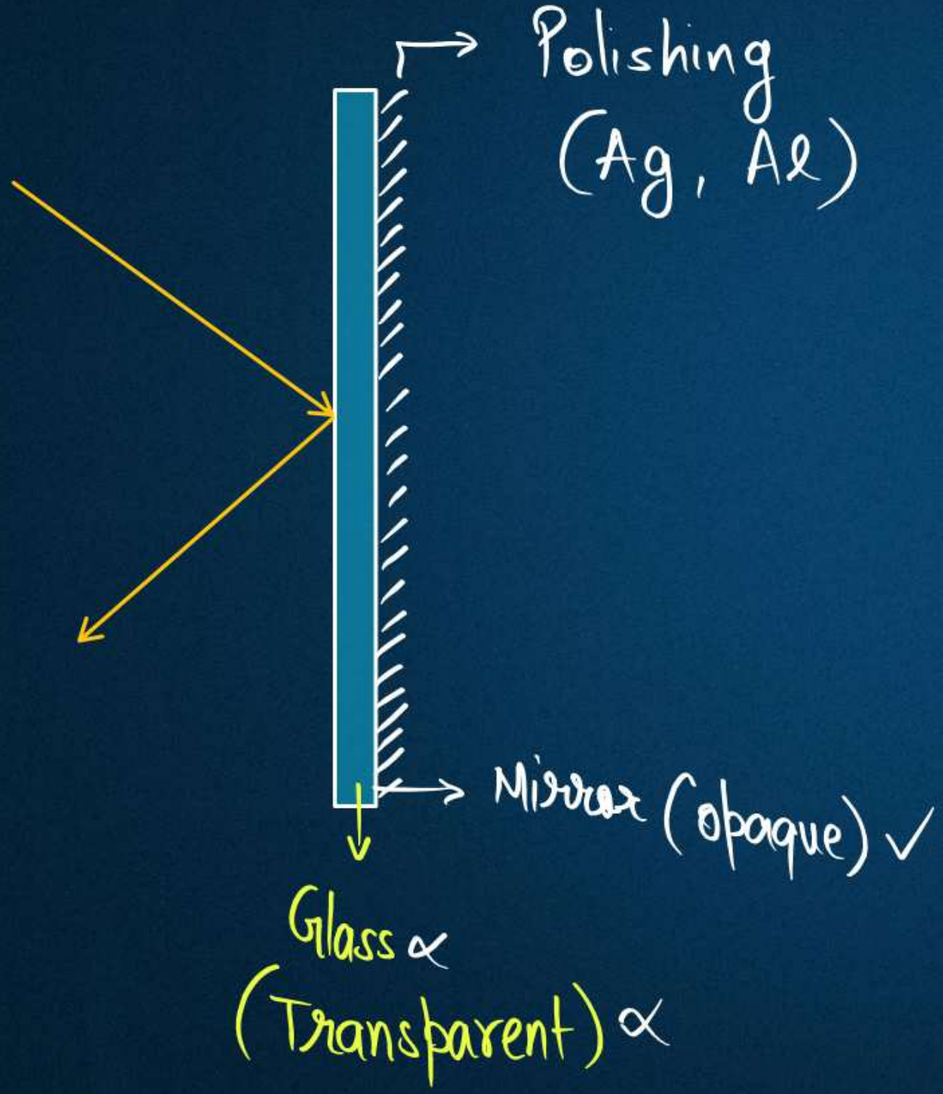
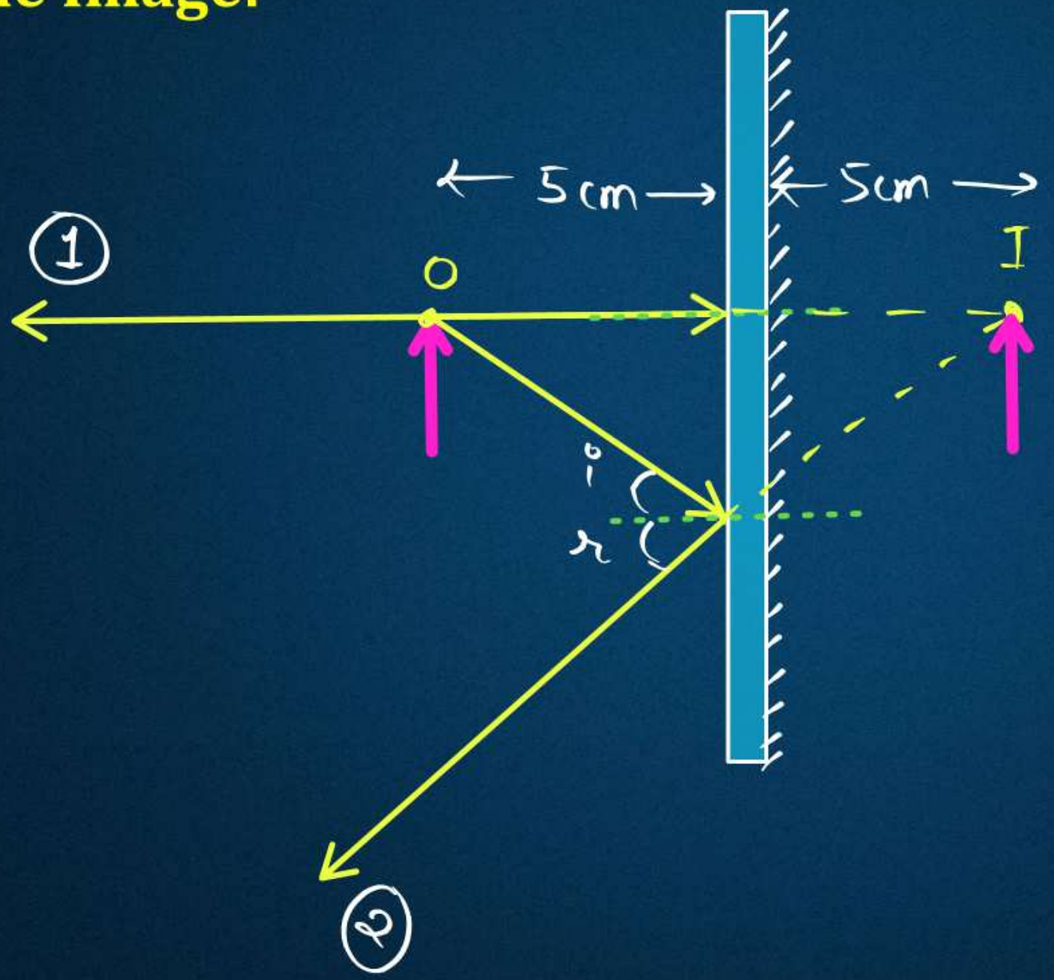


Image formation by Plane Mirror

NCERT ≲

Nature of the Image:

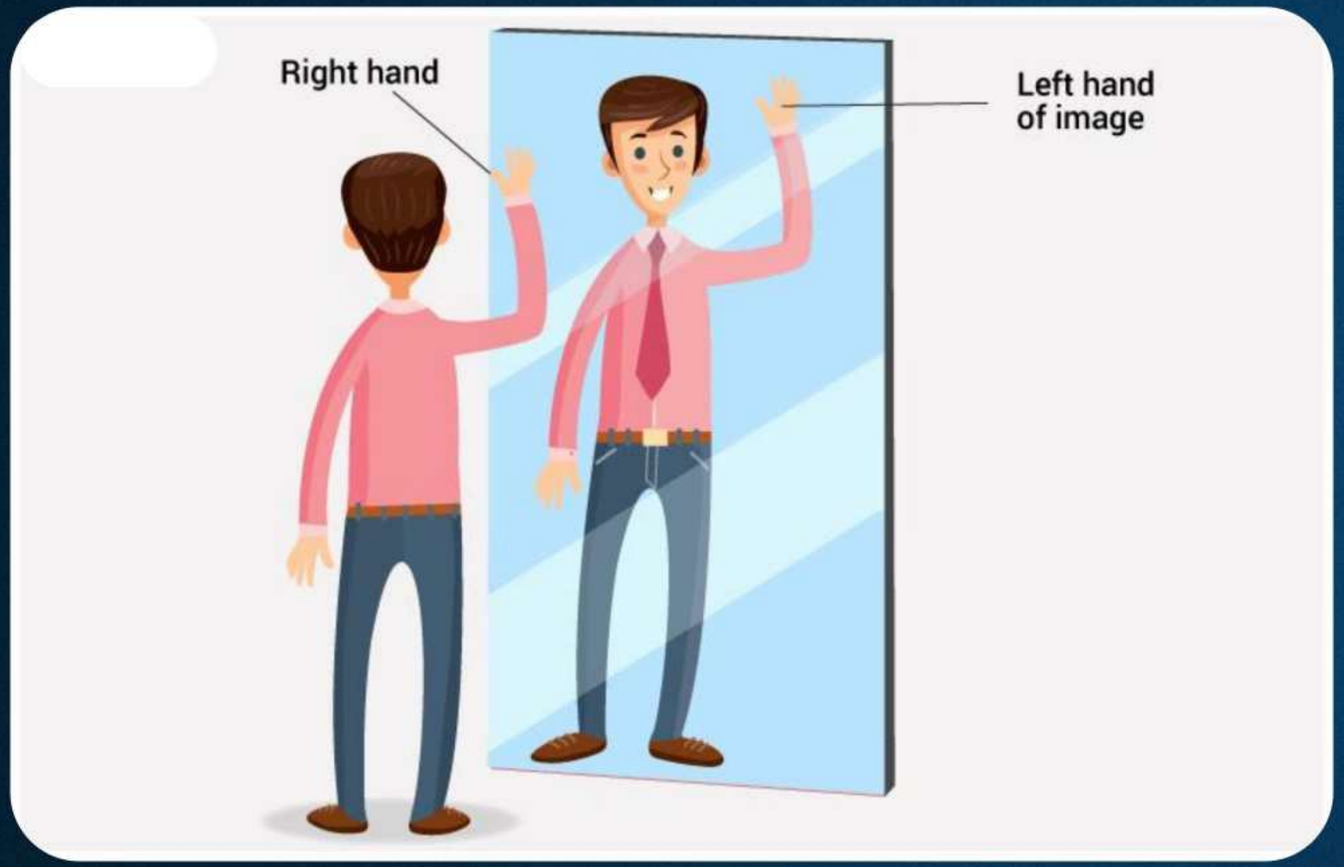


Nature

1. Same Size ✓
2. Same distance ✓
3. Virtual ✓
4. Erect or Upright (Seedha khada)
5. Laterally Inverted

Examples of Lateral Inversion

{ LHS = RHS }



Pehchaan kaun?

Con-Cave

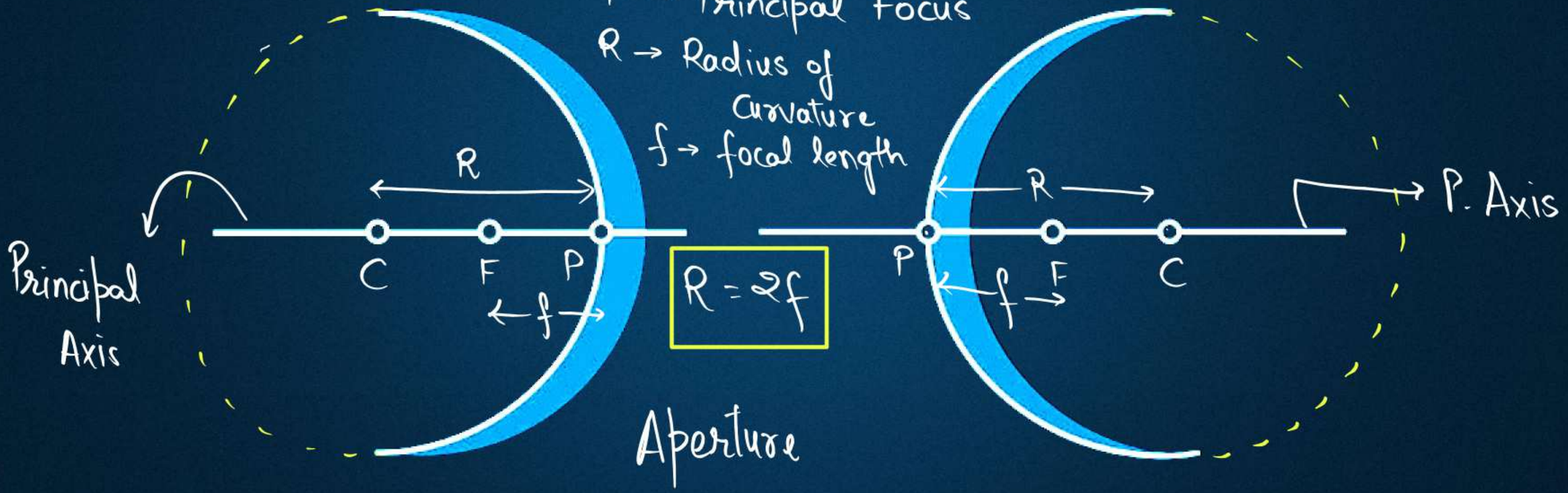
Convex

Spherical Mirrors ki Geometry

Concave Mirror

P → Pole
C → Centre of Curvature
F → Principal Focus
R → Radius of Curvature
f → focal length

Convex Mirror



Spherical Mirrors ka Basic Nature

(Converging mirror)

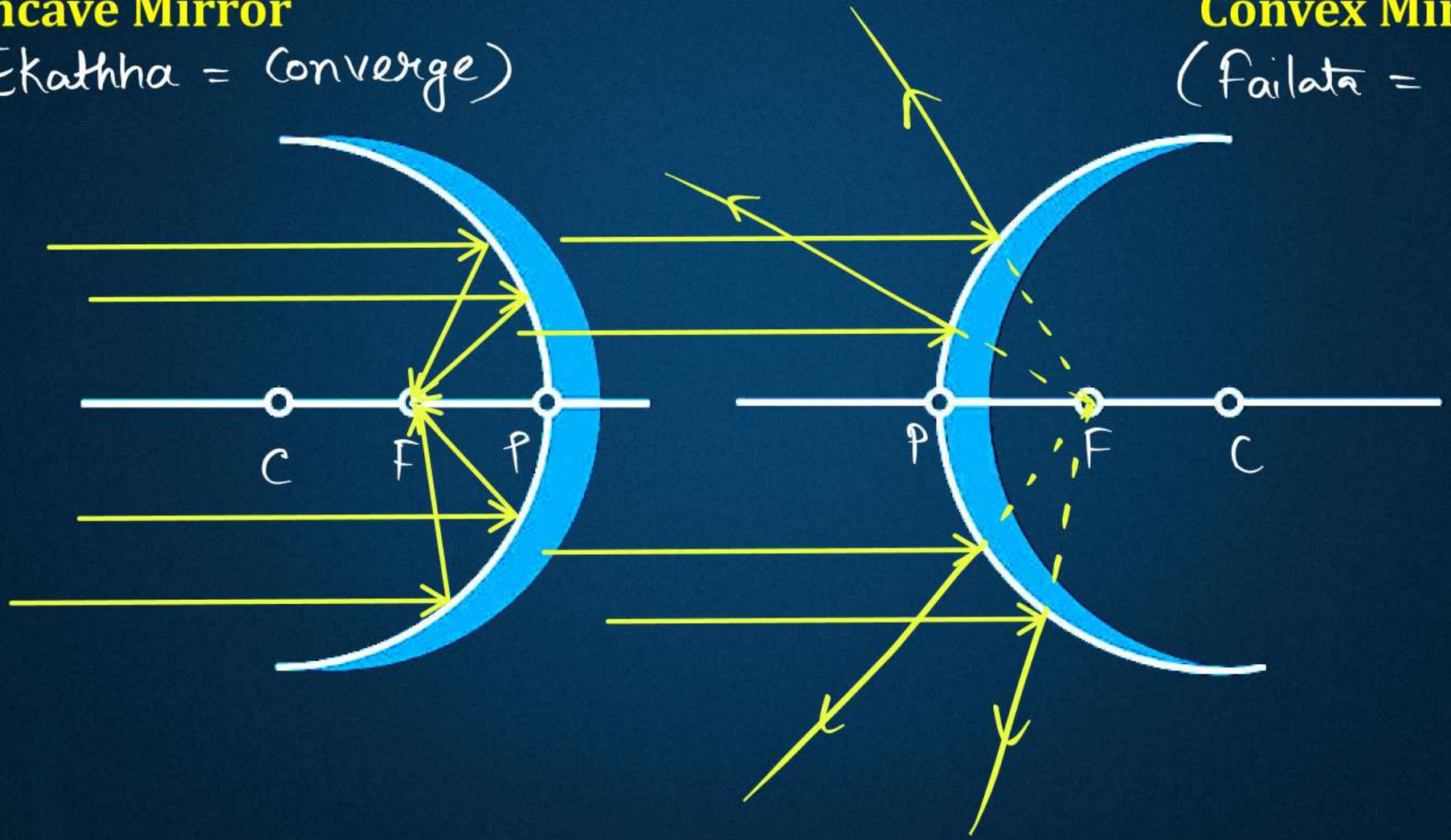
Concave Mirror

(Ekathha = Converge)

(Diverging Mirror)

Convex Mirror

(Failata = Diverge)



Important Terms : Spherical Mirrors

SOME IMPORTANT DEFINITION :

1. **Centre of curvature** the centre of a hollow sphere of which the spherical mirror forms a part is called centre of curvature it is denoted by c.
2. **Radius of curvature** the radius of a hollow sphere of which the spherical mirror forms a part is called radius of curvature it is denoted by R.
3. **Pole** the midpoint of a spherical mirror is called pole it is denoted by P.
4. **Aperture** the part of a spherical mirror exposed to the incident light is called the aperture of the mirror.

5. **Principal axis** a line joining the centre of curvature and pole is called principal axis.

*6. **Principal focus** a point on the principal axis of a spherical mirror where the rays of light parallel to the principal axis meet or appear to meet after reflection is called principal focus it is denoted by F.

7. **Focal length** the distance between the pole and principal focus of a spherical mirror is called focal length.

8. **Optical centre** it is a point on the principal axis of the lens such that a ray passing through goes undeviated.

Lens

Rules to Obtain Image

1. ➡ ∥ to P. Axis ⟶ F

2. ➡ F ⟶ ∥ to P. Axis

3. ➡ C ⟶ Back-trace

4. ➡ P ⟶ $\angle i = \angle r$

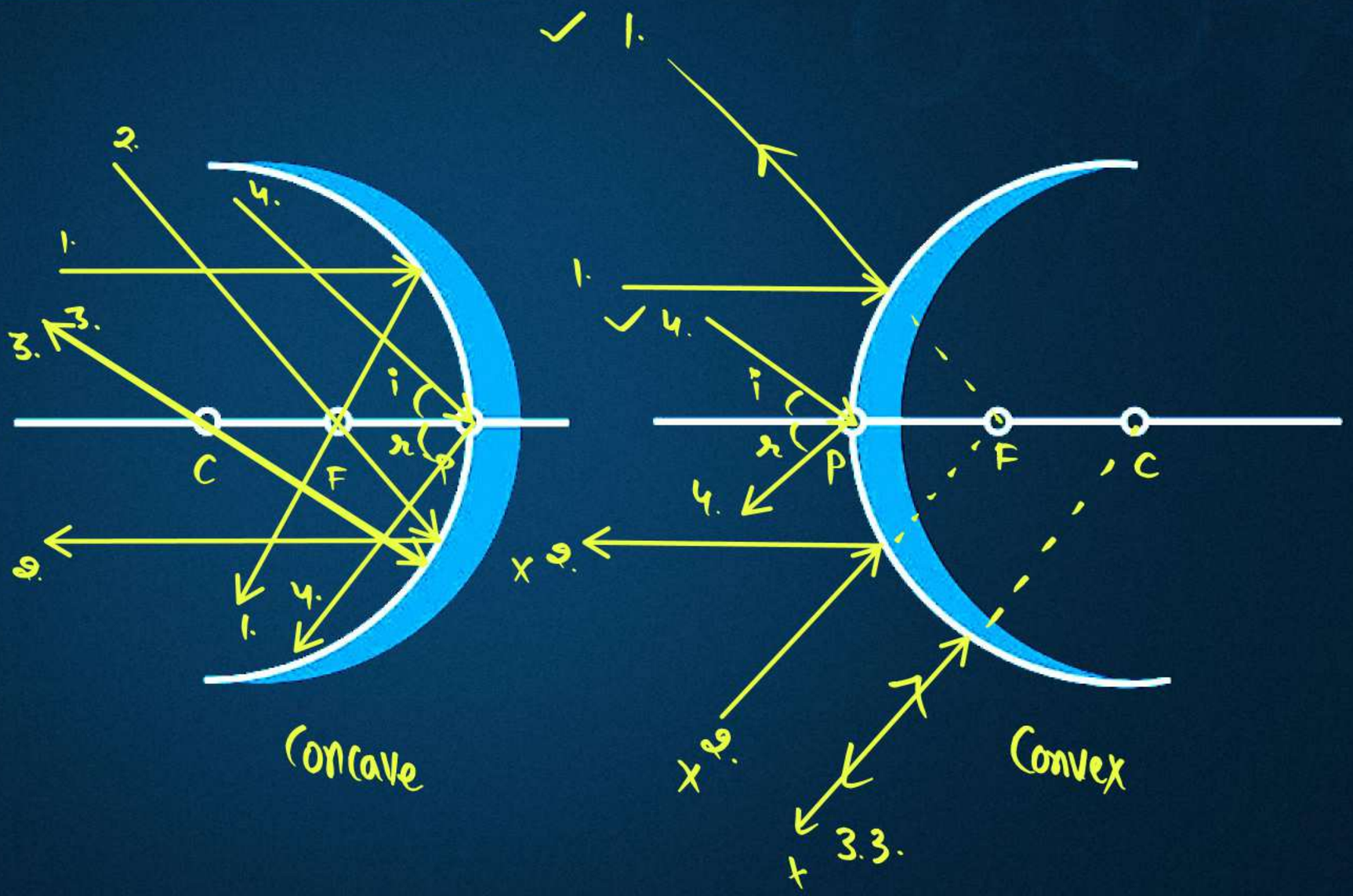
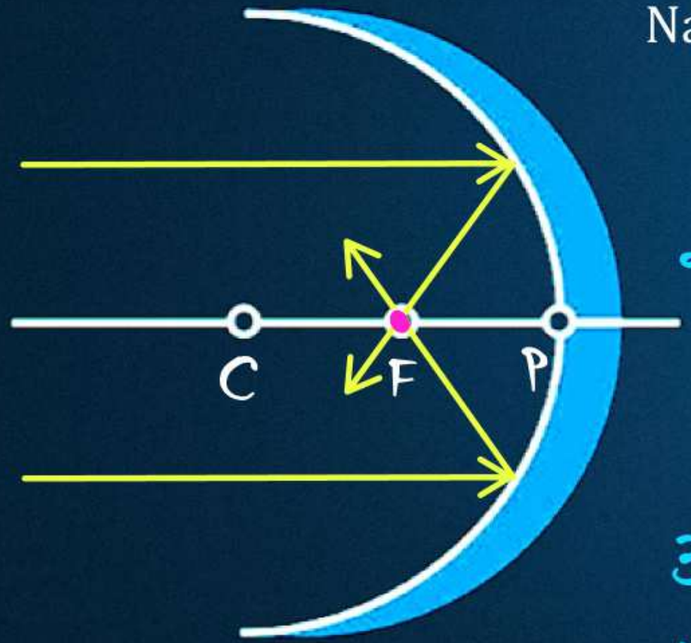


Image Formation : Concave Mirror (1)

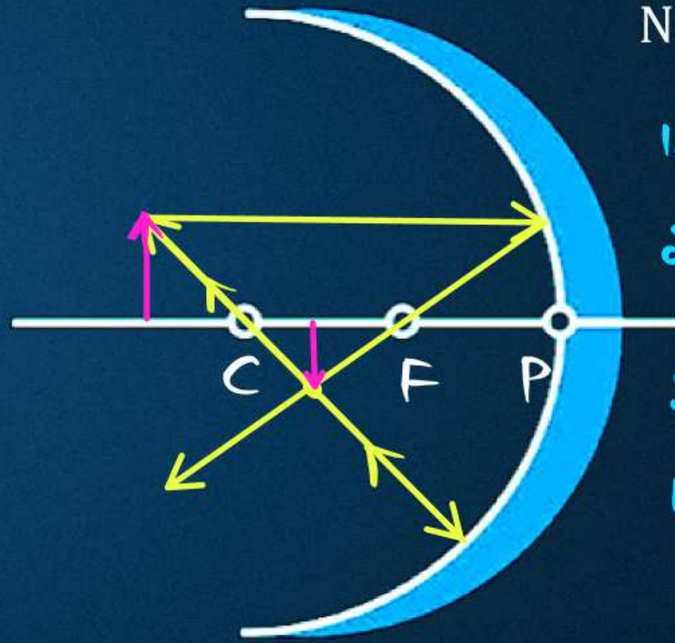
1. Object at Infinity



Nature of Image

1. At F
2. Highly diminished
   or
   Point Sized
3. Real
4. Inverted

2. Object beyond C

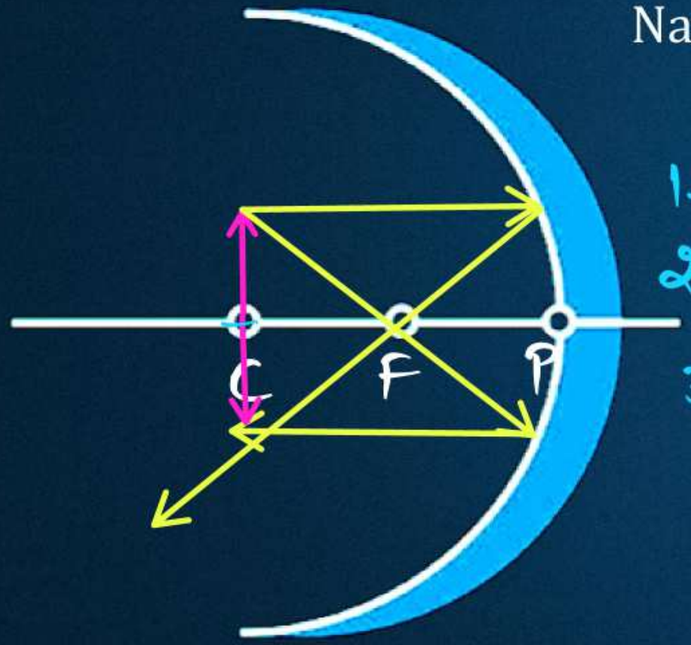


Nature of Image

1. B/w C and F
2. Diminished
3. Real
4. Inverted

Image Formation : Concave Mirror (2)

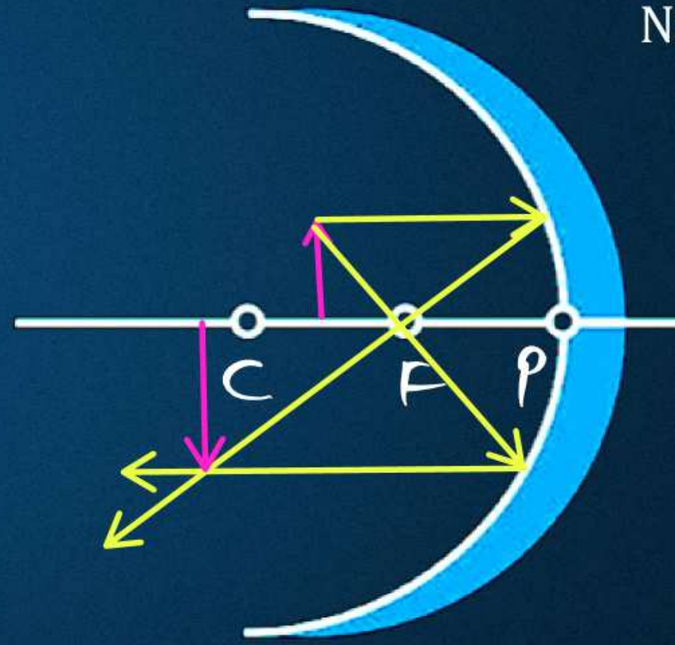
3. Object at C



Nature of Image

1. At C
2. Same Size
3. Real
4. Inverted

4. Object Between C & F



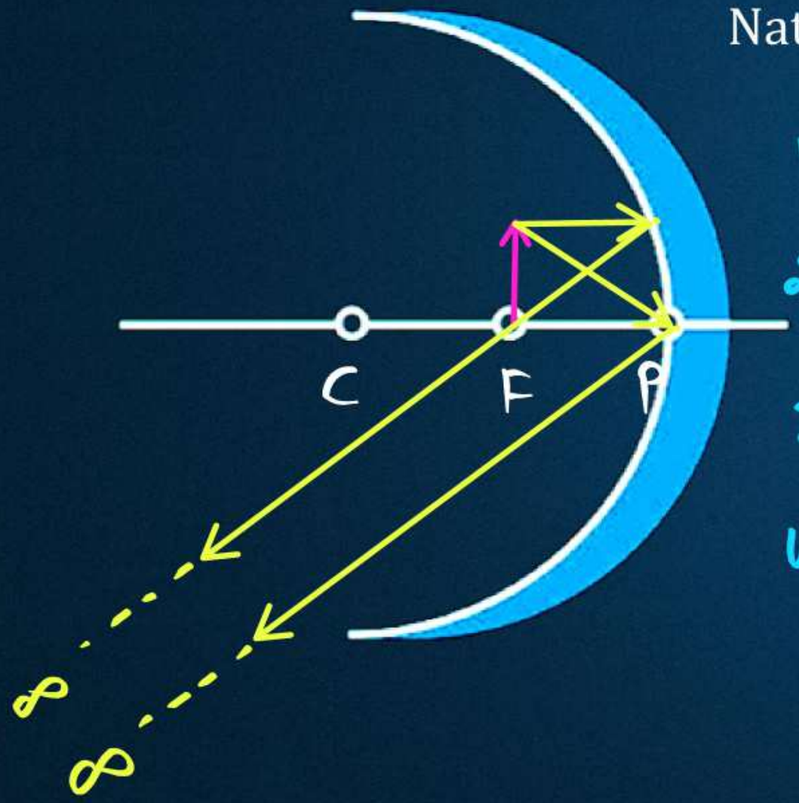
Nature of Image

1. Beyond C
2. Enlarged or magnified
3. Real
4. inverted

Image Formation : Concave Mirror (3)

V.V.I.P. Case

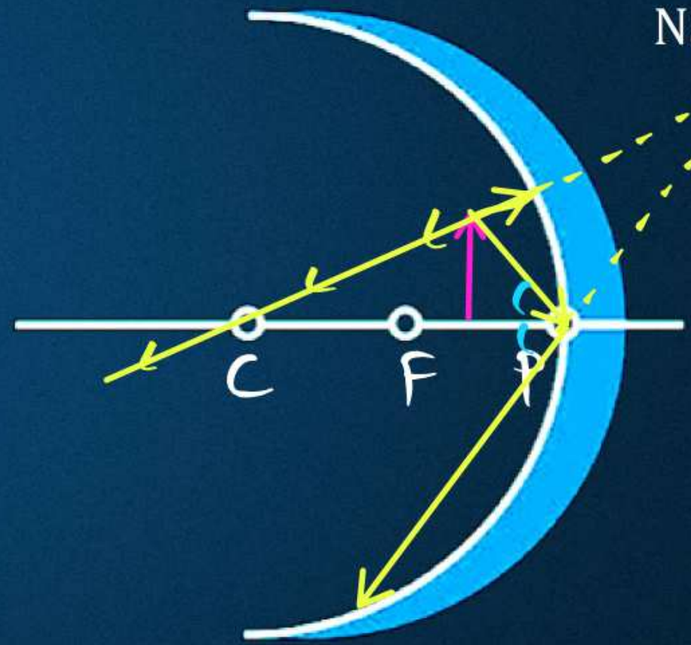
5. Object at F



Nature of Image

1. At Infinity
2. Highly Enlarged
3. Real
4. Inverted

6. Object Between P & F



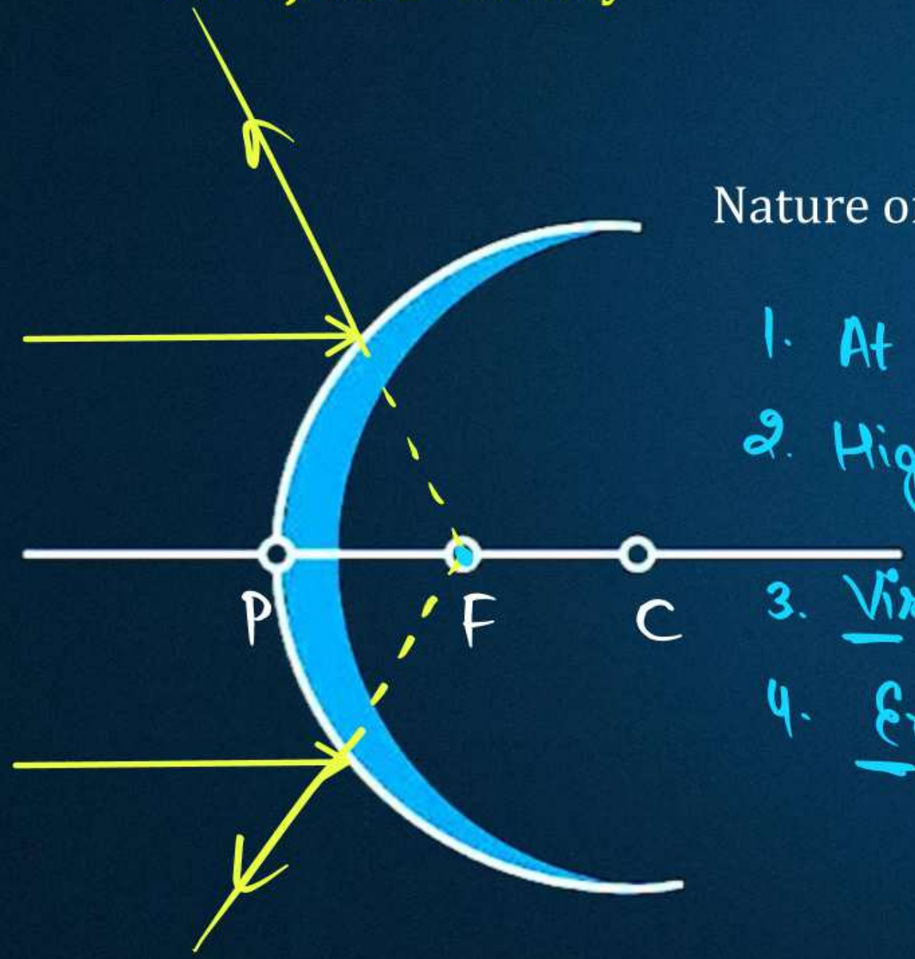
Nature of Image

1. Behind the Mirror
2. Enlarged
3. Virtual
4. Erect

Image Formation : Convex Mirror

V.E.D
Virtual Erect Diminished

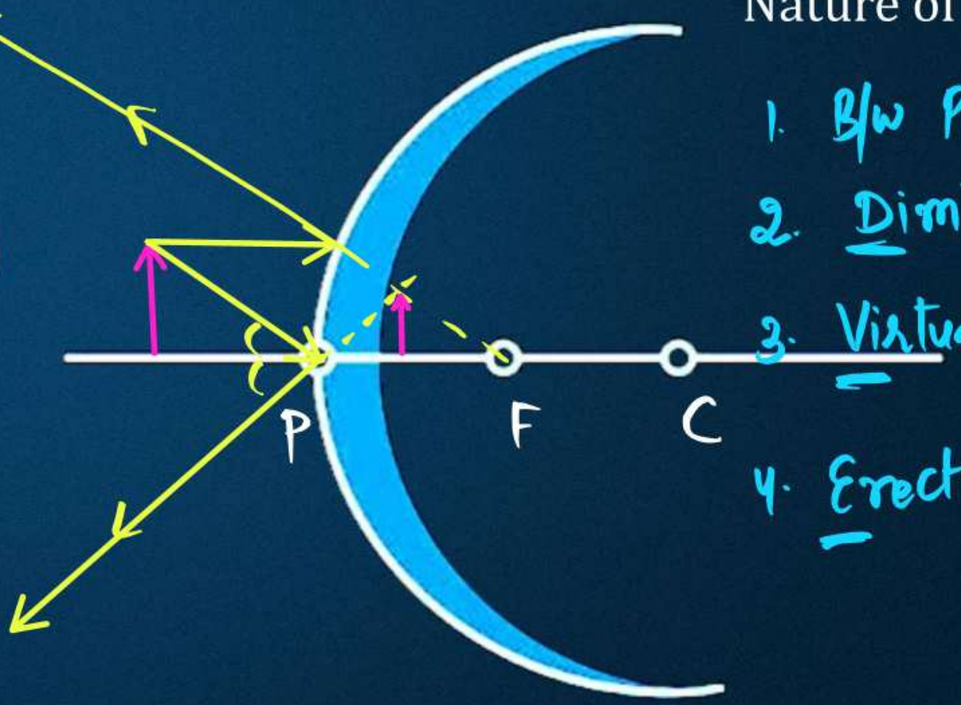
1. Object at Infinity



Nature of Image

1. At F
2. Highly diminished
3. Virtual
4. Erect

2. Object at Finite Distance (∞ → P)

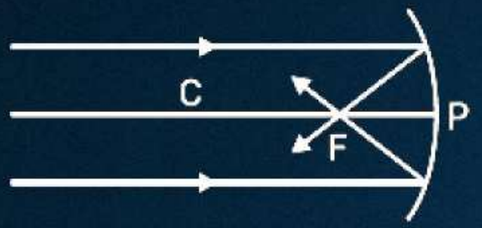


Nature of Image

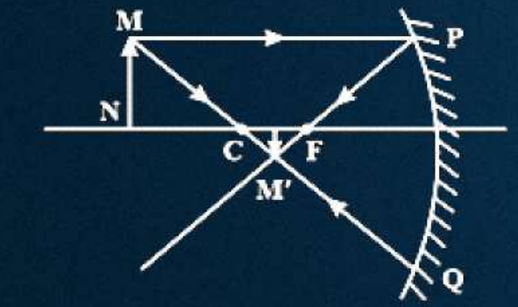
1. B/w P & F
2. Diminished
3. Virtual
4. Erect

All Ray Diagrams : Spherical Mirrors

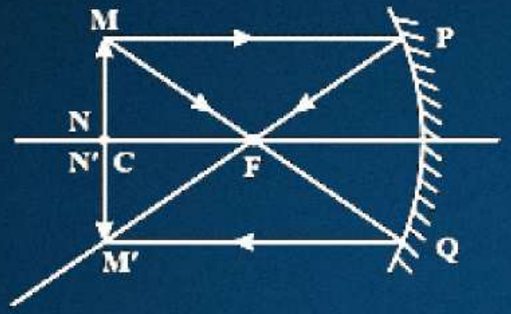
#Revision



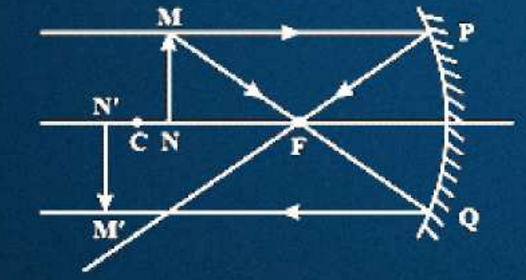
1. Object at Infinity



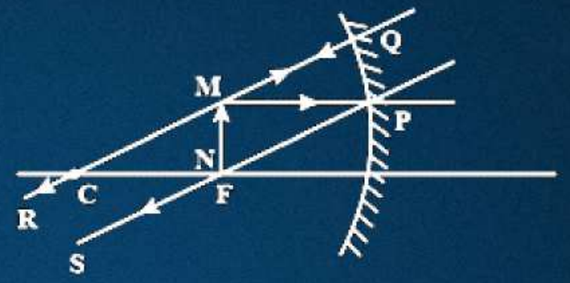
2. Object beyond C



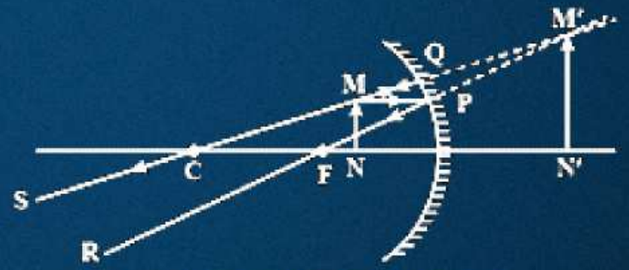
3. Object at C



4. Object Between F and C

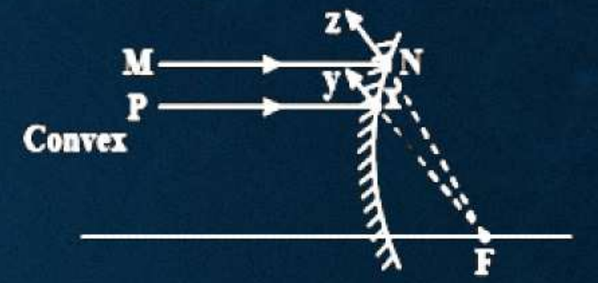


5. Object at F

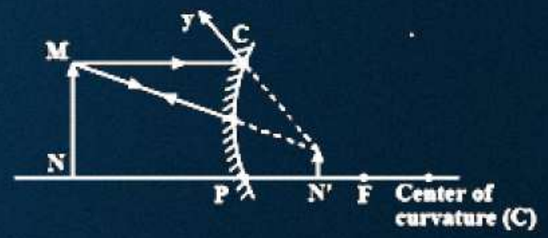


6. Object Between F and P

Concave Mirror



1. Object at Infinity



2. Object at Finite Distance

Convex Mirror

Uses of Mirrors

Convex Mirror

Rear-View Mirror

Parking lot

Concave Mirror

Shaving

Makeup

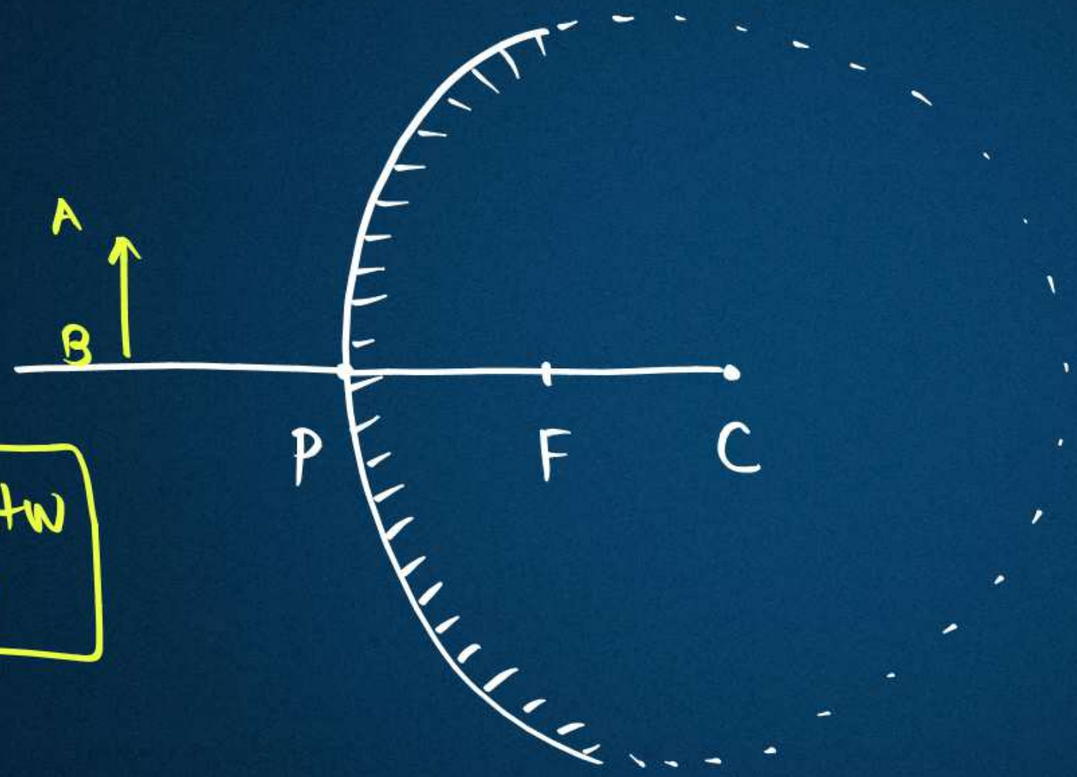
Dentist

Thodi si Ray Diagrams ki Practice

Practice

CBSE 2023 **

'P.N. 328'



Placed b/w ∞ & P

[Virtual
Erect
Diminished]

H.W. → Each diagram X2

Thank You

UDAAN

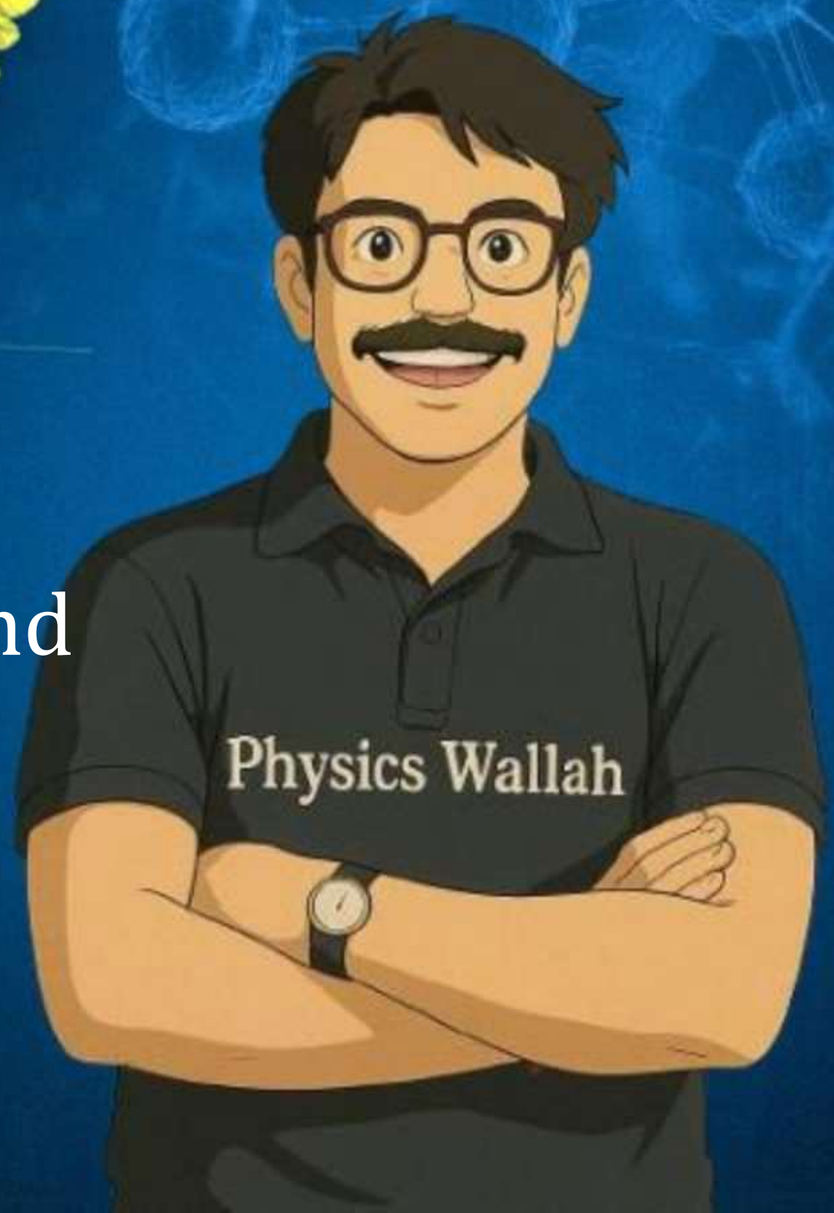
2026

LIGHT - Reflection and Refraction

{Numerical : Mirror}

PHYSICS | LECTURE-3

BY - RAKSHAK SIR



Topics to be covered

A Sign convention

B Mirror Formula and Magnification

C NCERT in One shot : Reflection

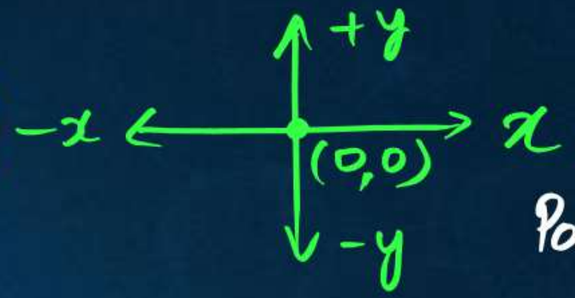
D Mirror Numerical

Agar Numerical Karne Ho To !!!

- Ray Diagrams (x 2)
- ✓ Sign Convention (Samajhne lalali)
- ✓ Formulae (Ratne Wali)

Sign Convention in Mirrors

" New Cartesian "



Pole = origin

i) u → object distance (cm)

ii) v → image distance (cm) = ?

iii) f → focal length (cm)

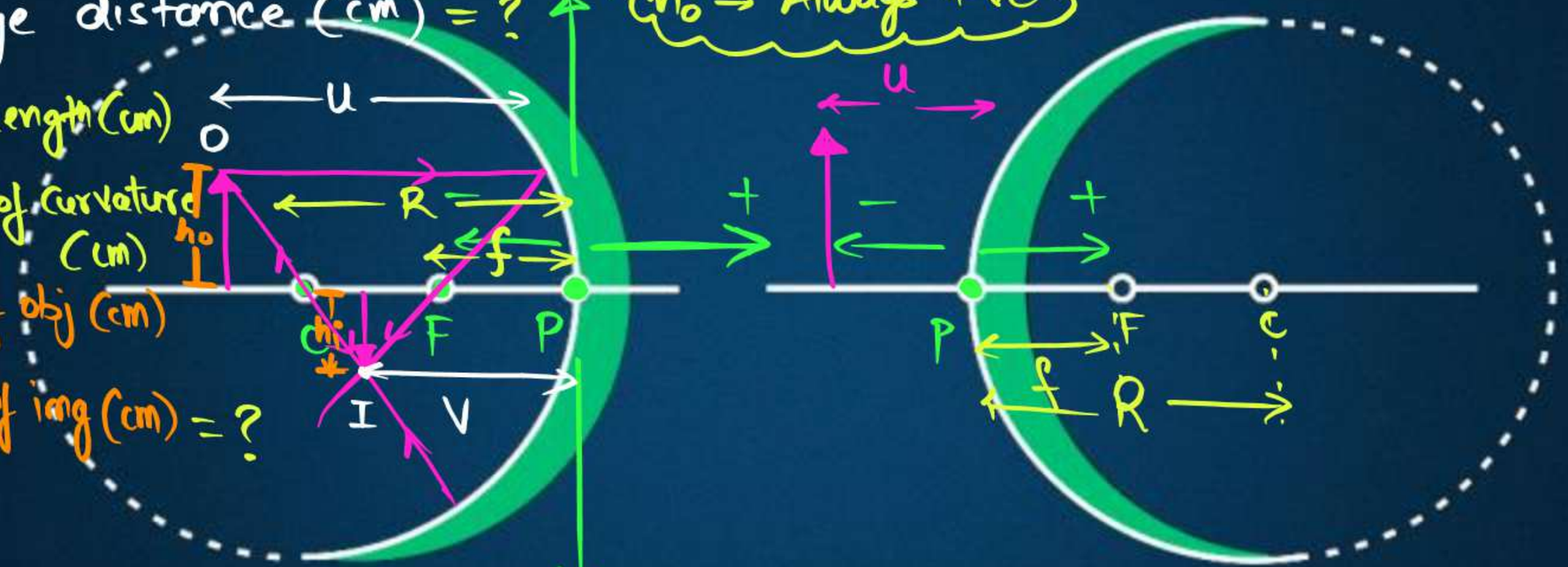
iv) R → Radius of curvature (cm)

v) h_o → height of obj (cm)

vi) h_i → height of img (cm) = ?

u → Always -ve

h_o → Always +ve



Concave

f⊖ R⊖

Convex

f⊕ R⊕

One Step Ahead : Formulae

Weapons (for Nature)

- Mirror Formula :

u, v, f

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

- Magnification Formula : (unitless)

$$m = \frac{-v}{u} \rightarrow \frac{cm}{cm}$$

$$m = \frac{h_{image}}{h_{object}} = \frac{h_i}{h_o} \rightarrow \frac{cm}{cm}$$

Define magnification

Ans :- It is the measure of size of image with respect to size of object

$0 < m < 1$: Diminished

$m = 1$: Same size

$m > 1$: Enlarged / Magnified

m → + : ERECT + Virtual

m → - : INVERTED + Real

QUESTION

Concave → Converging mirror

Convex → Diverging

1. An object is placed at a distance of 10 cm from a converging mirror of focal length 5 cm. find the nature and position of the image.

m

Given :-

$u = -10\,cm$

$f = -5\,cm$

To find :-

$m = ?$

$v = ?$

App" Mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-5} = \frac{1}{v} + \left(\frac{1}{-10}\right)$$

$$-\frac{1}{5} = \frac{1}{v} - \frac{1}{10}$$

$$\frac{1}{10} - \frac{1}{5} = \frac{1}{v}$$

$$\frac{1-2}{10} = \frac{1}{v}$$

$$-\frac{1}{10} = \frac{1}{v}$$

$v = -10\,cm$ ✓

$$m = -\frac{v}{u}$$

$$m = -\frac{(-10)}{(-10)}$$

$m = -1$

Real + Inverted

Same Size

NCERT DISCUSSION
REFLECTION

QUESTION-01 (Page No. 142)

Define the principal focus of a concave mirror.

→ in notes

QUESTION-02 (Page No. 142)

The radius of curvature of a spherical mirror is 20 cm. What is its focal length ?

$R = 20\,cm$

$R = 2f$

$20 = 2f$

$\frac{20}{2} = f$

$f = 10\,cm$

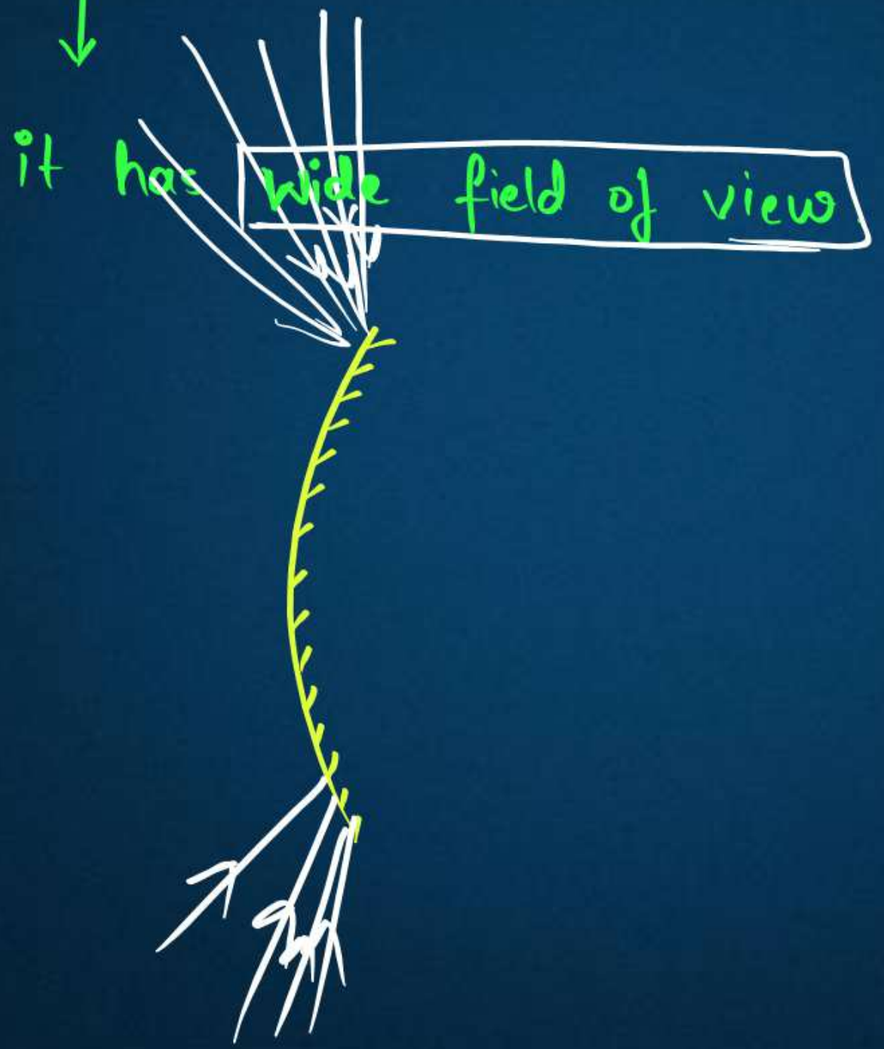
QUESTION-03 (Page No. 142)

Name a mirror that can give an erect and enlarged image of an object.

Concave Mirror

QUESTION-04 (Page No. 142)

Why do we prefer a convex mirror as a rear-view mirror in vehicles?



Page No. 144 (Ex. 9.1)

A convex mirror used for rear-view on an automobile has a radius of curvature of 3.00 m. If a bus is located at 5.00 m from this mirror, find the position, nature and size of the image.

$R = +3\ m$

$f = +1.5\ m$

$u = -5\ m$

$v = ?$

$m = ?$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{1.5} = \frac{1}{v} + \left(\frac{1}{-5}\right)$$

$$\frac{1}{1.5} = \frac{1}{v} - \frac{1}{5}$$

$$\frac{1}{5} + \frac{10}{15} = \frac{1}{v}$$

$$\frac{3+10}{15} = \frac{1}{v}$$

$$\frac{13}{15} = \frac{1}{v}$$

$$v = \frac{15}{13}\ m$$

$$m = -\frac{v}{u} = +\frac{15}{13(-5)}$$

$$m = \frac{3}{13}$$

Virtual + Diminished
Erect

Page No. 144 (Ex. 9.2)

$m = \frac{h_i}{h_o}$ | $-\frac{3}{2} = \frac{h_i}{4}$ | $h_i = -6\,cm$

An object, 4.0 cm in size is placed at 25.0 cm in front of a concave mirror of focal length 15.0 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image? Find the nature and the size of the image.

$h_o = +4\,cm$

$u = -25\,cm$

$f = -15\,cm$

✓ $V = ?$

$m = ?$

$h_i = ?$

$\frac{1}{f} = \frac{1}{V} + \frac{1}{u}$

$\frac{1}{-15} = \frac{1}{V} + \left(\frac{1}{-25}\right)$

$-\frac{1}{15} = \frac{1}{V} - \frac{1}{25}$

$\frac{1}{25} - \frac{1}{15} = \frac{1}{V}$

$\frac{3-5}{75} = \frac{1}{V}$

$\frac{-2}{75} = \frac{1}{V}$

$V = -\frac{75}{2}\,cm$

$m = -\frac{V}{u}$

$= -\frac{-75}{2(-25)} = \frac{3}{2}$

$m = -\left(\frac{3}{2}\right)$

R + I + Enlarged

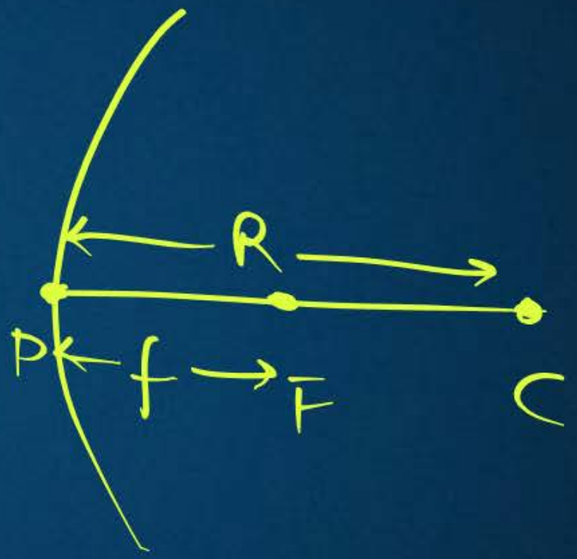
Page No. 145 (Q.1)

Find the focal length of a convex mirror whose radius of curvature is 32 cm.

$R = +32\ cm$

$f = \frac{R}{2} = \frac{32}{2}\ 16\ cm$

$\boxed{f = +16\ cm}$ ✓



Page No. 145 (Q.2)

A concave mirror produces three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located?

m

inverted
+

$u = -10cm$

$m = -3$

$V = ?$

$$m = \frac{-V}{u}$$

$$-3 = \frac{+V}{+10}$$

$V = -30cm$

Page No. 159 (Ex. Q.2)

6th VVIP

The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object?

(a) Between the principal focus and the centre of curvature

(b) At the centre of curvature

(c) Beyond the centre of curvature

(d) Between the pole of the mirror and its principal focus.

Page No. 159 (Ex. Q.4)

A spherical mirror and a thin spherical lens have each a focal length of −15 cm. The mirror and the lens are likely to be

(a) both concave.

(b) both convex.

(c) the mirror is concave and the lens is convex.

(d) the mirror is convex, but the lens is concave.

Page No. 160 (Ex. Q.5)

No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be

(a) only plane.

(b) only concave.

(c) only convex.

(d) either plane or convex.

VED

Page No. 160 (Ex. Q.7)

Virtual
+

V.V.I.P. Chaltha case!!!

We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror? What is the nature of the image? Is the image larger or smaller than the object? Draw a ray diagram to show the image formation in this case.

$f = -15\,cm$

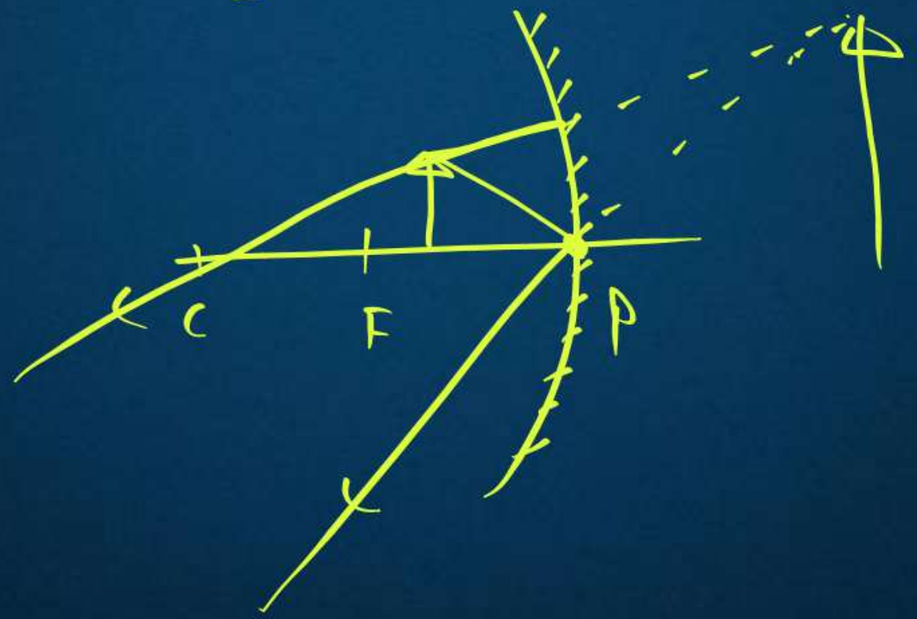
$[0 - 15\,cm]$: B/w P and F

Nature

V

E

Enlarged



Page No. 160 (Ex. Q.8)

Name the type of mirror used in the following situations.

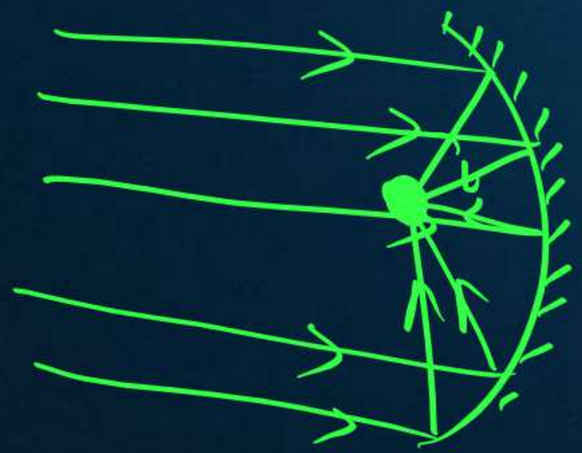
(a) Headlights of a car. : Concave : Parallel beam of light

(b) Side/rear-view mirror of a vehicle. : Convex : Wide field of View

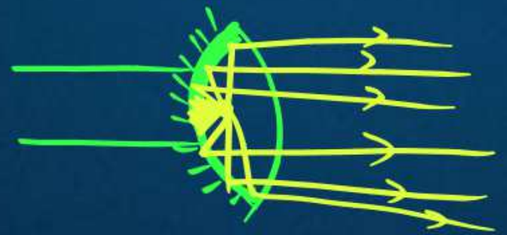
(c) Solar furnace. : Concave : Converging effect

Support your answer with reason.

Solar furnace



Head lights / Torch light



Page No. 160 (Ex. Q.12)

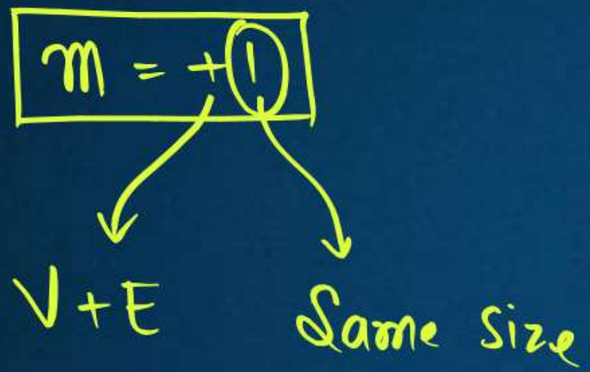
H.W.

An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.

v m

Page No. 160 (Ex. Q.13)

The magnification produced by a plane mirror is +1. What does this mean?



Page No. 160 (Ex. Q.14)

V.E.D.

An object 5.0 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.

$h_o = 5\,cm$

$u = -20\,cm$

$R = +30\,cm$

$f = +15\,cm$

$V = ?$

$m = ?$

$h_i = ?$

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\frac{1}{15} = \frac{1}{v} + \left(\frac{1}{-20}\right)$

$\frac{1}{15} = \frac{1}{v} - \frac{1}{20}$

$\frac{1}{20} + \frac{1}{15} = \frac{1}{v}$

$\frac{3+4}{60} = \frac{1}{v}$

$\frac{7}{60} = \frac{1}{v}$

$v = \frac{60}{7}\,cm$

$m = -\frac{v}{u}$

$= +\frac{60}{7(+20)} = \frac{3}{7}$

$m = \frac{3}{7}$

$m = \frac{h_i}{h_o}$

$\frac{3}{7} = \frac{h_i}{5}$

$\frac{15}{7}\,cm = h_i$

Page No. 160 (Ex. Q.15)

H.W.

An object of size 7.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed, so that a sharp focussed image can be obtained? Find the size and the nature of the image.

$h_o = 7\ cm$

$u = -27\ cm$

$f = -18\ cm$

$v = ?$

$m = ?$

$h_i = ?$

Permanant

HOMEWORK

- Notes
- in-class H.W.

Thank You

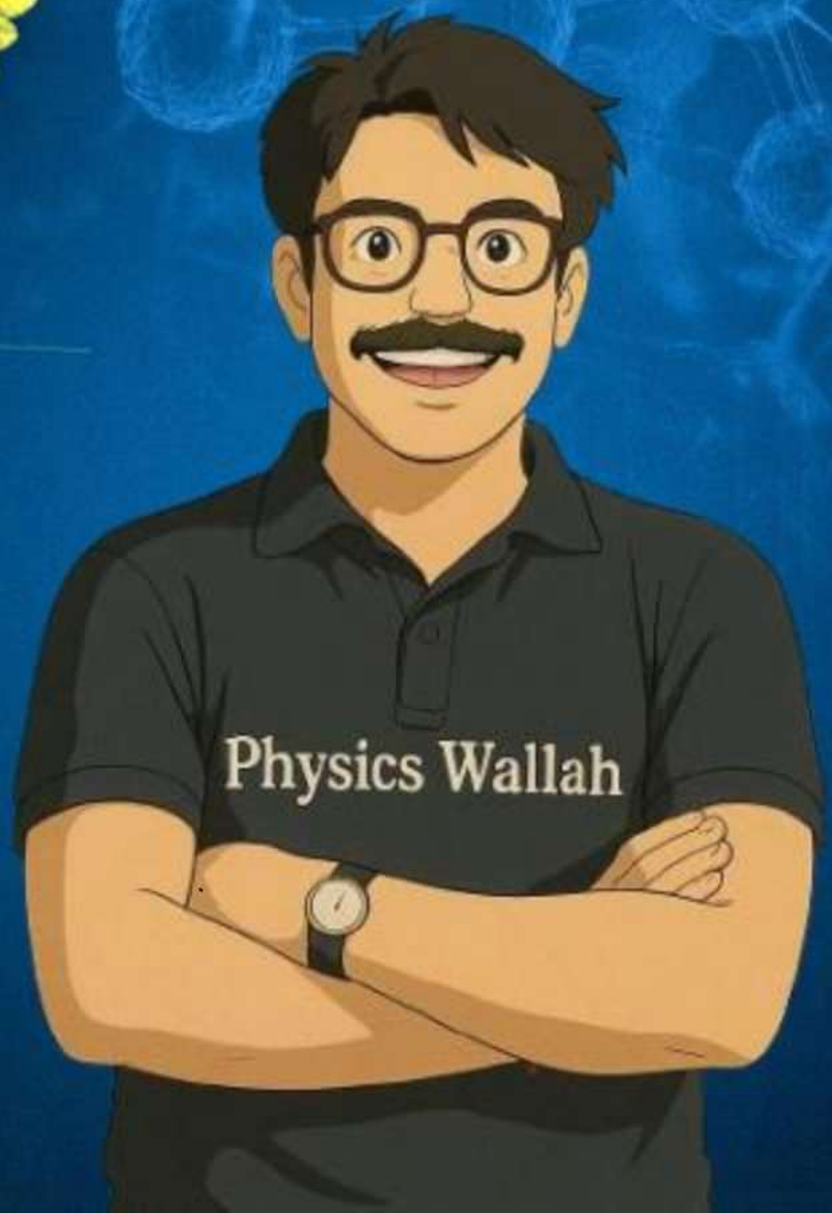
UDAAN

2026

LIGHT - Reflection and Refraction

PHYSICS | LECTURE-4

BY - RAKSHAK SIR



Topics to be covered

A Refraction of Light: Ray Theory — Bending of light

B Laws of Refraction : Snell's Law (Reading only)

C Rules of Refraction (Transiting Media)

D Refraction of Light Through Glass Slab


PHYSICS
IS
PHUN

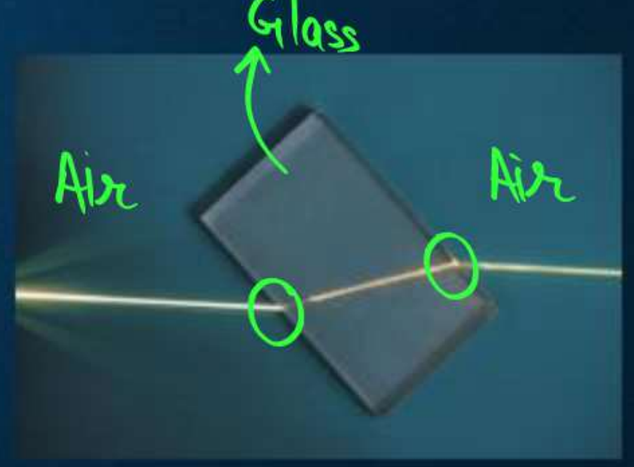
Phenomenon of Light : Refraction

Vacuum = 1 → rarer
Air = 1.003 → or
Water = 1.33 → D
glass = 1.5 → Denser

- Refraction of light is the change in the direction of a light ray passing from one medium to another.

Transparent → glass, Water, air, Vacuum, Kerosene, Oils, fibre, etc.

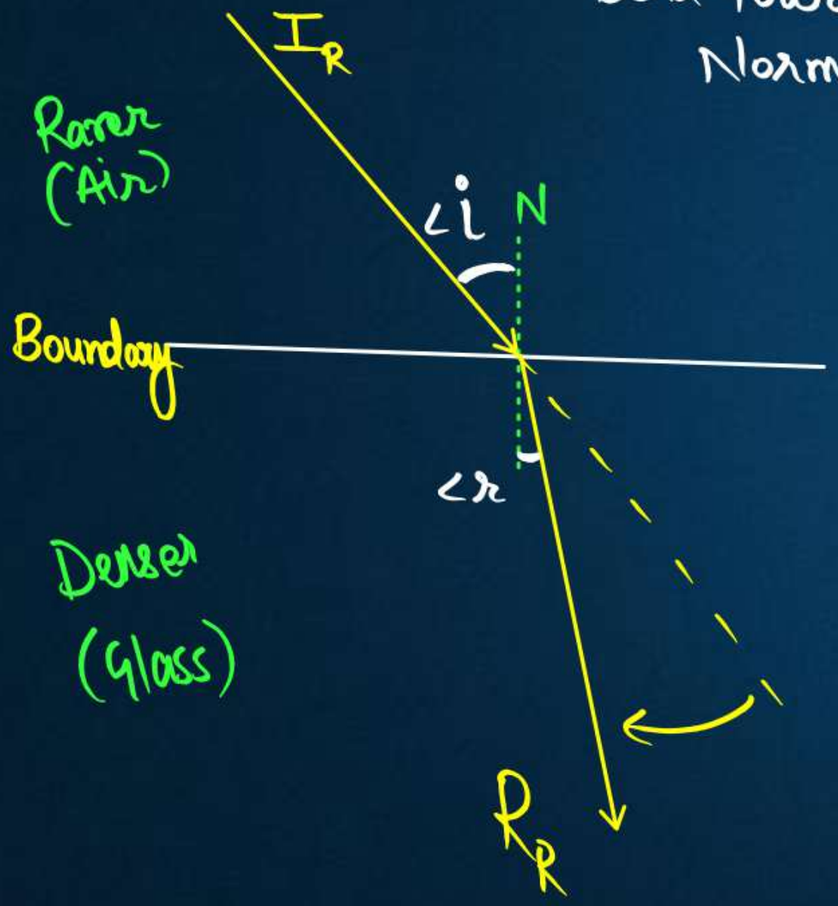
- The bending of Light Ray is caused due to the differences in optical density = Refractive index between the two transparent media.



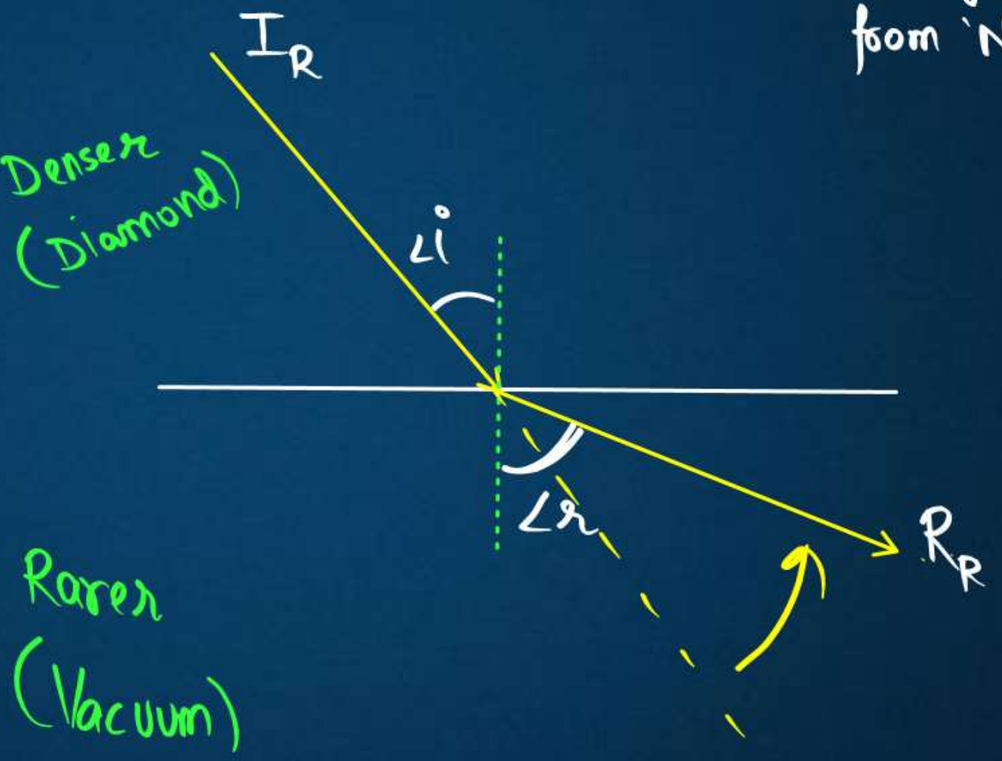
Rules of Refraction (Transiting Media)

Singular = Medium
Plural = Mediums ✗ Media ✓

① Rarer ⟶ Denser : Bend towards Normal



② Denser ⟶ Rarer : Bend away from 'N'

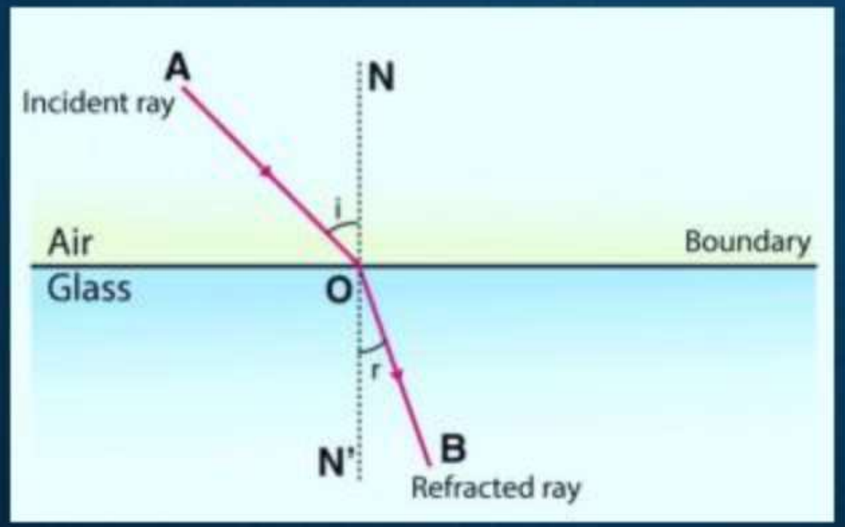


LAWS OF REFRACTION

The laws of refraction states that

- The incident ray refracted ray, and the normal to the interface of two media at the point of incidence all lie on the same plane.
- The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant. This is also known as Snell's law of refraction.

$$\frac{\sin i}{\sin r} = \text{Constant}$$

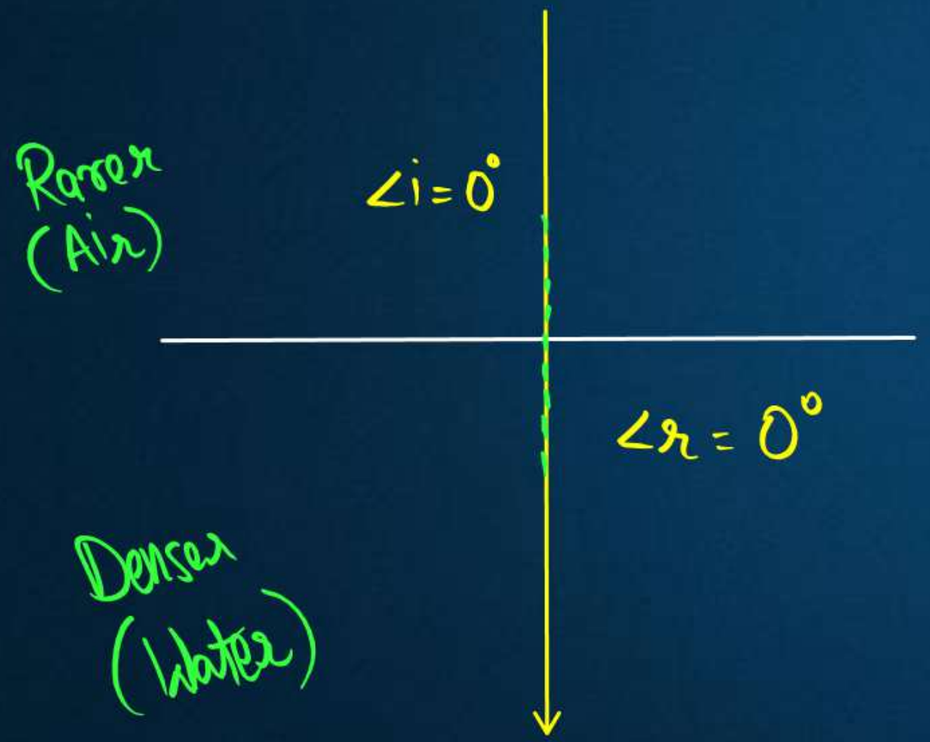


$$\frac{\sin i}{\sin r} = \text{constant}$$

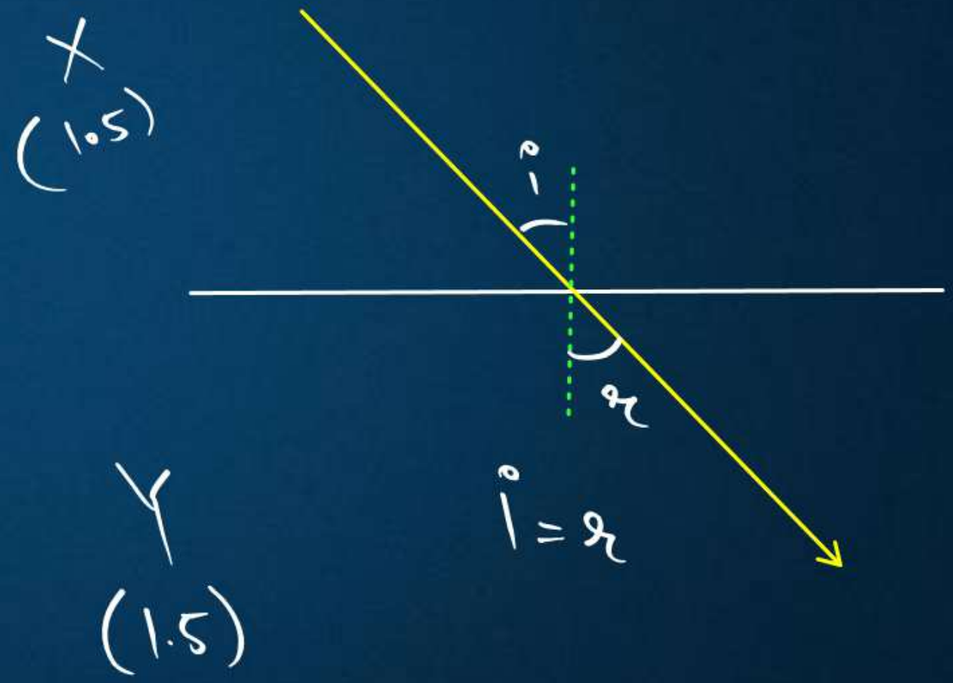
When Refraction does not occur !!!

* imp.

1. When light ray falls Normally (Normal incidence)



2. When the two media have nearly same optical density



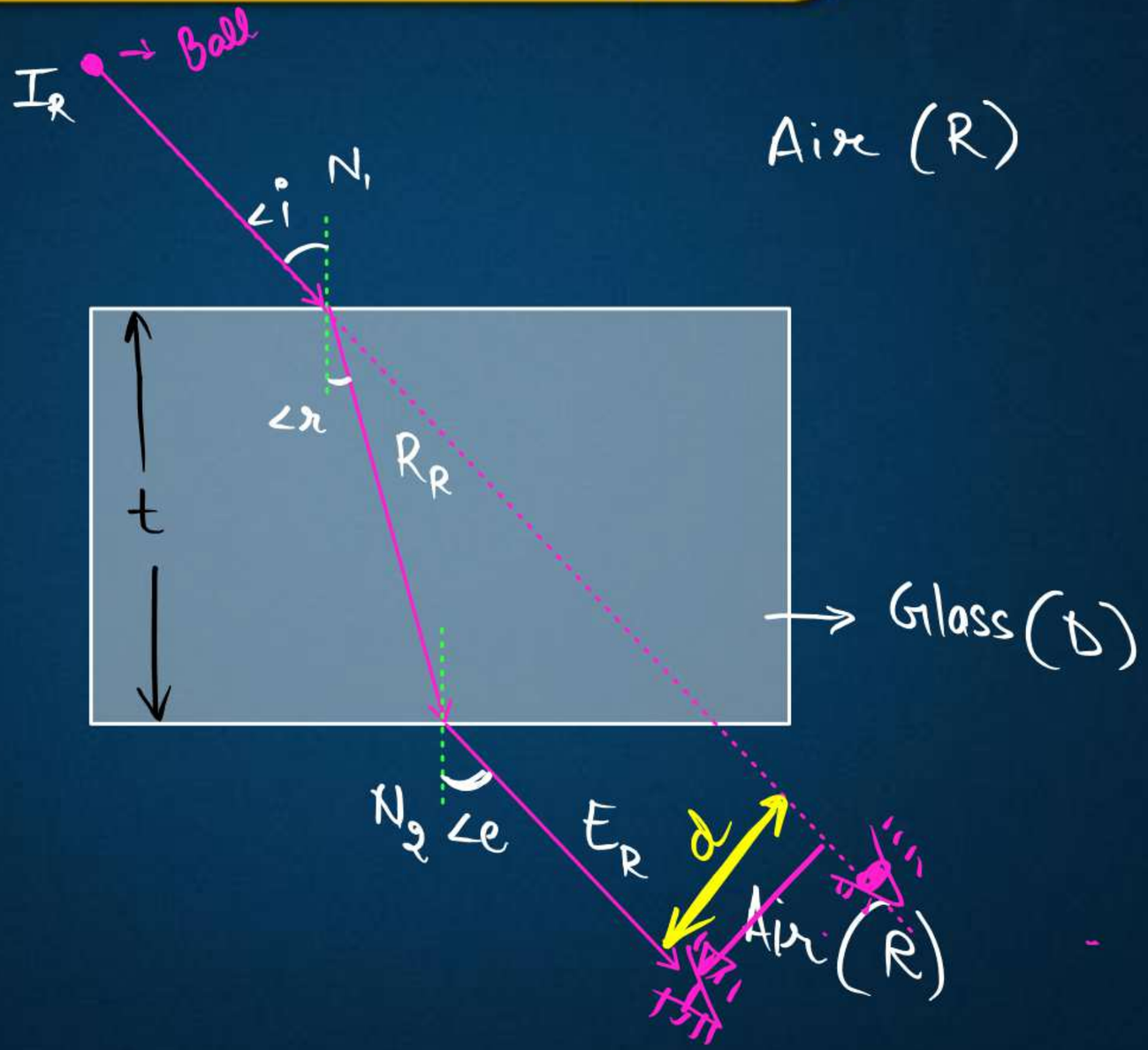
Blue Box Activity :-

Refraction through Glass Slab

Glass Slab

I_R - Incident Ray
R_R - Refracted Ray
E_R - Emergent Ray
$\angle i$ - Angle of incidence
$\angle r$ - Angle of refraction
$\angle e$ - Angle of emergence
N_1, N_2 } Normals

'd' - Lateral displacement
or
Optical shift.



Lateral Shift

it is the perpendicular distance between original incident ray and Actual Emergent

it depends :-

1. Angle of incidence (i)
2. Thickness of slab (t)
3. Refractive index / optical density

PHYSICS WALLAH

Topper Wali Taiyaari
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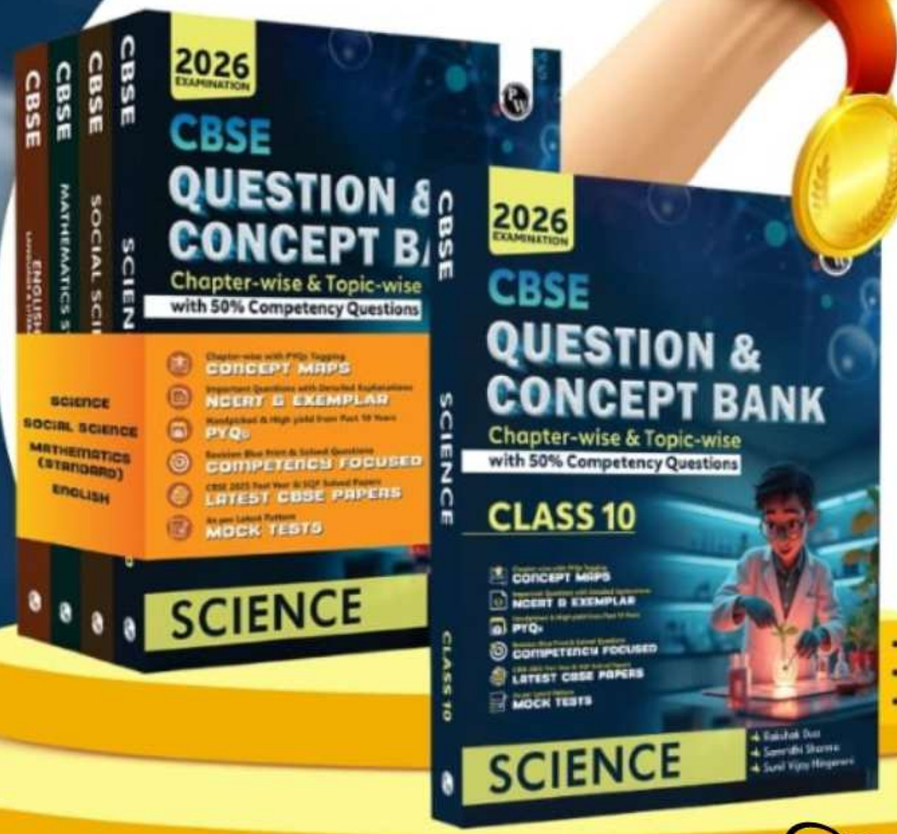

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Competency-Based Questions

Mock Tests As Per The Latest Pattern

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Class 10 Question Bank (2025-26)

HOMEWORK

- Notes Complete ✓
- Revision ✓


Thank
You

UDAAN

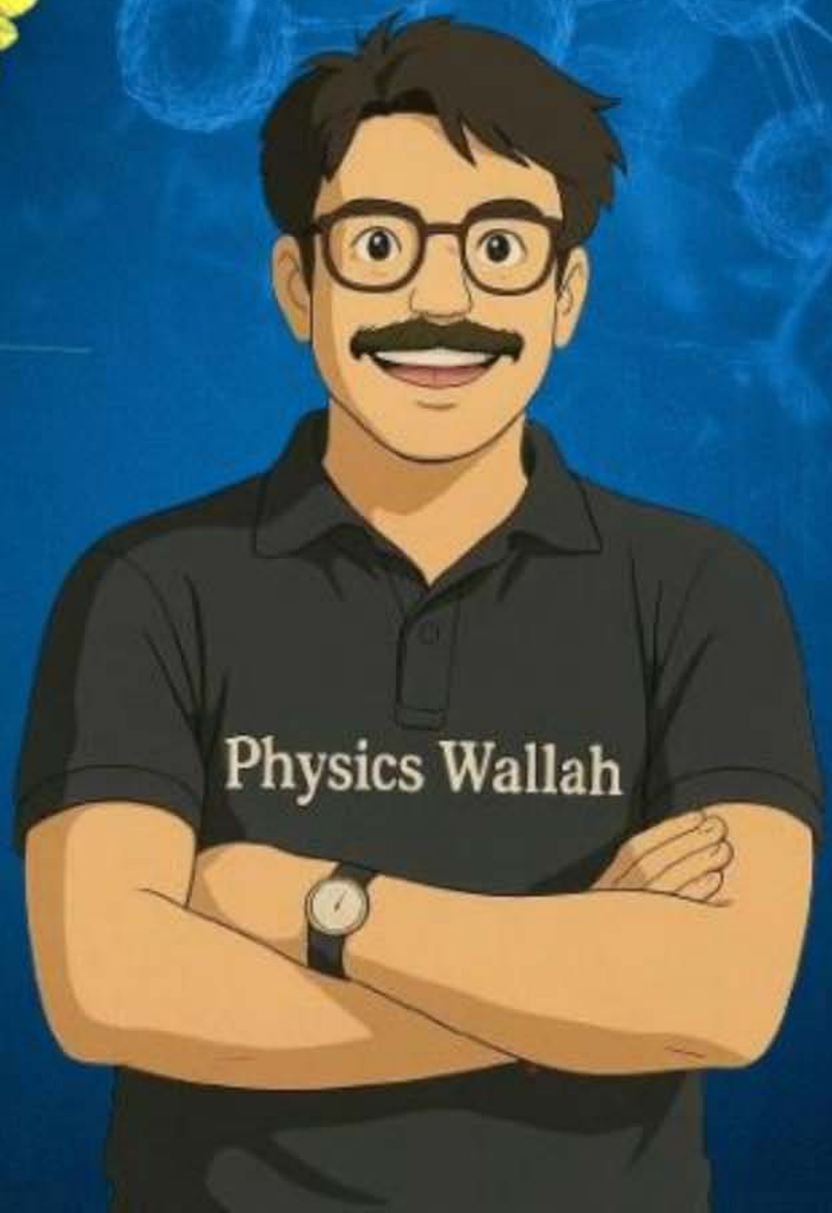
2026

LIGHT

- Reflection and Refraction

PHYSICS LECTURE-5

BY - RAKSHAK SIR



Topics *to be covered*

A

B

C Snell's Law (feel lenge !!)

D Refractive Index (Absolute and Relative)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QUESTION & CONCEPT BANK
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with 50% Competency Questions
CLASS 10
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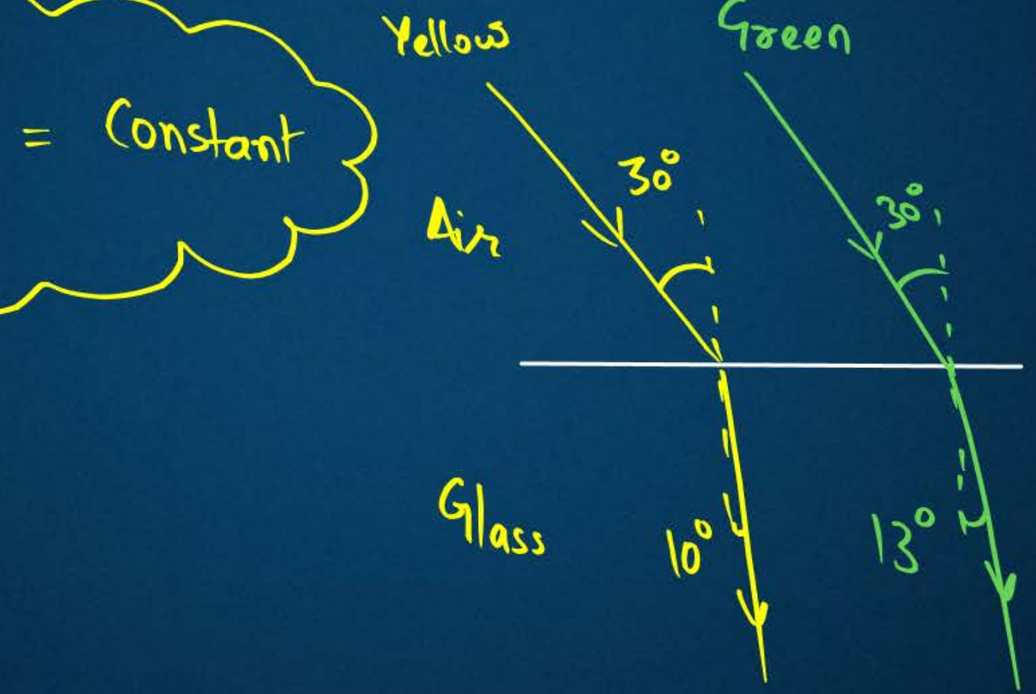
Snell's Law - The **ratio** of **Sine of Angle of incidence** to the **Sine of Angle of refraction** is always Constant for a **given pair of media** ⇒ Constant ✓ and for a **particular Wavelength** ⇒ Constant ✓

$$\frac{\sin i}{\sin r} = \text{Constant}$$



Refractive index/Optical density (The idea behind)

$\eta_{Neeche} = \frac{Uparwali}{Neechewali}$

Vacuum (3×10^8 m/s)

1. Absolute Refractive Index

⇒ **Definition :** If medium 1 is vacuum or air, then the refractive index of medium *m* is considered with respect to vacuum. This is called the absolute refractive index of the medium. It is simply represented as n_m.

⇒ **Formula :**

$$n_m = \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

2. Relative Refractive Index

⇒ **Definition :** The refractive index of medium 2 with respect to medium 1 is given by the ratio of the speed of light in medium 1 and the speed of light in medium 2. This is usually represented by the symbol n_{21}.

⇒ **Formula :**

$$n_{21} = \frac{\text{Speed of light in medium 1}}{\text{Speed of light in medium 2}} = \frac{v_1}{v_2}$$

REFRACTIVE INDEX (ABSOLUTE AND RELATIVE)

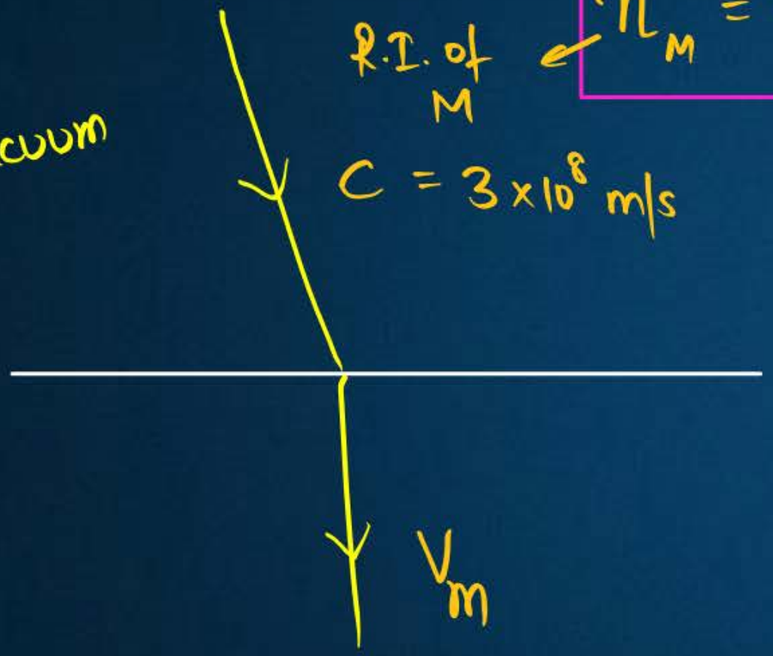
Absolute R.I.

$$\eta_M = \frac{c}{v_M}$$

R.I. of M

Air/Vacuum

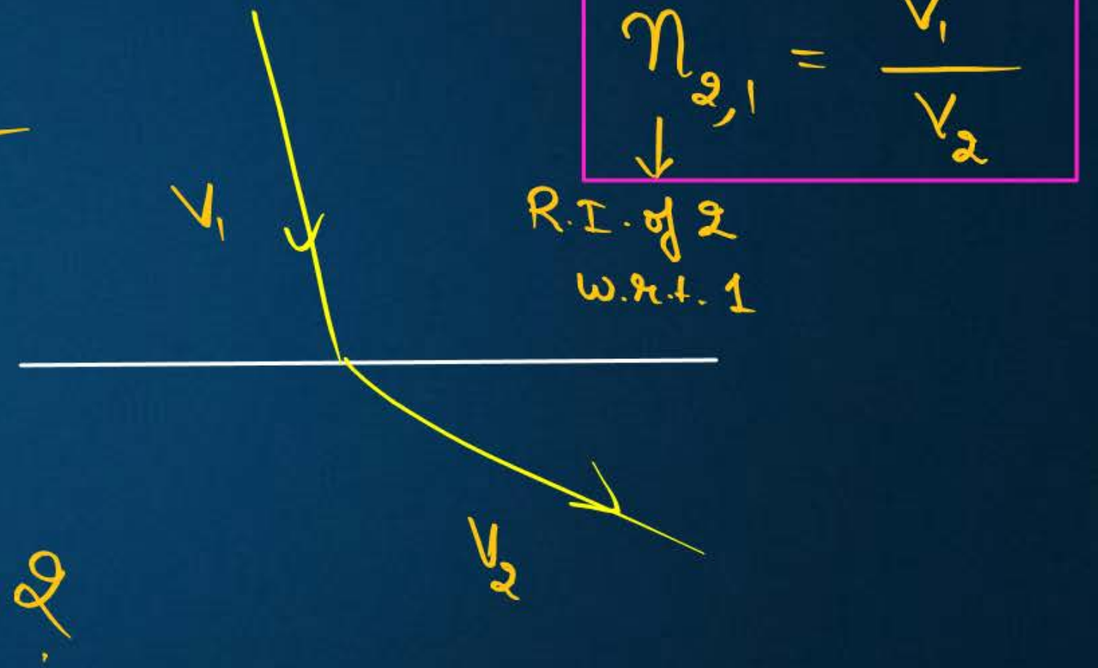
$C = 3 \times 10^8$ m/s



Relative R.I.

$$\eta_{2,1} = \frac{V_1}{V_2}$$

R.I. of 2 w.r.t. 1



Q1 R.I. of water is 1.5

Absolute

$$\eta_{water} = \frac{c}{v_{water}}$$

$$\eta_w = \frac{c}{v_w}$$

Q2 R.I. of water w.r.t. glass is 0.8

Relative

$$\eta_{water,\,glass} = \frac{v_{glass}}{v_{water}}$$

$$\eta_{w,g} = \frac{v_g}{v_w}$$

QUESTION

CS_2

"The refractive index of carbon disulphide is 1.63." What is the meaning of this statement in relation to speed of light?

Sol" This means that speed of light when enters inside CS_2 becomes 1.63 times less than that in Vacuum.

This also shows that CS_2 is 1.63 times optically denser than Vacuum/air.

glass → 1.33

speed ⇒ $\frac{c}{1.33} = \frac{3\times10^8}{1.33}$

PW → $n = 3$

Light Ki speed = $\frac{c}{3}$

$= \frac{3\times10^8}{3}$

$= 10^8$ m/s

QUESTION

Find the velocity of the light when it enters a medium which has refractive index 1.5.

Absolute

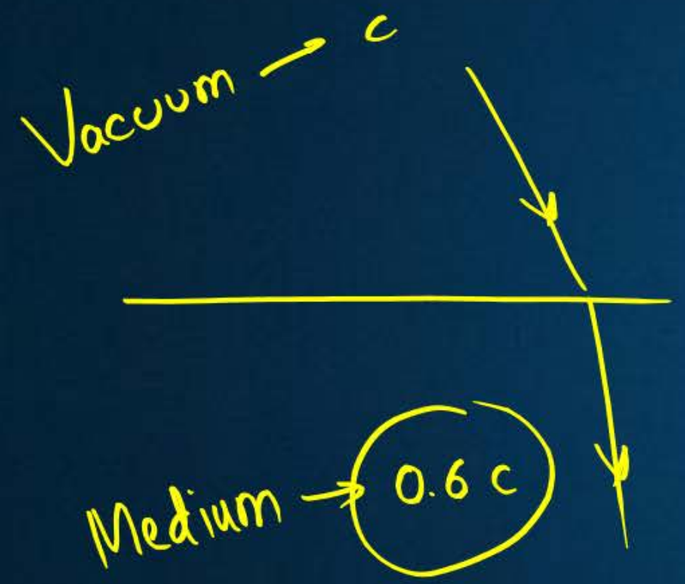
$$\eta_m = \frac{c}{v_m}$$

$$1.5 = \frac{3\times10^8}{v_m}$$

$$v_m = \frac{3\times10^8}{1.5} = 2\times10^8 \text{ m/s}$$

QUESTION

The speed of light in a transparent medium is 0.6 times that of its speed in vacuum. What is the refractive index of the medium?



$$\eta = \frac{c}{v}$$

$$\eta = \frac{c}{0.6c} = \frac{1}{0.6} = \frac{10}{6} = \frac{5}{3}$$ Ans

QUESTION H.W.

Refractive index of glass with respect to water is 5/4 and the refractive index of water with respect to air is 4/3, what is the refractive index of glass with respect to air ?

A 5/3

B 5/4

C 16/15

D 1.5

QUESTION

Easy PYQ H.W.

The refractive indices of four media A, B, C and D are given in the following table :

Medium	A	B	C	D
Refractive Index	1.33	1.50	1.52	2.40

If light, travels from one medium to another, in which case the change in speed will be (i) minimum, (ii) maximum ?

HOMEWORK

- in-class Ques
- Notes ~
- Revision

Thank You

UDAAN

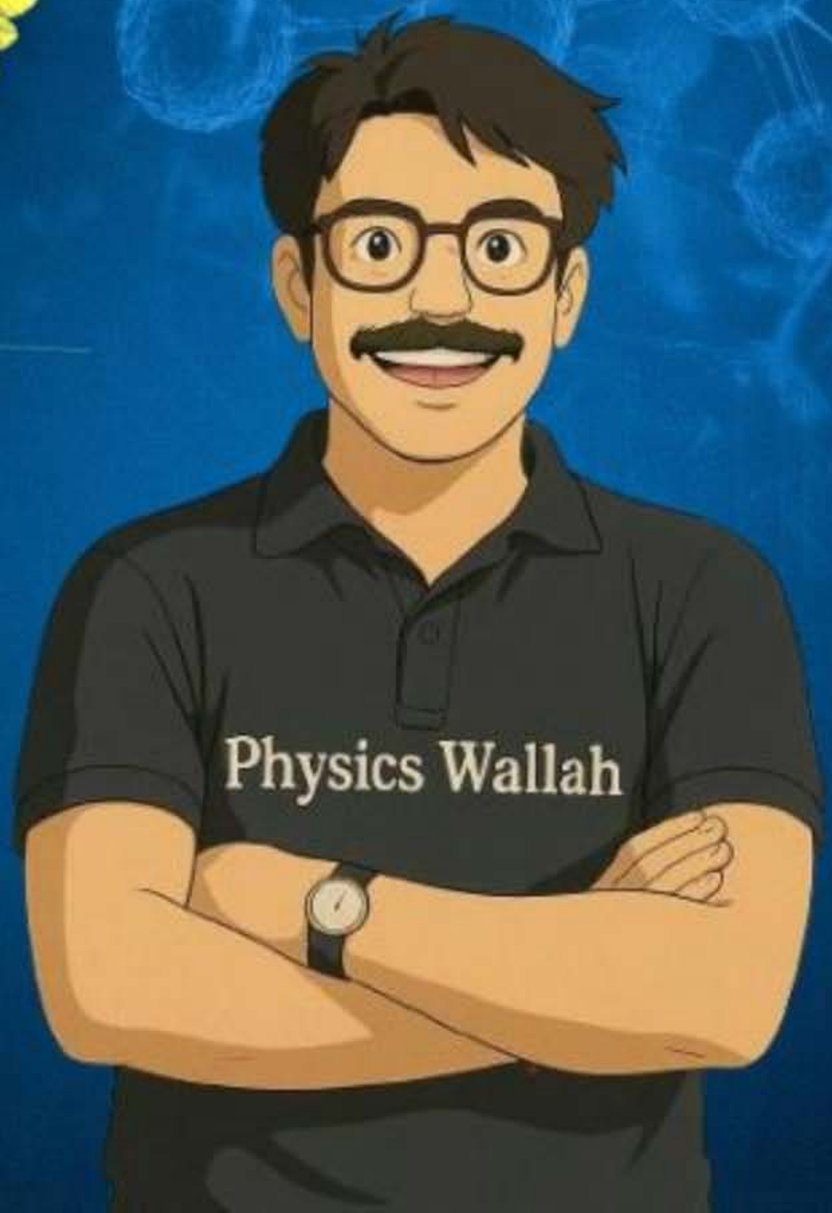
2025

LIGHT

- Reflection and Refraction

PHYSICS | LECTURE-6

BY - RAKSHAK SIR



Topics *to be covered*

A Refraction through Spherical Lenses ✓

B Rules of Image Formation : Ray Diagrams (hand-to-hand)

C Uses of Spherical Lenses ✓

D PYQs on Ray Diagrams

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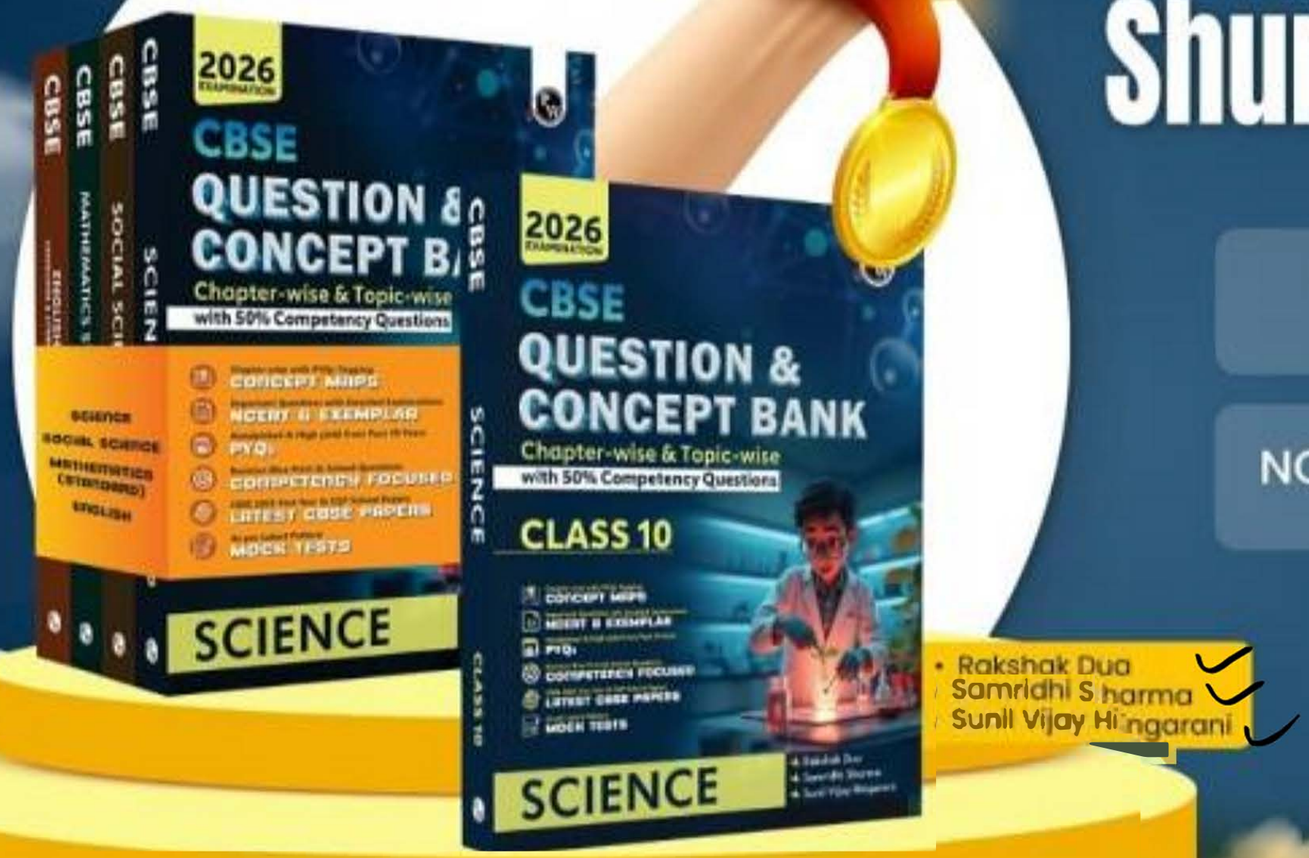

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• Samridhi Sharma
• Sunil Vijay Hingarani

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Tell Samridhi mam (Pookie mam)

Congrats !!!

QUESTION H.W.

Refractive index of glass with respect to water is 5/4 and the refractive index of water with respect to air is 4/3, what is the refractive index of glass with respect to air ?

(Relative; Absolute; Absolute)

A. 5/3

B. 5/4

C. 16/15

D. 1.5

Given :-

$\eta_{glass,Water} = \frac{5}{4}$

$\eta_{Water} = \frac{4}{3}$

$\eta_{glass} = ?$

$\eta_{g,w} = \frac{V_w}{V_g}$

$\eta_w = \frac{c}{V_w}$

$\eta_g = \frac{c}{V_g}$

$\frac{5}{4} = \frac{V_w}{V_g} \rightarrow V_g = \frac{4}{5} \times \frac{9\times10^8}{4}$ m/s

$\frac{4}{3} = \frac{3\times10^8}{V_w} \rightarrow V_w = \frac{9\times10^8}{4}$ m/s

$\eta_g = \frac{3\times10^8}{V_g} = \frac{3\times10^8}{\frac{9\times10^8}{5}} = \frac{15\times10^8}{9\times10^8} = \frac{5}{3}$

(5/3)

QUESTION H.W.

The refractive indices of four media A, B, C and D are given in the following table :

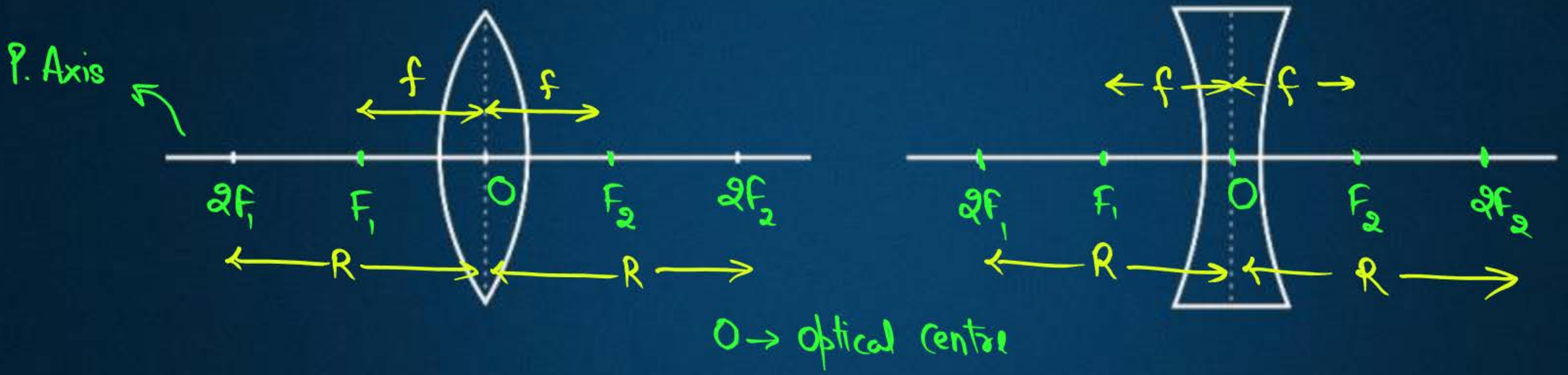
Medium	A	B	C	D
Refractive Index	1.33	1.50	1.52	2.40

If light, travels from one medium to another, in which case the change in speed will be (i) minimum, (ii) maximum ?

B to C

A to D

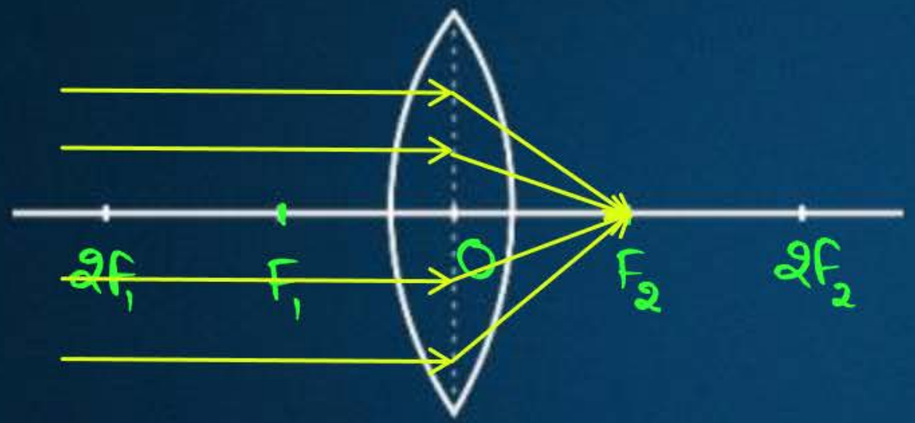
REFRACTION THROUGH SPHERICAL LENSES



Convex

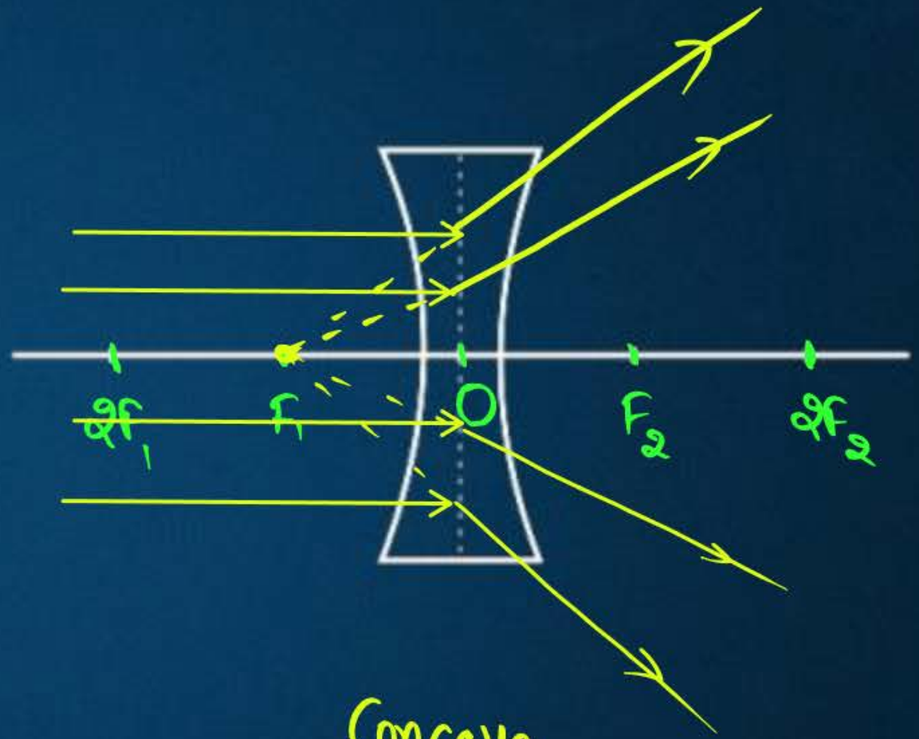
Concave

REFRACTION THROUGH SPHERICAL LENSES (Nature)



Convex

(Converging lens)

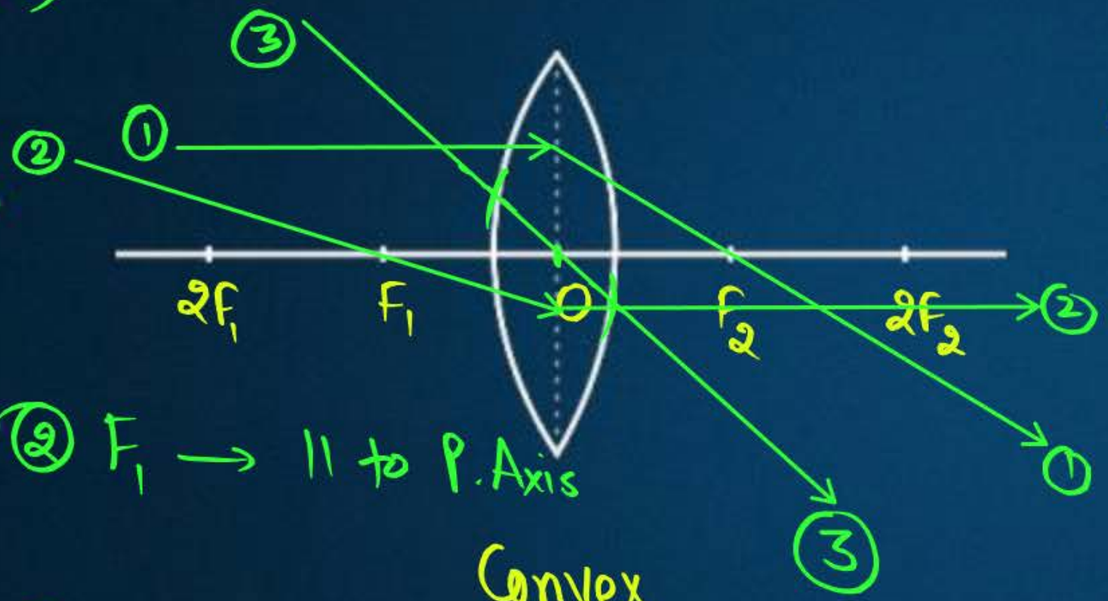


Concave

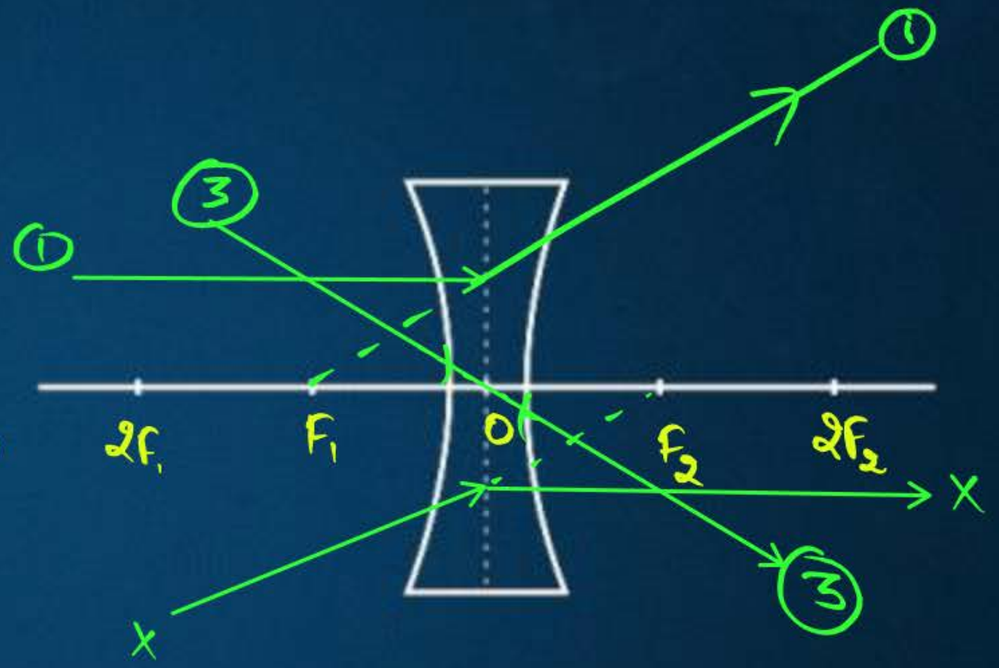
(Diverging lens)

RULES TO OBTAIN IMAGE

1) ∥ to P. Axis → F



Convex



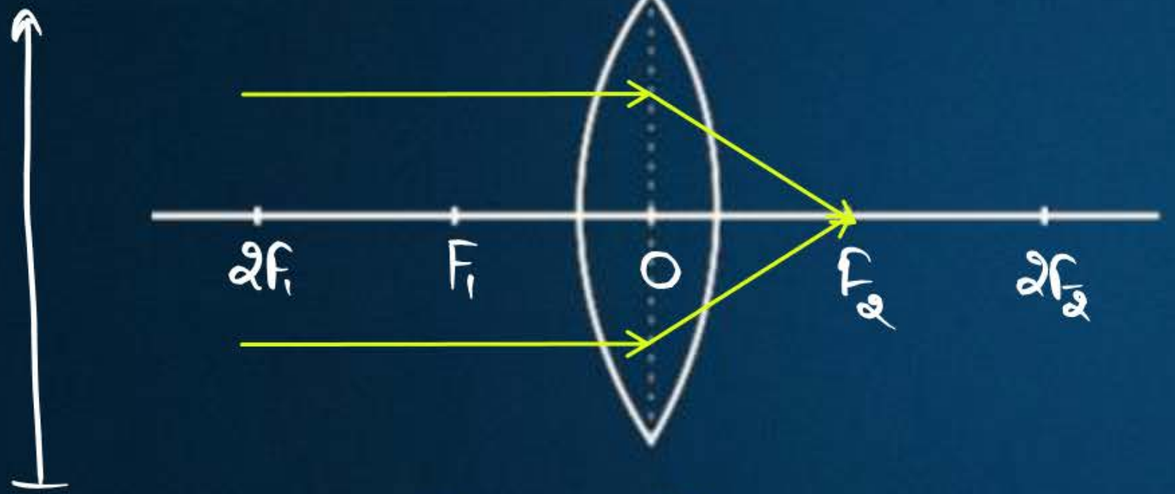
Concave

2) F_1 → ∥ to P. Axis

3) O → Undeviated
(Normal incidence)

IMAGE FORMATION : CONVEX LENS (1)

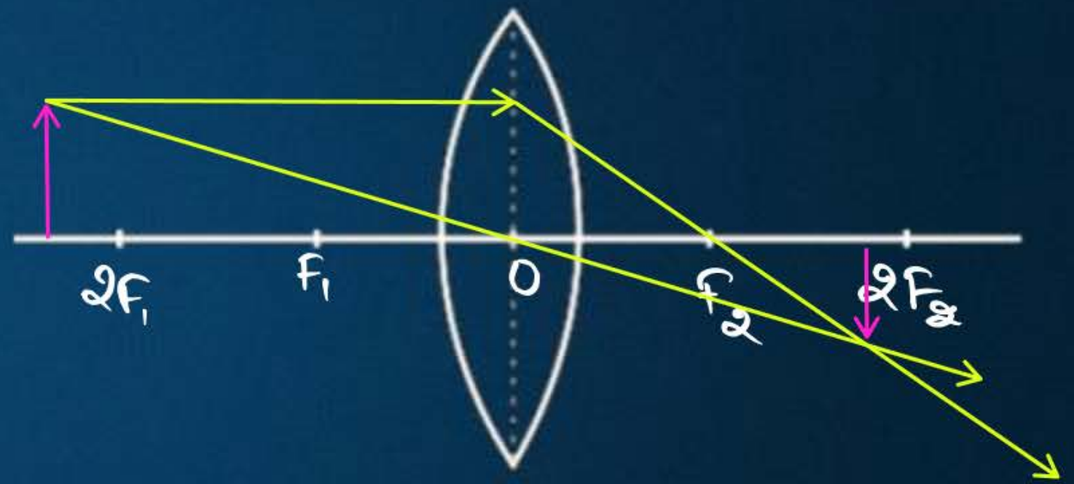
1. Object at Infinity



Nature of Image

① At F_2 ② Highly diminished
③ Real ④ inverted

2. Object beyond $2F_1$

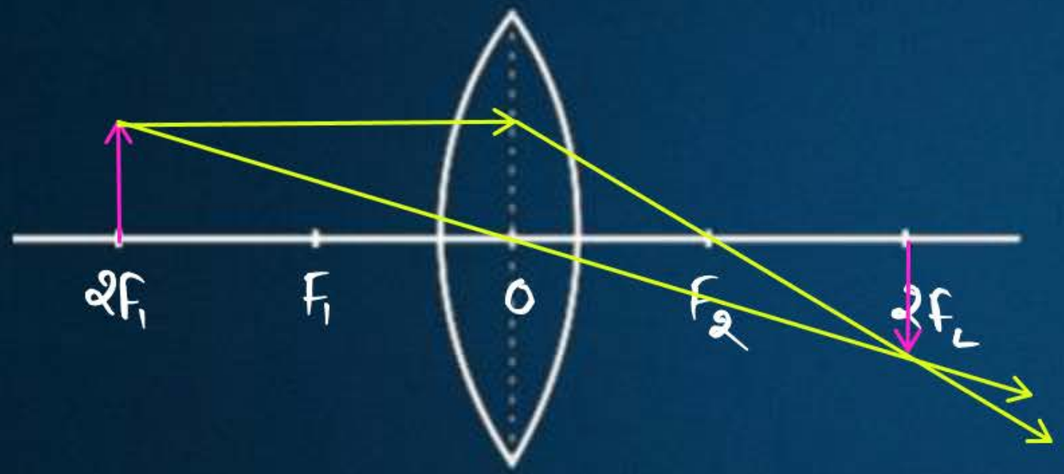


Nature of Image

① B/w F_2 and $2F_2$ ② Diminished
③ Real ④ inverted

IMAGE FORMATION : CONVEX LENS (2)

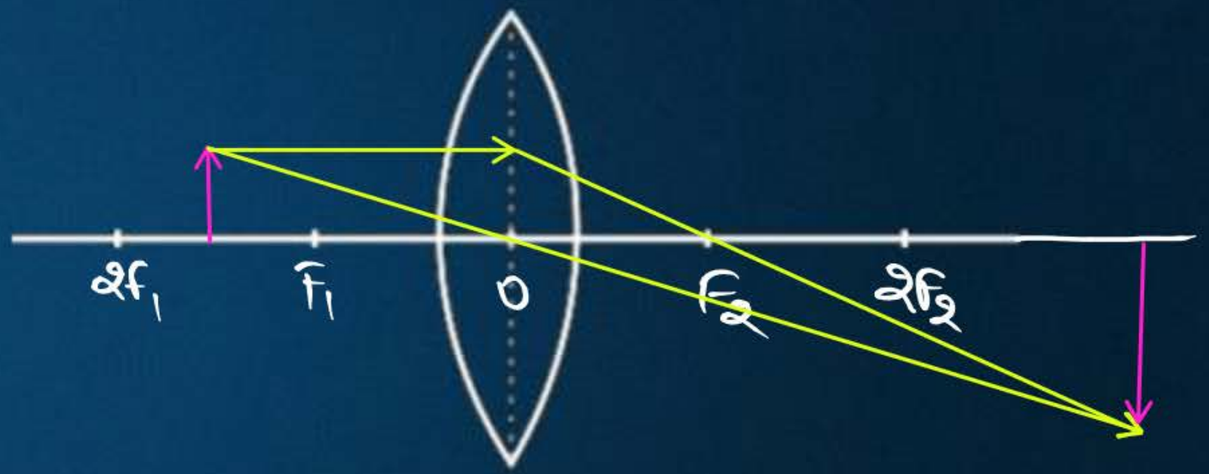
3. Object at $2F_1$



Nature of Image

① At $2F_2$ ② Same size
③ Real ④ Inverted

4. Object between $2F_1$ and F_1

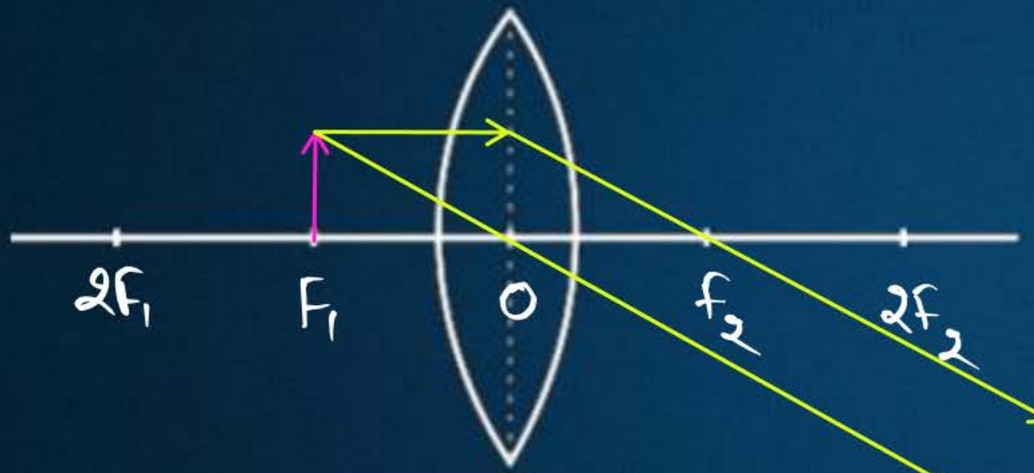


Nature of Image

① Beyond $2F_2$ ② Enlarged / magnified
③ Real ④ inverted

IMAGE FORMATION : CONVEX LENS (3)

5. Object at F_1

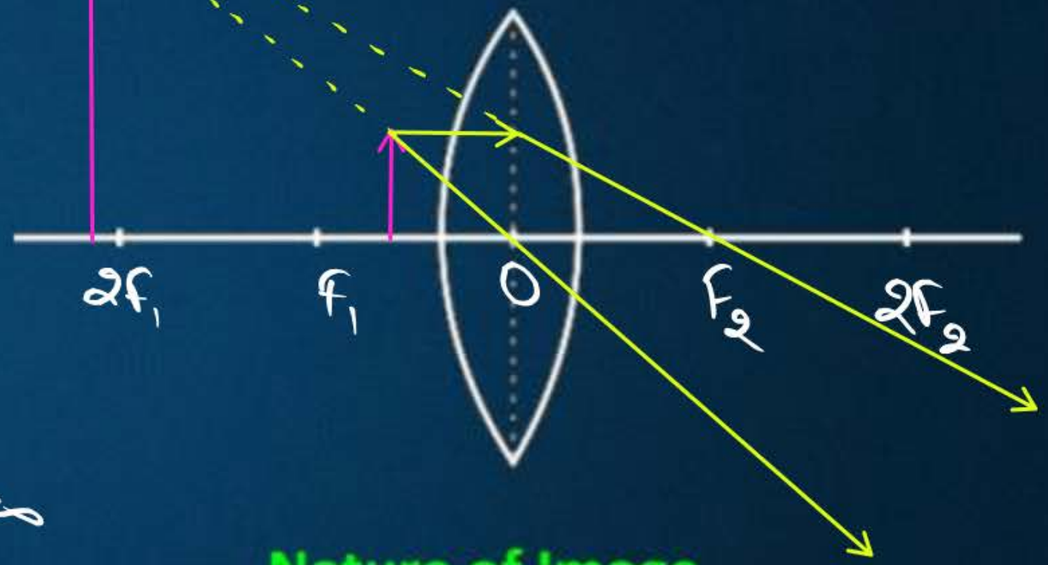


Nature of Image

1. At ∞
2. Highly Enlarged
3. Real
4. inverted

VVIP Case

6. Object between F_1 and O



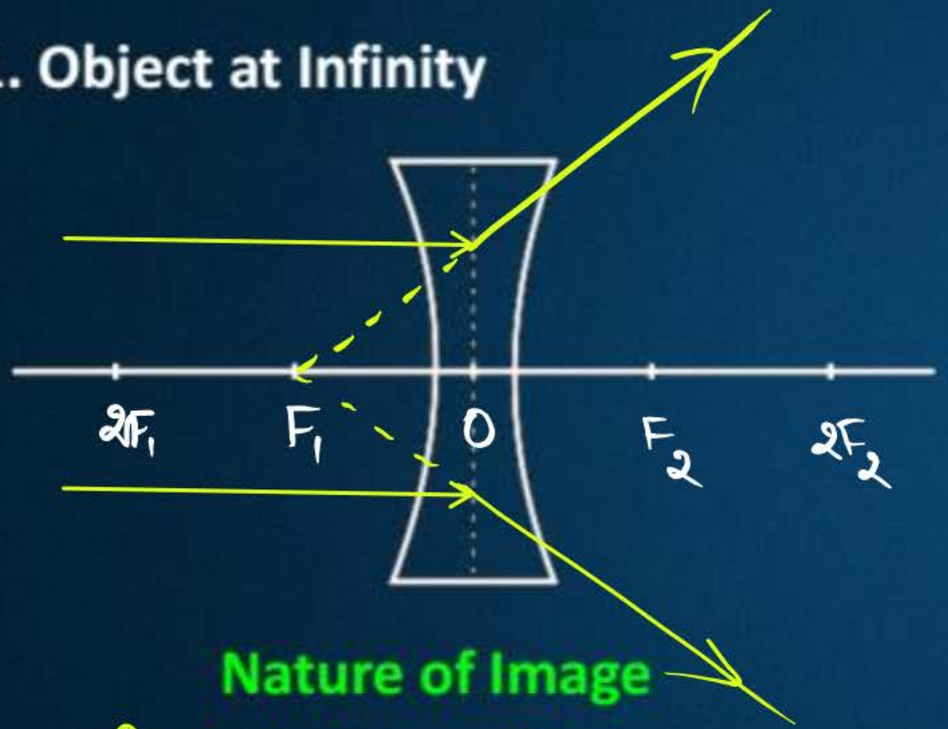
Nature of Image

① Behind the lens
② Enlarged
③ Virtual
④ Erect

IMAGE FORMATION : CONCAVE LENS

V.E.D.

1. Object at Infinity

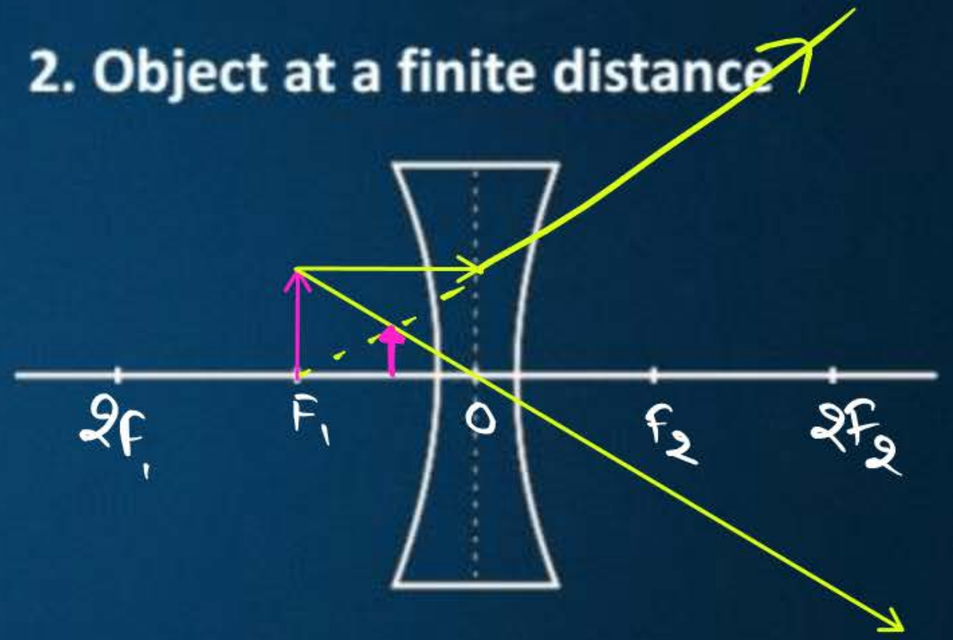


Nature of Image

① At F_1 ② Highly diminished

③ Virtual ④ Erect

2. Object at a finite distance

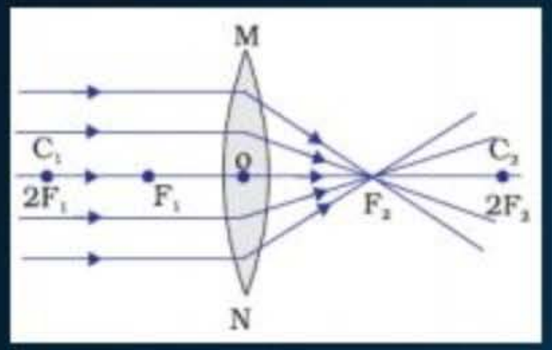


Nature of Image

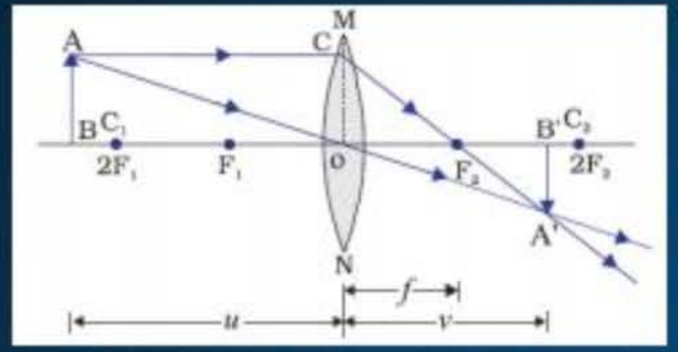
① B/w F_1 and O ② Diminished

③ Virtual ④ Erect

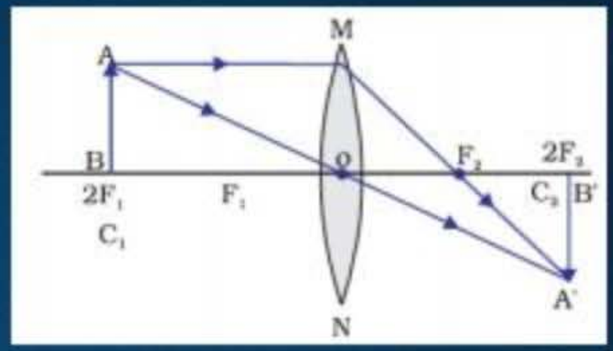
ALL RAY DIAGRAMS : SPHERICAL LENSES



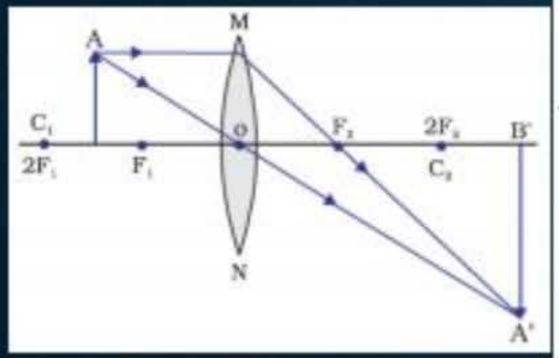
1. Object at Infinity



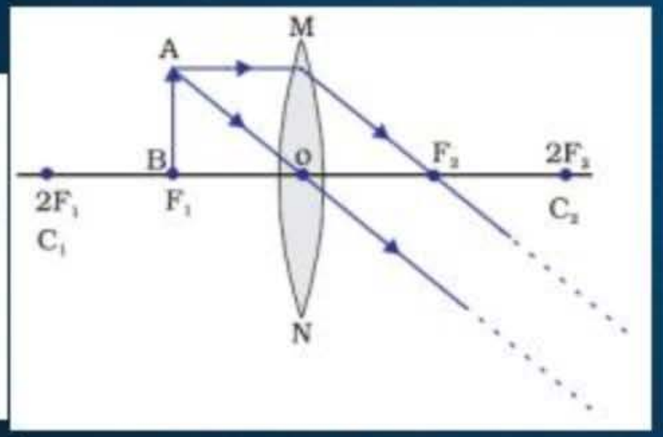
2. Object beyond $2F_1$



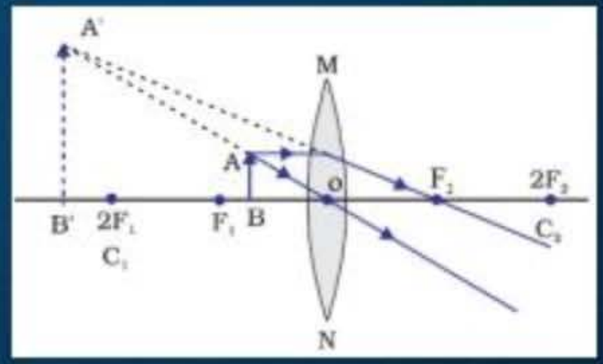
3. Object at $2F_1$



4. Object between $2F_1$ and F_1

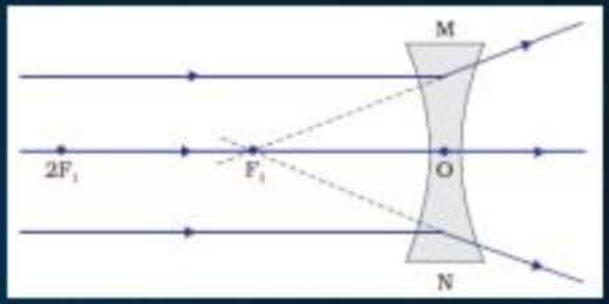


5. Object at F_1

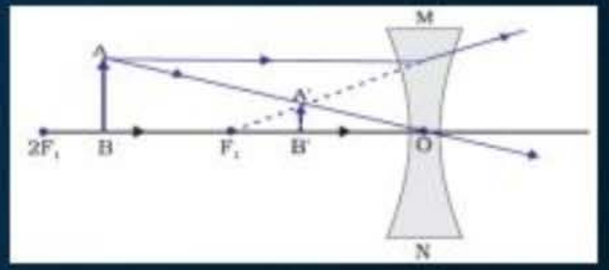


6. Object between F_1 and O

Convex Lens



1. Object at Infinity



2. Object at a finite distance

Concave Lens

USES OF LENSES

O · O · S ·
↓ ↓ ↓
Out of Syllabus

Spectacles

Camera

Projector

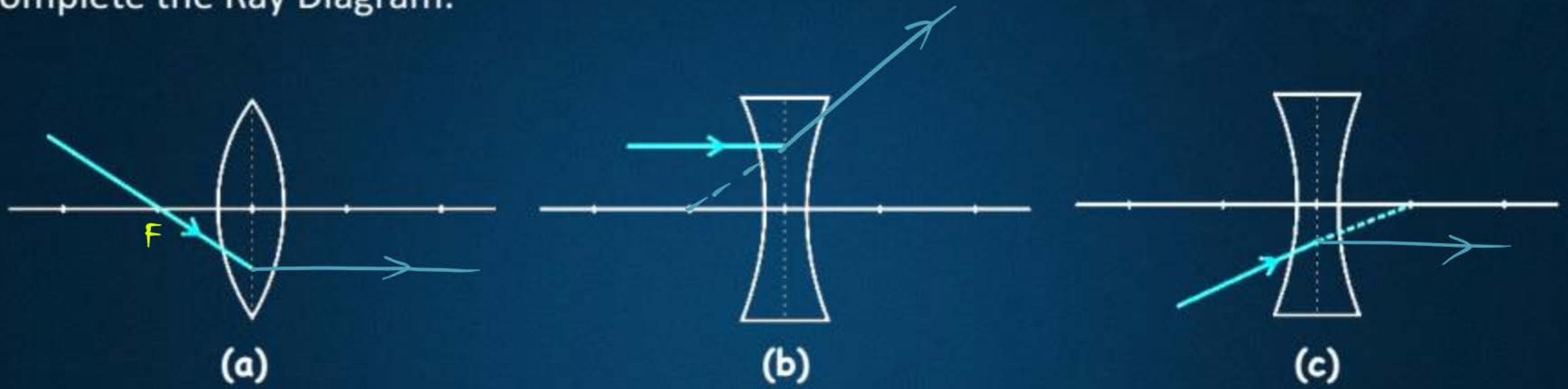
Microscope

Telescope

Jasoosi Glass

QUESTION PYQ (1 Marker)

Complete the Ray Diagram.



HOMEWORK

→ 2 times ray diagram Practice

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Shuruat Se Karne Ki Baari

- Latest 2025 Solved PYQ
- Chapter-wise Concept Maps
- NCERT & Exemplar
- Competency-Based Questions
- Mock Tests As Per The Latest Pattern

- Rakshak Dua
- Samridhi Sharma
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Thank You

UDAAN

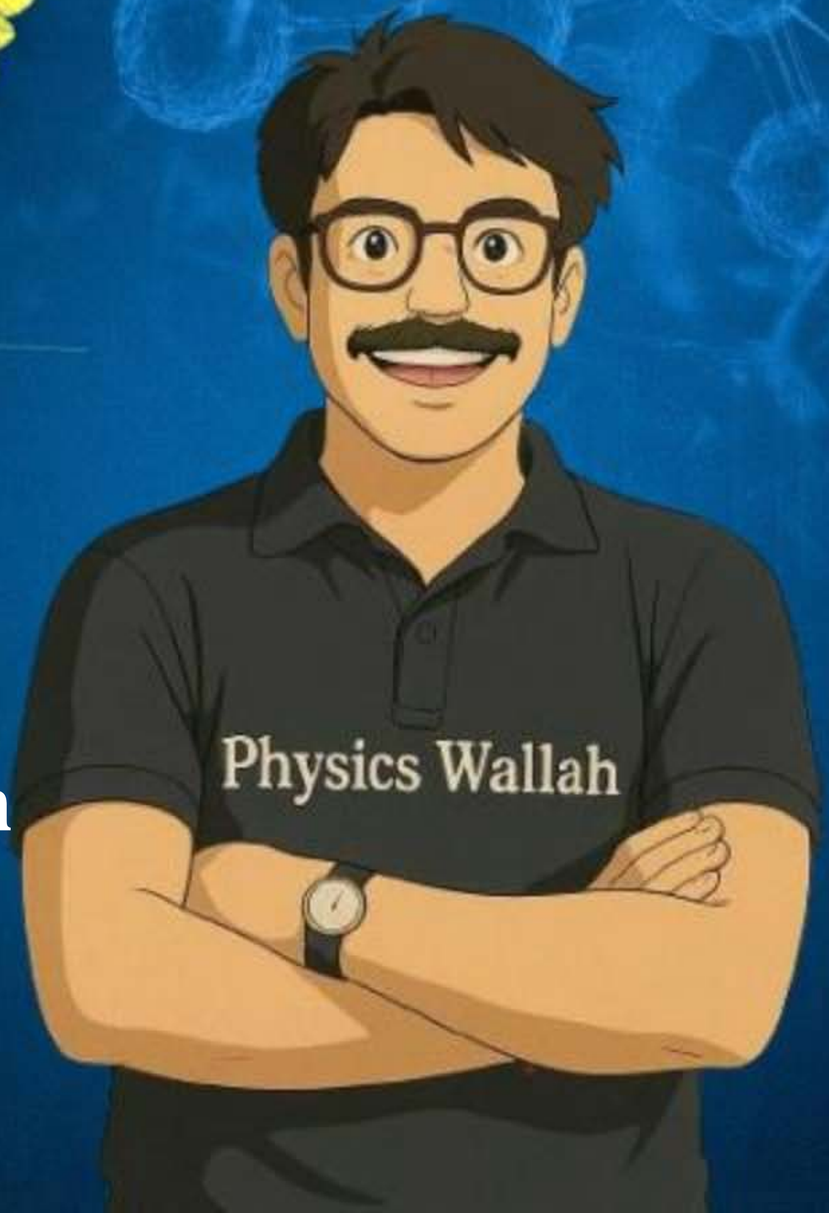
2026

LIGHT

- Reflection and Refraction

PHYSICS | LECTURE-7

BY - RAKSHAK SIR



Topics *to be covered*

A Power of the Lens

B Combination of Lenses

C Questions on Power of the Lens

D NCERT Questions : Refraction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* **Power of the lens** — The degree of convergence or divergence of a lens for incident light on it.

(P)

→ SI unit :- Dioptre (D)

$$P_{(D)} = \frac{1}{f_{(m)}}$$

or $P \propto \frac{1}{f}$; $f \uparrow P \downarrow$; $f \downarrow P \uparrow$

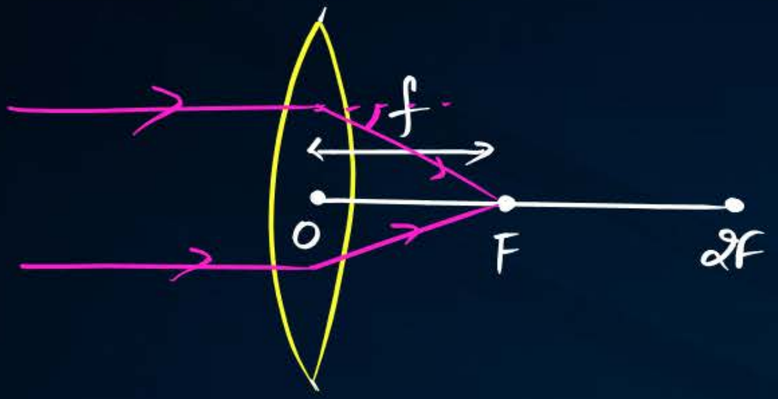
Power of the lens is reciprocal of focal length

OR

$$P_{(D)} = \frac{100}{f_{(cm)}}$$

Feel

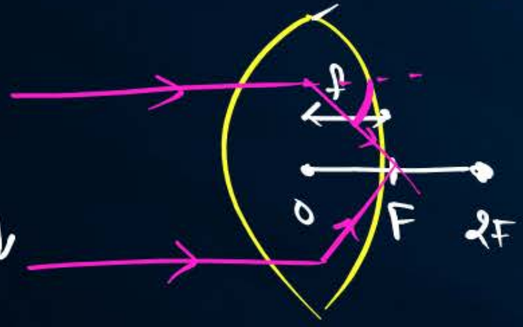
Patla $f\uparrow$



Patla $f\uparrow$ $P\downarrow$

$P \propto \frac{1}{f}$

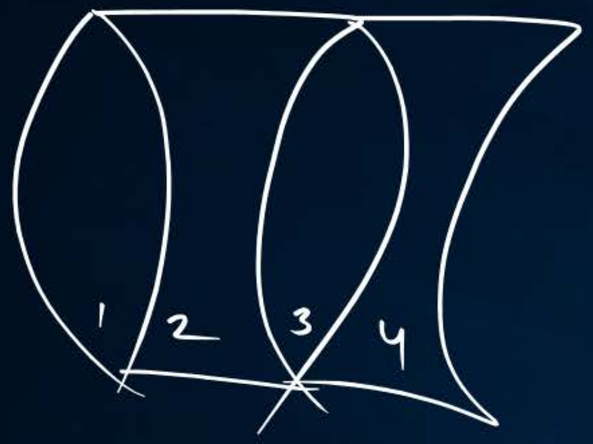
Motta $f\downarrow$



$P\uparrow$ $f\downarrow$ Motta

* Combination of lenses

Q



find i) P_{net}

ii) f_{net}

iii) Nature of this Combination

= Converging (convex)

Sol i) $P_{net} = P_1 + P_2 + P_3 + P_4$

$= +3 - 1.5 + 2 - 2.5$

$= +5 - 4$

$P_{net} = +1D$

Convex: $P_1 = +3D$

Concave: $P_2 = -1.5D$

$P_3 = +2D$

$P_4 = -2.5D$

ii) $P_{net} = \frac{100}{f_{net}(cm)}$

$+1 = \frac{100}{f_{net}}$

$f_{net} = 100\ cm = 1m$

Numerical

1. Ray diagrams X3
2. Formulae
3. Sign convention

Formulae for lenses

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$m = \frac{v}{u}$$

$$m = \frac{h_i}{h_o}$$

Weapons

$0 < m < 1$: Diminished

$m = 1$: Same size

$m > 1$: Enlarged

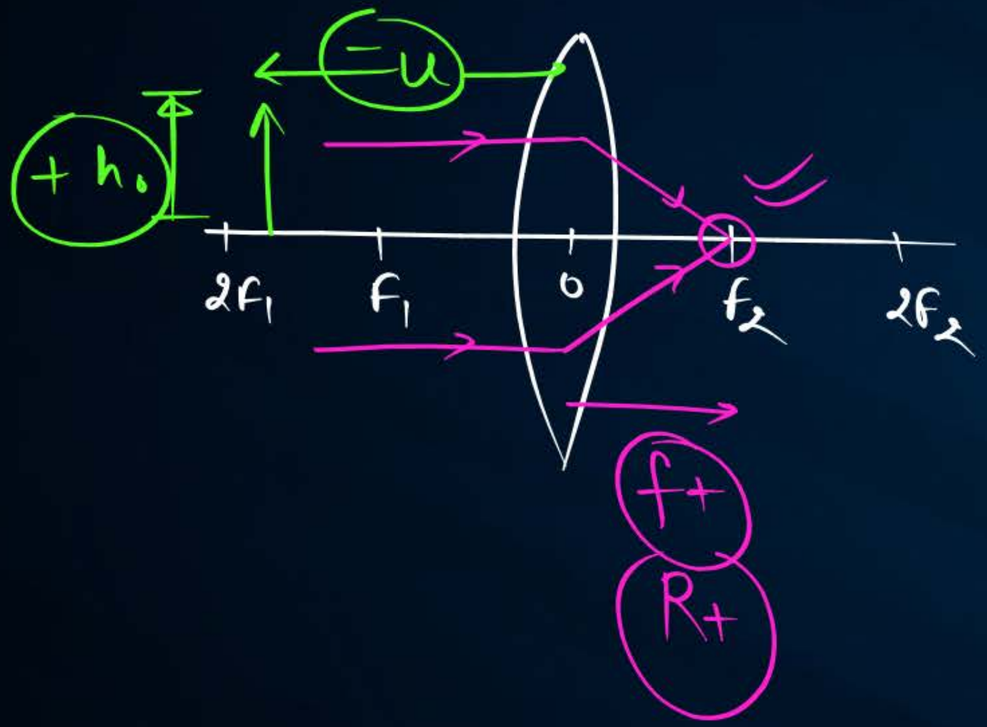
$m \begin{cases} + \\ - \end{cases}$: Virtual + Erect

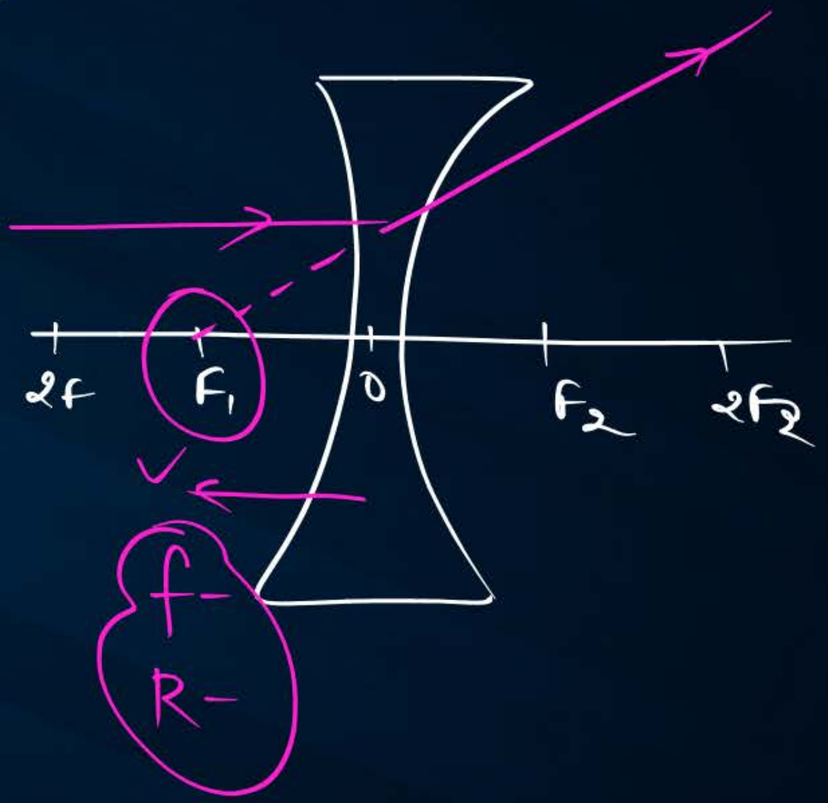
: Real + inverted

Sign Convention

$h_o \rightarrow +ve$

$u \rightarrow -ve$





NCERT IN ONE SHOT

REFRACTION

Page No. 176 (Q. 01)

Tedhi/Tirchi

A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal? Why?

Due to law of Refraction

Page No. 176 (Q. 02)

Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass? The speed of light in vacuum is 3×10^8 m s^{-1}.

$$\eta = \frac{c}{v}$$

$$1.5 = \frac{3 \times 10^8}{v}$$

$$v = \frac{3 \times 10^8}{1.5} \text{ m/s}$$

Page No. 176 (Q. 03)

Find out, from Table 10.3, the medium having highest optical density. Also find the medium with lowest optical density.

Diamond (2.42)

Vacuum (n = 1)

Page No. 176 (Q.04)

H.W.

You are given kerosene, turpentine and water. In which of these does the light travel fastest? Use the information given in Table 10.3.

$$n = \frac{c}{v}$$ (c → constant)

$$n \downarrow \propto \frac{1}{v \uparrow}$$

Page No. 176 (Q.05)

in Notes

The refractive index of diamond is 2.42. What is the meaning of this statement?

Page No. 184 (Q. 01)

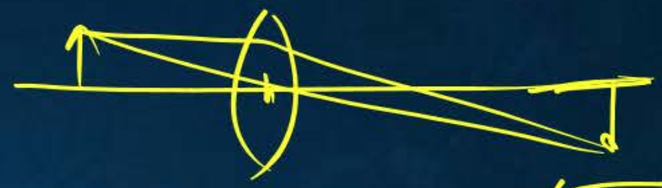
Define 1 dioptre of power of a lens.

$$\text{Power} = \frac{1}{\text{focal length (m)}}$$

1D of Power of a lens is defined as when the focal length of the lens is 1 m.

$$P = \frac{1}{1} = 1\text{D}$$

Page No. 184 (Q. 02)



A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal to the size of the object? Also, find the power of the lens.

Given :-

$V = +50\ cm$

$u = ?$

$m = -1$

$m = \frac{V}{u}$

$-1 = \frac{+50}{u}$

$u = -50\ cm$

$\frac{1}{f} = \frac{1}{V} - \frac{1}{u}$

$\frac{1}{f} = \frac{1}{+50} - \left(\frac{1}{-50}\right)$

$\frac{1}{f} = \frac{1}{50} + \frac{1}{50} = \frac{2}{50}$

$\frac{1}{f} = \frac{1}{25}$

$f = 25\ cm$

$P = \frac{100}{f(cm)}$

$= \frac{100}{25} = 4D$

$P = +4D$

Page No. 184 (Q. 03)

Find the power of a concave lens of focal length 2 m.

$f = -2\,m$

$P = ?$

$P = \frac{1}{f(m)}$

$= \frac{1}{-2}$

$P = -0.5\,D$

Page No. 185 (Ex. 01)

Which one of the following materials cannot be used to make a lens?

A Water

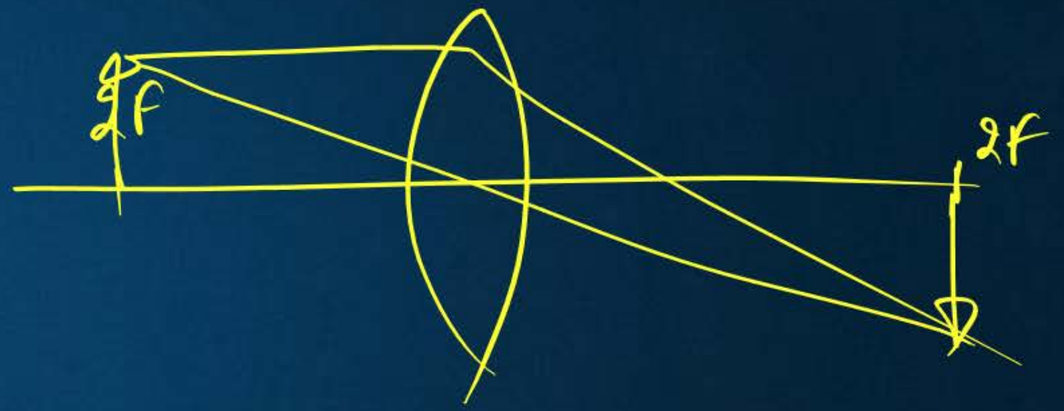
B Glass

C Plastic

D Clay

Page No. 185 (Ex. 03)

Where should an object be placed in front of a convex lens to get a real image of the size of the object?



A. At the principal focus of the lens

B. At twice the focal length

C. At infinity

D. Between the optical centre of the lens and its principal focus.

Page No. 185 (Ex. 02)

A spherical mirror and a thin spherical lens have each a focal length of –15 cm. The mirror and the lens are likely to be

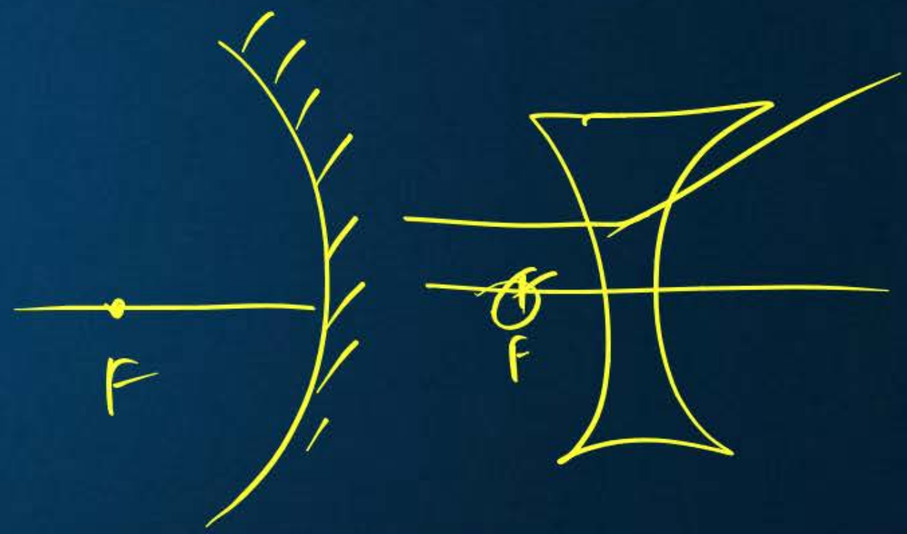
(A) Both concave.

(B) both convex.

(C) the mirror is concave and the lens is convex.

(D) the mirror is convex, but the lens is concave.

Concave lens / mirror



Page No. 186 (Ex. 06)

Which of the following lenses would you prefer to use while reading small letters found in a dictionary?

A. A convex lens of focal length 50 cm.

B. A concave lens of focal length 50 cm.

C. A convex lens of focal length 5 cm.

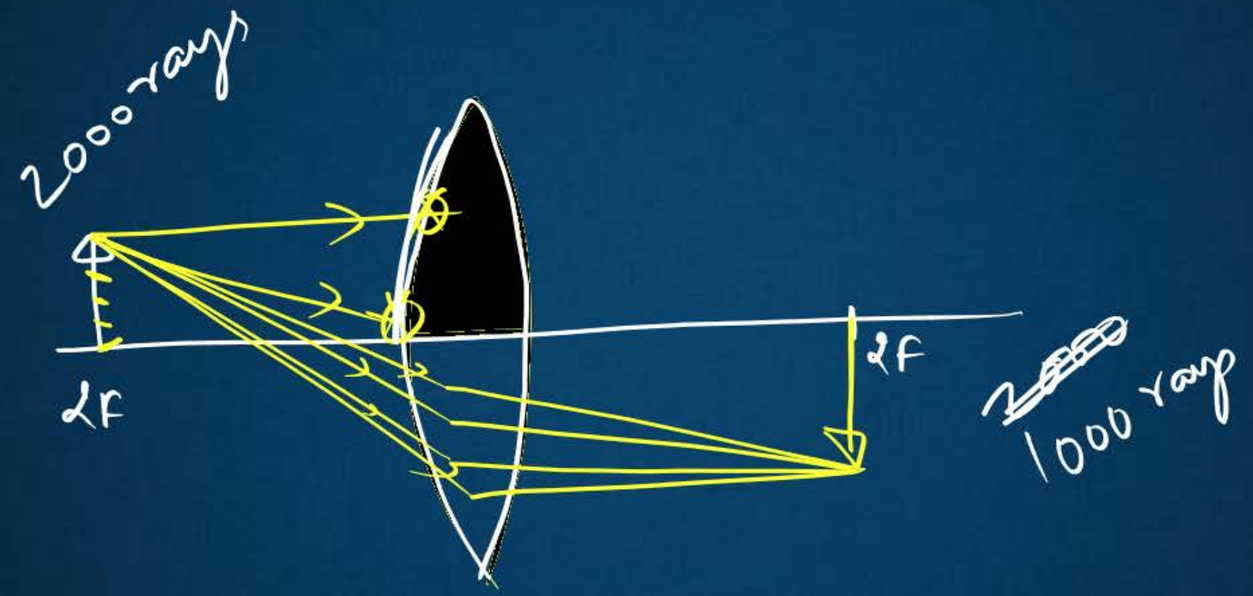
D. A concave lens of focal length 5 cm.

$P \uparrow = \frac{1}{f \downarrow}$

Page No. 186 (Ex. 09)

Mashoor

One-half of a convex lex is covered with a black paper. Will this lens produce a complete image of the object? Verify your answer experimentally. Explain your observations.

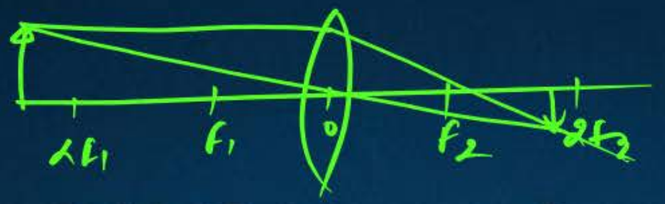


i) Banegi
~~Na~~/Na

ii) Poori Banegi
~~Full~~/half

iii) Toh asar Kya Padega ??
Intensity will be half

Page No. 186 (Ex. 10)



Convex

An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm. Draw the ray diagram and find the position, size and the nature of the image formed.

Given :-

$h_o = 5\ cm$

$u = -25\ cm$

$f = +10\ cm$

To find :-

$V = ?$

$m = ?$

$h_i = ?$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{10} = \frac{1}{v} - \left(\frac{1}{-25}\right)$$

$$\frac{1}{10} = \frac{1}{v} + \frac{1}{25}$$

$$\frac{1}{10} - \frac{1}{25} = \frac{1}{v}$$

$$\frac{5-2}{50} = \frac{1}{v}$$

$$\frac{3}{50} = \frac{1}{v}$$

$$\boxed{v = \frac{50}{3}\ cm}$$

$$m = \frac{v}{u}$$

$$= \frac{50}{3(-25)} = -\frac{2}{3}$$

$$m = -\frac{2}{3}$$

R + I

Diminished

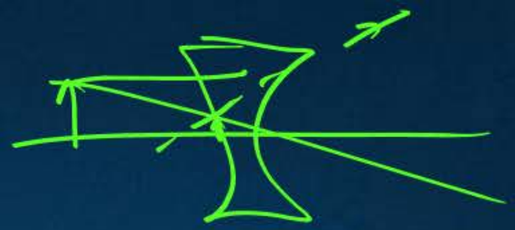
$$m = \frac{h_i}{h_o}$$

$$\frac{-2}{3} = \frac{h_i}{5}$$

$$\boxed{h_i = -\frac{10}{3}\ cm}$$

Page No. 186 (Ex. 11)

H.W.



A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens? Draw the ray diagram.

$f = -15\,cm$

$V = -10\,cm$

$u = ?$

Page No. 186 (Ex. 16)

Find the focal length of a lens of power – 2.0 D. What type of lens is this?

$P = -2\,D$

$f = ?$

$P = \frac{100}{f(cm)}$

$-2 = \frac{100}{f}$

$f = \frac{100}{-2} = -50\,cm$

Name : 'Concave'

Type : Diverging

Page No. 186 (Ex. 17)

A doctor has prescribed a corrective lens of power +1.5 D. Find the focal length of the lens. Is the prescribed lens diverging or converging?

Convex (converging)

$P = +1.5\ D$

$f = ?$

$$P = \frac{100}{f(cm)}$$

$$1.5 = \frac{100}{f}$$

$$f = \frac{100}{1.5} \times 200$$

$$f = \frac{200}{3}\ cm$$

HOMEWORK

- Practice x3 All Diag
- DPP Ques —
- NCERT Repeat !!!
- Refresher / QCB / Online PYQ

Thank You

Light : Reflection and Refraction

- Light is the form of energy that provides sensation of vision.

Laws of Reflection

1) Angle of incidence is equal to the angle of reflection.
2) The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane.

Characteristics of Image formed by Plane mirror

1) Virtual and erect
2) Size of image is equal to size of object.
3) Distance of object from mirror = Distance of image from mirror.
4) Laterally inverted

Spherical Mirrors

- Mirror whose reflecting surface is curved.
- There are two types of spherical mirrors :

Concave mirror :- Reflecting surface is curved inwards.
Convex mirror :- Reflecting surface is curved outwards.

Concave mirror Convex mirror

Common terms for Spherical mirrors

Principal axis : The line joining the pole and centre of curvature.

Pole : The centre of the spherical mirror.

Apperture : It is the effective diameter of the spherical mirror.

Centre of Curvature : The centre of the hollow glass sphere of which the mirror was a part.

Radius of Curvature : The distance between the pole and the centre of curvature.

Focus : The point on the principal axis where all the parallel light rays actually meet or appear to meet or after reflection.

Relationship between focal length and radius of curvature :

$$f = \frac{R}{2}$$

Rules for making ray diagrams by spherical mirror :

1. A ray parallel to the principal axis, after reflection, will pass through the principal focus in case of a concave mirror or appear to diverge from the principal focus in case of convex mirror.
2. A ray passing through the principal focus of a concave mirror or ray which is directed towards the principal focus of a convex mirror, after reflection will emerge parallel to the principal axis.
3. A ray passing through the centre of curvature of a concave mirror or directed in the direction of the centre of curvature of a convex mirror, after reflection, is reflected back along the same path.

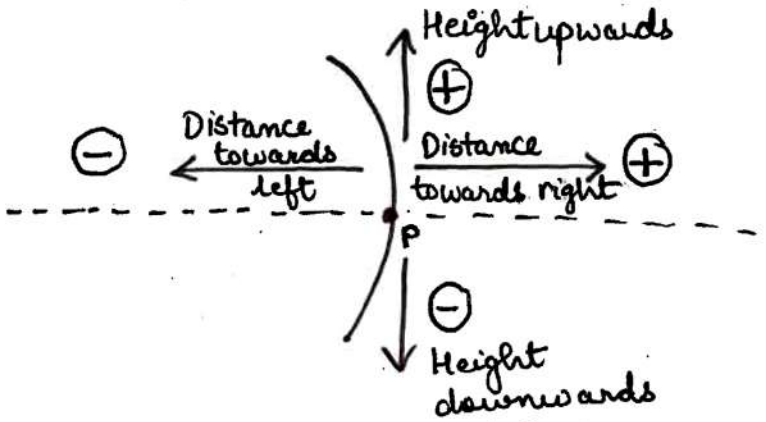
Image formation by concave mirror:

	Object Position	Image Position	Nature & Size of Image
1	At infinity	At 'F'	Real, inverted, point sized
2	Beyond C	Between 'F' & 'C'	Real, Inverted, diminished
3	At C	At 'C'	Real, inverted, same size
4	Between C & F	Beyond 'C'	Real, inverted, enlarged
5	At F	At Infinity	Real, Inverted, highly enlarged
6	Between P & F	Behind the mirror	Virtual, erect and enlarged

Image formation by convex mirror

Object distance	Image distance	Nature & Size of Image
At infinity	At 'F'	Virtual, erect & point sized
Between Pole and infinity	Between 'P' and 'F'	Virtual, erect & diminished

Sign convention for mirrors



Mirror formula and magnification

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$f \rightarrow$ focal length
$v \rightarrow$ image distance
$u \rightarrow$ object distance

$$m = \frac{h_I}{h_O} = -\frac{v}{u}$$

$h_I \rightarrow$ height of image
$h_O \rightarrow$ height of object

Refraction of light

Refraction is bending of light when it enters obliquely from one transparent medium to the other.

Laws of Refraction

① The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

② Snell's law: The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for a light of given colour and for a given pair of media.

Refractive index

The ratio of speed of light in given pair of media.

$$n_{21} = \frac{v_1}{v_2} \quad \text{and} \quad n_{12} = \frac{v_2}{v_1}$$

n_{21}: Refractive index of medium '2' wrt '1'

n_{12}: Refractive index of medium '1' wrt '2'.

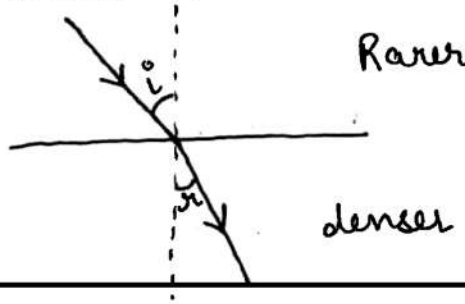
Absolute refractive index

Refractive index of a medium with respect to vacuum or air.

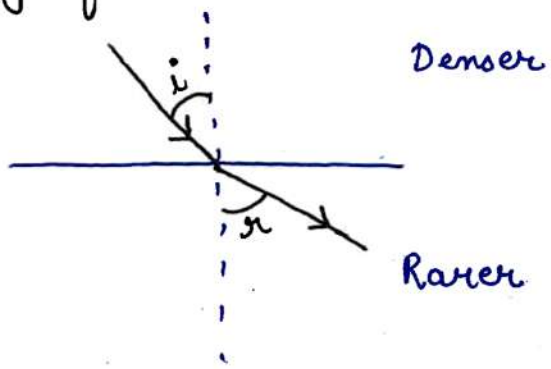
$$\boxed{n = \frac{c}{v}}$$

$c \rightarrow 3 \times 10^8$ m/s

- When light enters obliquely from a rarer to a denser medium, it bends towards the normal.



- When light enters obliquely from denser to rarer medium it bends away from the normal.



Spherical lens

A transparent medium bound by two surfaces, of which one or both surfaces are curved.

convex lens concave lens

Rules for image formation by convex lens

1. A ray of light parallel to the principal axis of a convex lens always pass through the focus on the other side of the lens.
2. A ray of light passing through the principal focus will emerge parallel to the principal axis after refraction
3. A ray of light passing through the optical centre will emerge without any deviation.

Rules for image formation by concave lens

1. A ray of light parallel to the principal axis appear to diverge from the principal focus located on the same side of the lens.
2. A ray of light appearing to meet at the principal focus of a concave lens will emerge parallel to the principal axis.

③ A ray of light passing through the optical centre of a lens will emerge without any deviation.

Image formation by convex lens

Object distance	Image distance	Nature and Size of Image
1) At infinity	at F_2	Real, inverted, point sized
2) Beyond $2F_1$	Between F_2 & $2F_2$	Real, inverted, diminished
3) At $2F_1$	at $2F_2$	Real, inverted, same size
4) Between F_1 & $2F_1$	Beyond $2F_2$	Real, inverted, enlarged
5) At F_1	Infinity	Real, Inverted, highly enlarged
6) Between 'F_1' and Optical centre	On the same side of the lens	Virtual, erect enlarged

Image formation by concave lens

Object position	Image position	Nature and size of image
① At infinity	At 'F_1'	Virtual, erect, point sized
② Between infinity and optical centre	Between 'F' and 'O'	Virtual erect, diminished

Lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$m = \frac{h_I}{h_O} = \frac{v}{u}$$

Power of a lens

It is defined as the reciprocal of focal length in meter.

$$P = \frac{1}{f(m)} \quad \text{or} \quad P = \frac{100}{f(cm)}$$

S.I Unit of Power → Dioptre (D)

Power of concave lens → negative

Power of convex lens → positive