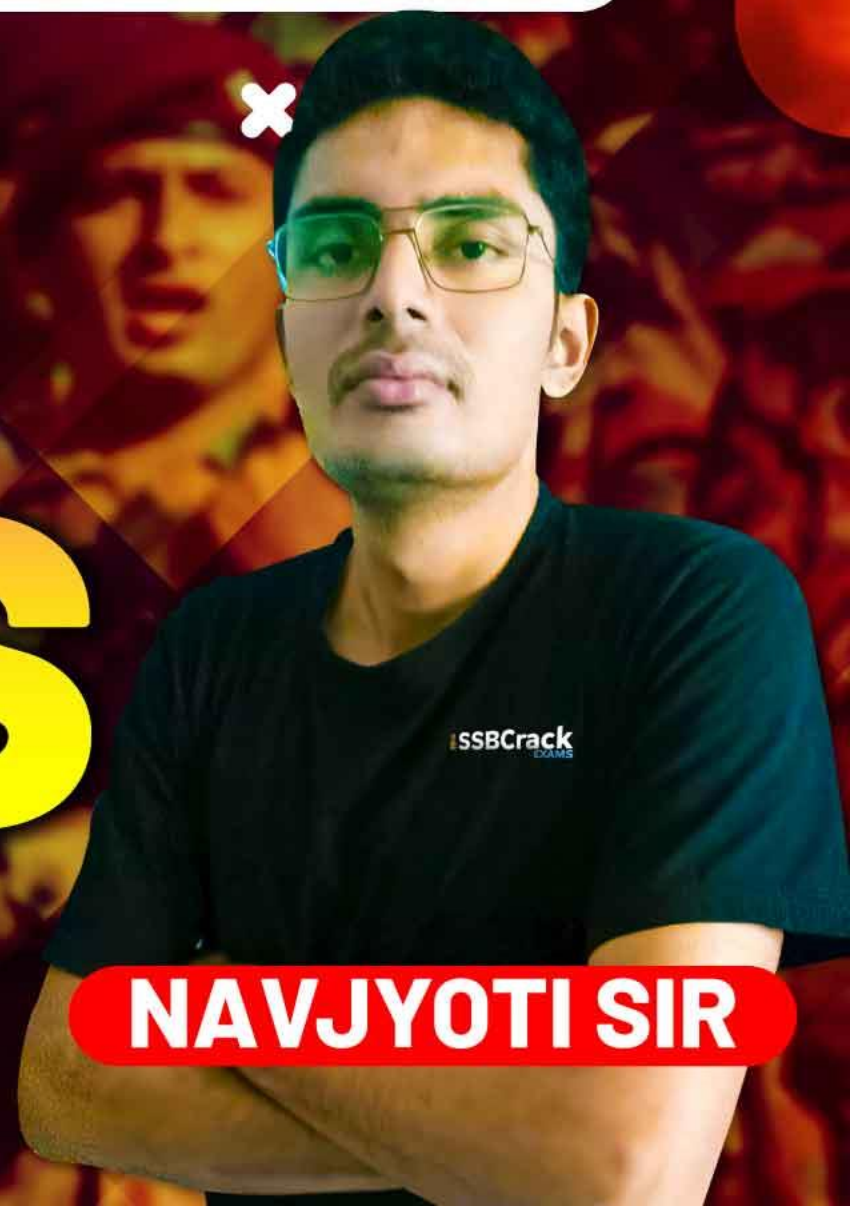
NDA-CDS 2 2024

GS

LIVE

PHYSICS

CLASS 3



NAVJYOTI SIR

SSBCrack EXAMS

03 July 2024 Live Classes Schedule

8:00AM	03 JULY 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	03 JULY 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:00AM	OVERVIEW OF OIR & PRACTICE	ANURADHA MA'AM

NDA 2 2024 LIVE CLASSES

11:30AM	GK - MODERN HISTORY - CLASS 5	RUBY MA'AM
1:00PM	GS - PHYSICS - CLASS 3	NAVJYOTI SIR
2:30PM	GS - CHEMISTRY MCQS - CLASS 8	SHIVANGI MA'AM
4:00PM	MATHS - DIFFERENTIAL EQUATIONS - CLASS 1	NAVJYOTI SIR
5:30PM	ENGLISH - PARTS OF SPEECH - CLASS 1	ANURADHA MA'AM

CDS 2 2024 LIVE CLASSES

11:30AM	GK - MODERN HISTORY - CLASS 5	RUBY MA'AM
1:00PM	GS - PHYSICS - CLASS 3	NAVJYOTI SIR
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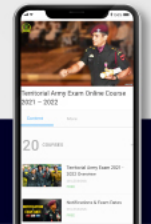
5:30PM	ENGLISH - PARTS OF SPEECH - CLASS 1	ANURADHA MA'AM



LIGHT - REFRACTION

WHAT WILL WE STUDY ?

- Refraction And Laws
- Refractive Index
- Lenses – Convex And Concave Lens
- Image Formation By Lenses
- Power
- Total Internal Reflection And Applications
- Refraction In Nature

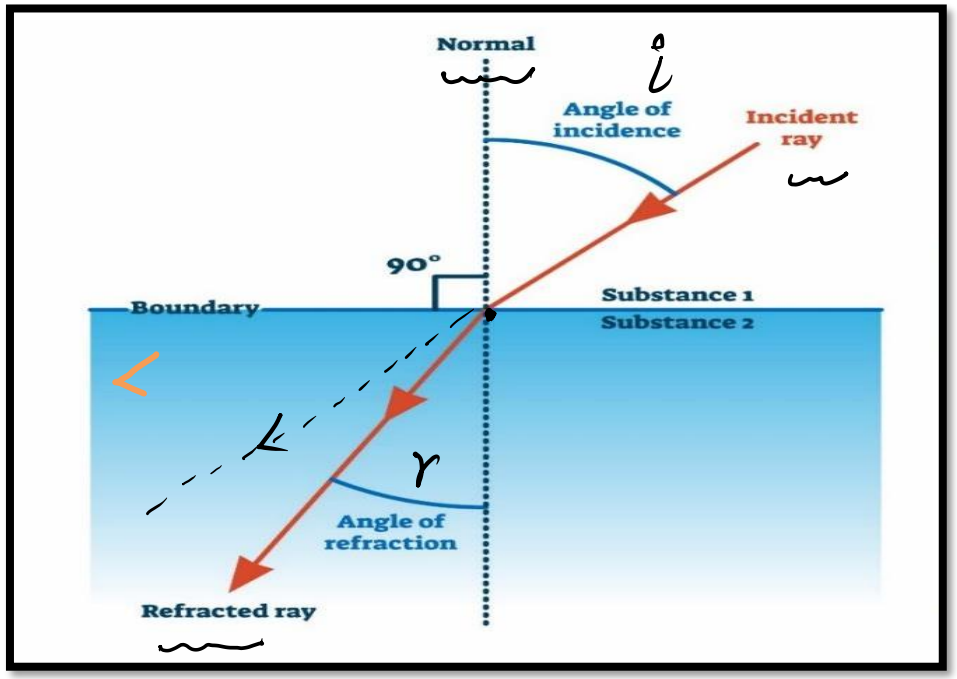
Refraction

- **Bending of a light ray due to change in speed of light.**
- **It happens between two mediums / media.**

LAWS OF REFRACTION

1. The Incident Ray, The Refracted Ray And The Normal At The Incident Point All Lie In The Same Plane.

2. Snell's Law : The Ratio Of The Sine Of The Angle Of Incidence To The Sine Of The Angle Of Refraction Is A Constant.



$$\frac{\sin i}{\sin r} = \text{constant (with same Mediums)}$$

Refractive index (μ / n)

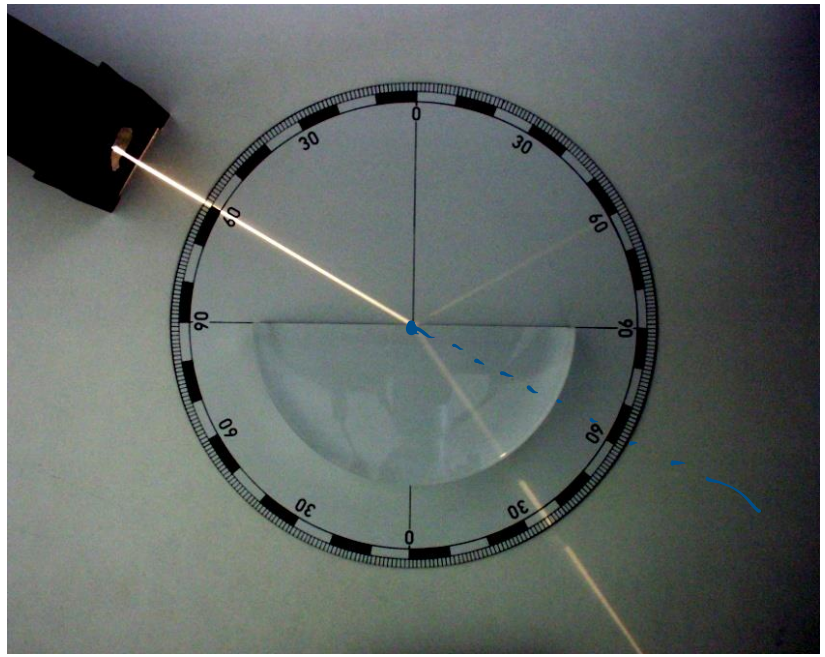
REFRACTIVE INDEX

- **The Ratio Of Speed Of Light In Vacuum (c) To The Speed Of Light In Any Medium**

  (v) Is Called Refractive Index Of The Medium.

$c = 3.0 \times 10^8$ m/s

(speed of light in vacuum/air)



$$\mu_{(\text{medium})} = \frac{\text{speed of light in air/vacuum}}{\text{speed of light in medium}}$$

* If has no units / dimensionless. $\left\{ \mu_{air} = 1 \right.$ $\mu_{water} = \frac{4}{3}$ $\mu_{glass} = \frac{3}{2}$

medium 1 (n_1)

Medium -2 (n_2)

away from normal

($n_2 < n_1$)

n_1 — denser

n_2 — rarer

Normal

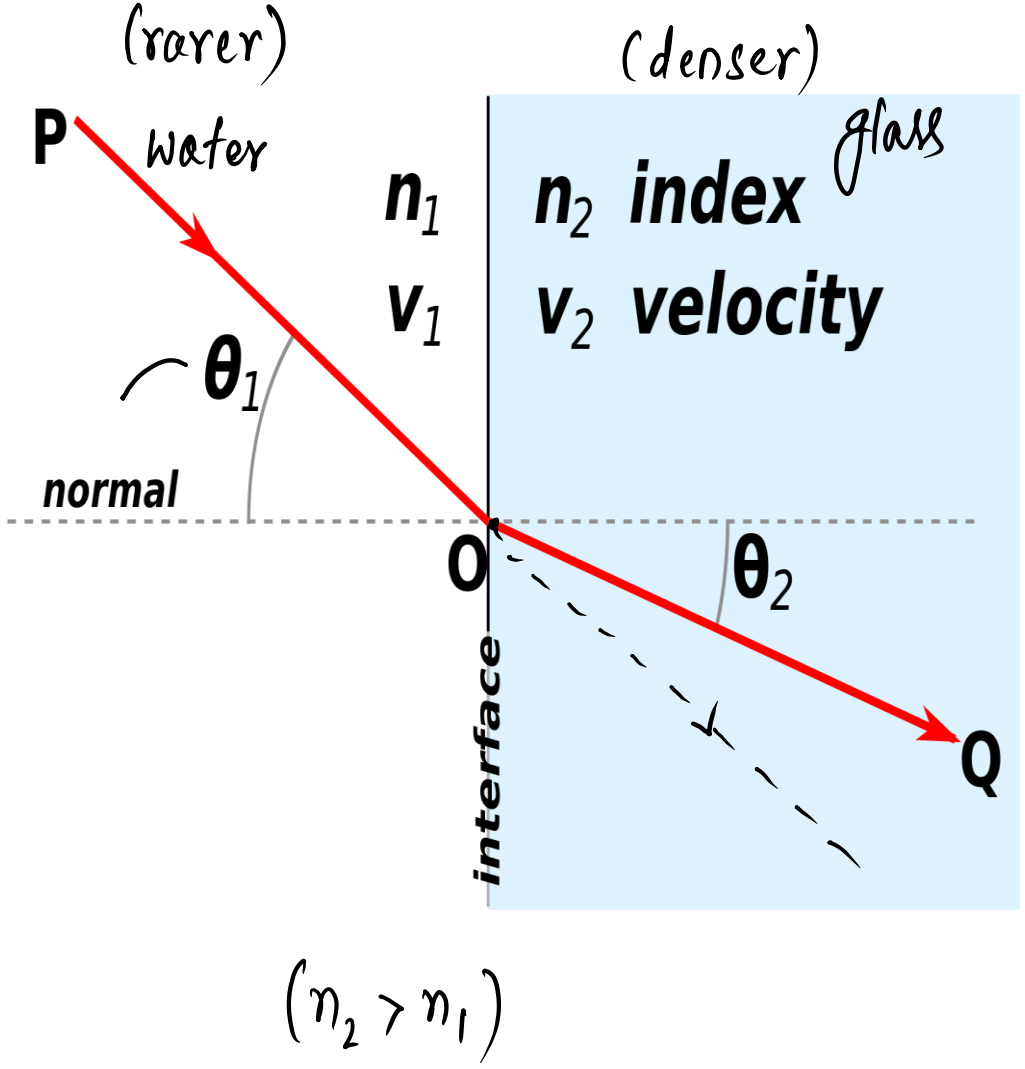
towards the normal

($n_2 > n_1$)

n_2 — denser

n_1 — rarer

Absolute And Relative Refractive Indices



Absolute — w.r.t. air/vacuum.

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

Relative — $\mu_r = \left(\frac{\mu_g}{\mu_w}\right)$ (ratios of absolute) → {Medium going / Medium coming from}

$$= \left(\frac{n_2}{n_1}\right) = n_{21}$$

Snell's law,

$$n_1 \cdot \sin\theta_1 = n_2 \cdot \sin\theta_2 \Rightarrow \frac{\sin\theta_1}{\sin\theta_2} = \mu_r = \frac{n_2}{n_1}$$

LENS

- **A Transparent Material Bound By Two Surfaces, Of Which One Or Both Surfaces Are Spherical, Forms A Lens.**

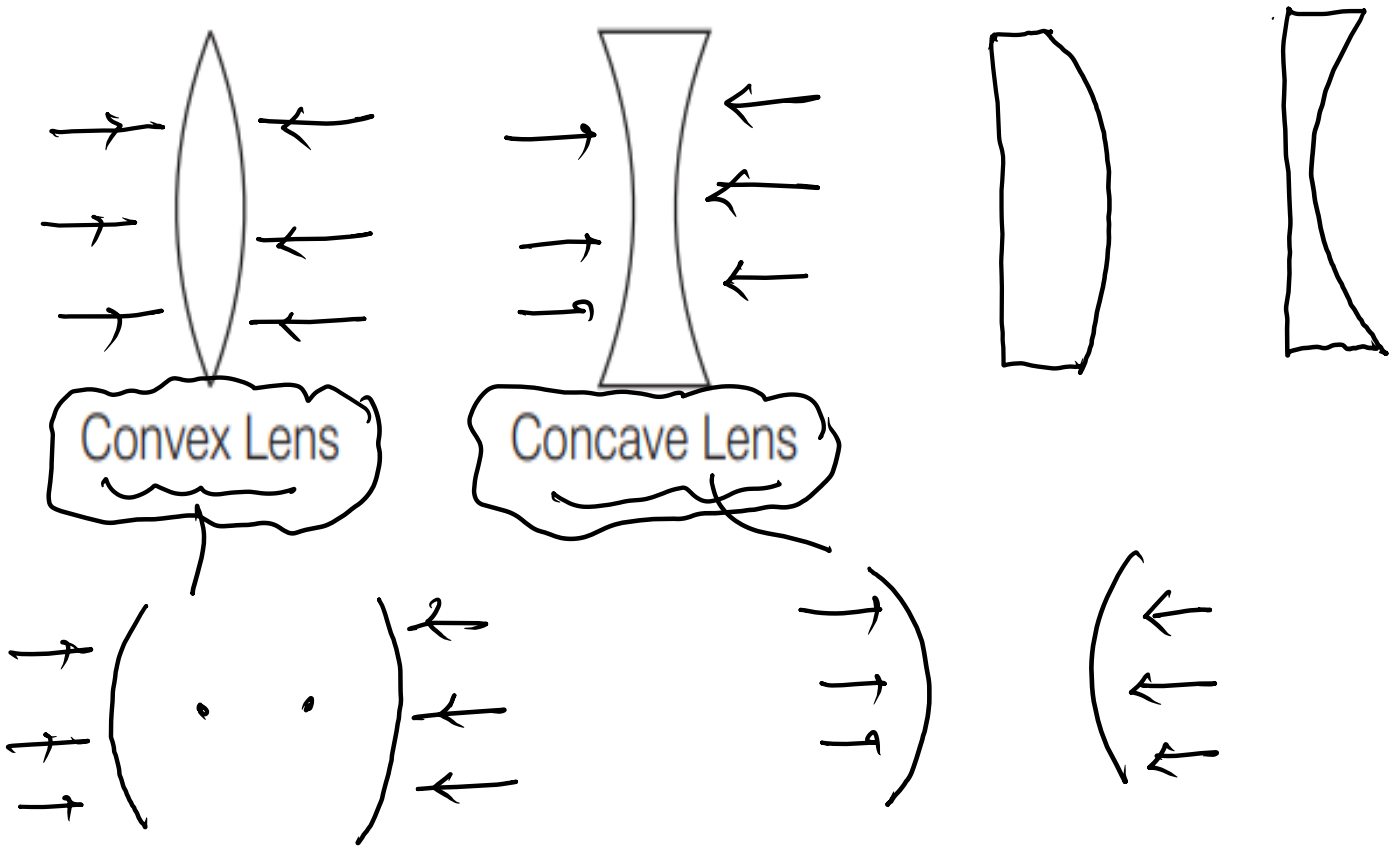
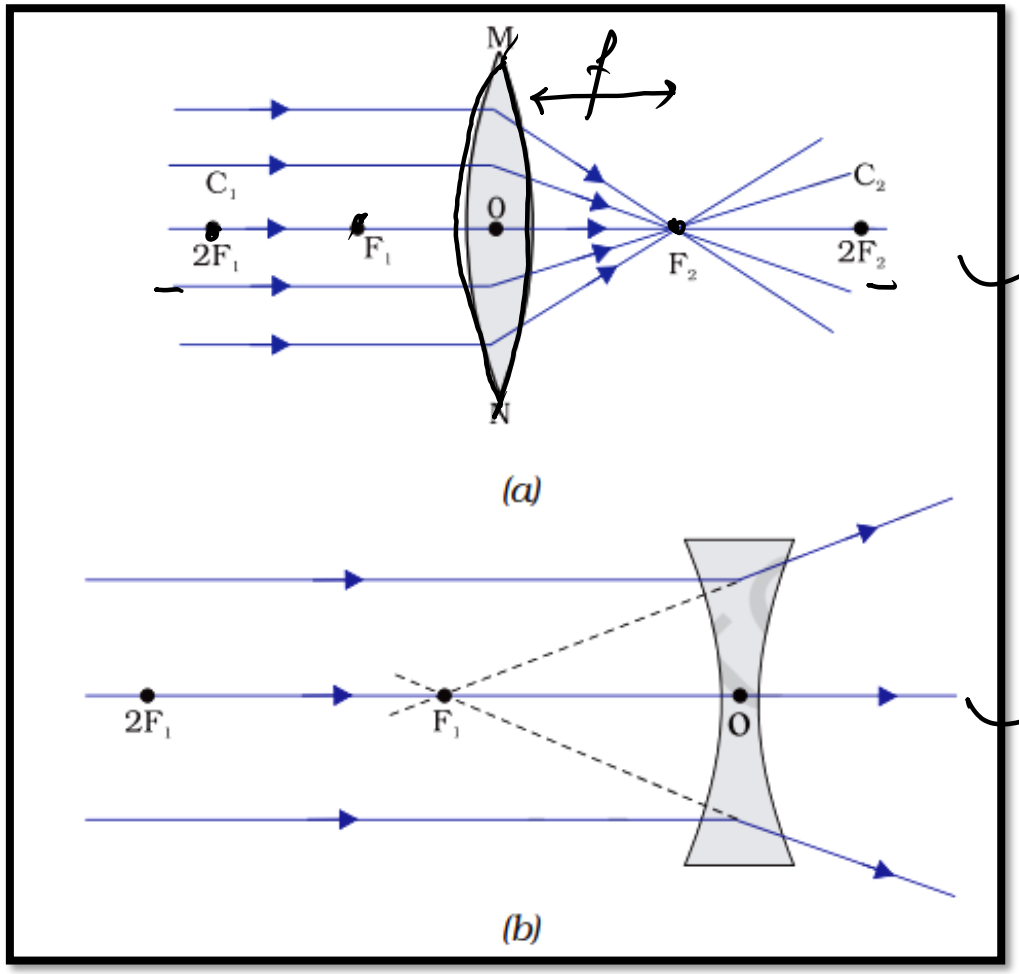


IMAGE FORMED BY CONCAVE AND CONVEX LENS

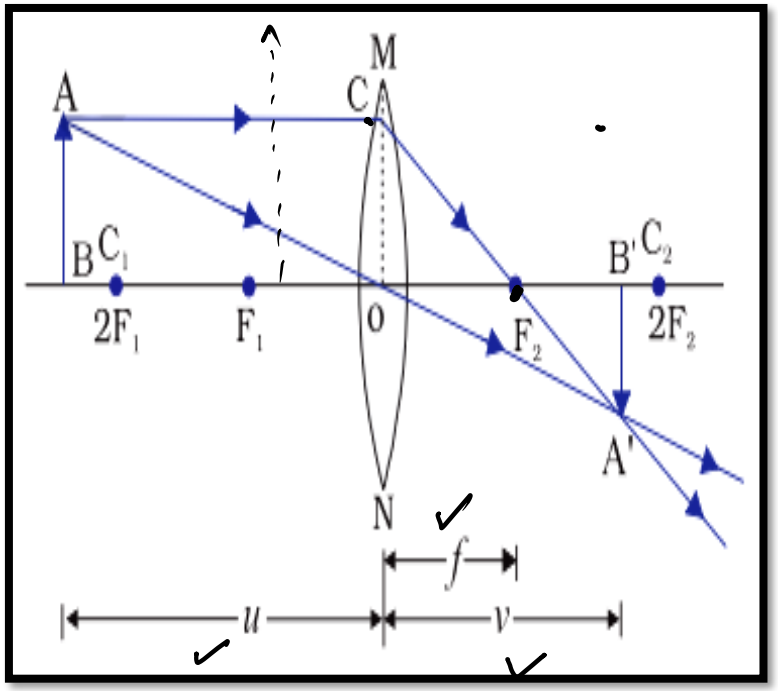


convex lens — f = +ve (acts as concave mirror)

concave lens — f = -ve (acts as convex mirror)

IMAGE FORMED DUE TO DIFFERENT POSITION OF OBJECTS

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_2	Highly-diminished, point-sized	Real and inverted
Beyond $2F_1$	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At Focus F_1	At infinity	Infinitely large or highly enlarged	Real and inverted
Between F_1 and Optical centre O	On the same side of the lens as the object	Enlarged	Virtual and erect

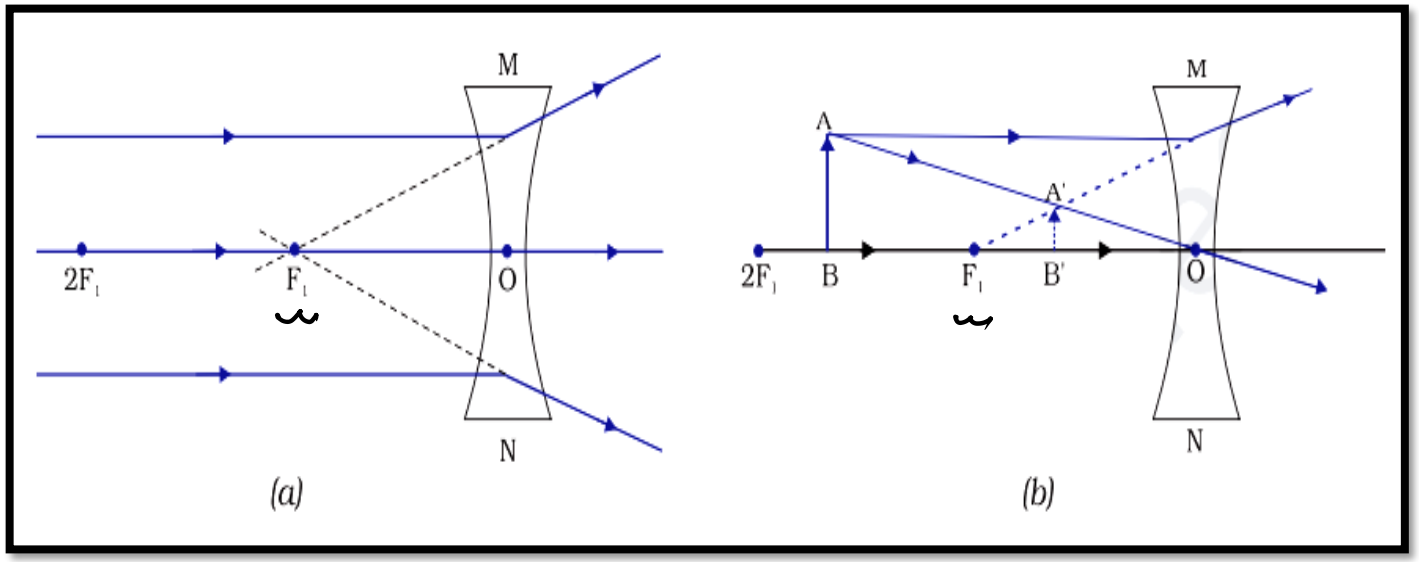


2F1 — C

CONCAVE LENS

(convex mirror)

Position of the Object	Position os the Image	Relative size of the Image	Nature of
At infinity	At focus F_1	Highly-diminished, point, sized	Virtual and erect
Between infinity and Optioal centre O of the lens	Between F_1 and Optioal centre O	Diminished	Virtual and erect



Mirror / Pole (P) ≡ lens / Optical centre (O)

POWER OF LENS

- The Reciprocal Of Focal Length Of Lens In Metres. Its Unit Is Dioptre(D).

$$\text{Power of a lens, } (P) = \frac{1}{f\,(\text{metre})} = \frac{100}{f(\text{in cm})}$$

Convex lens of 25 cm focal length,

$$P = \frac{1}{f(m)} = \frac{1}{\left(\frac{(+25)}{100}\right) m} = \frac{100}{25}\ D$$

$$= +4\ D$$

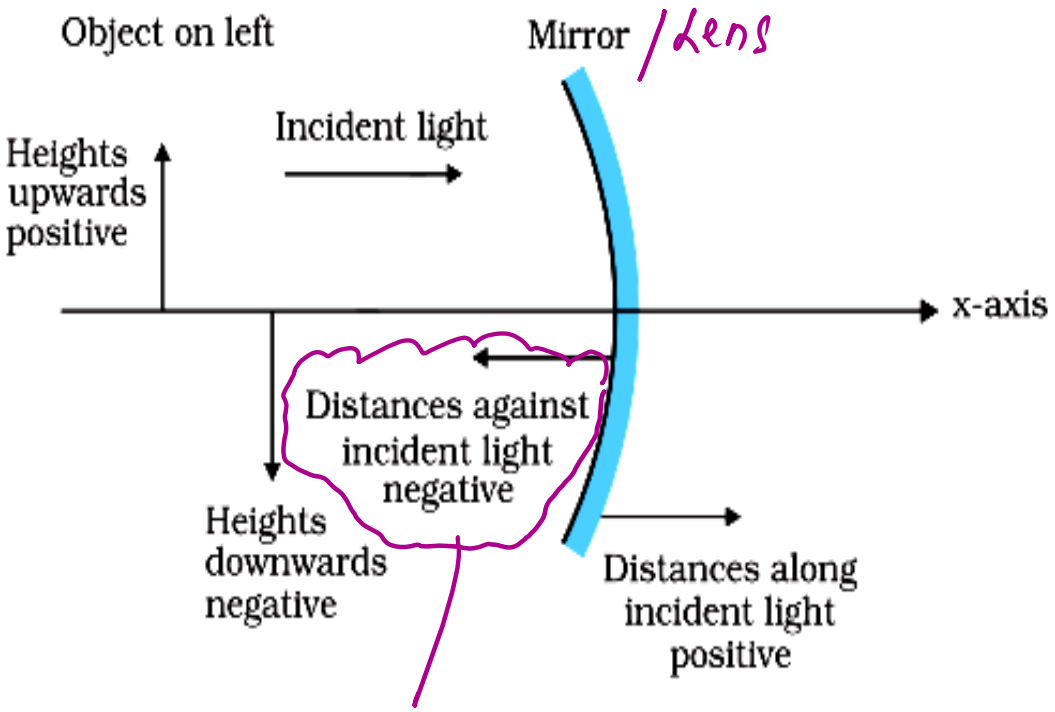
- For a combination of lenses ,

  (a) When in contact , $P = P_1 + P_2$

  (b) When seperated by distance 'd' ,

$$P = P_1 + P_2 - dP_1P_2$$

SIGN CONVENTION FOR LENS



incident light — from object towards lens / mirror.

LENS FORMULA AND MAGNIFICATION

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

Mirror

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

- **Magnification ,**

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

h' → height of image

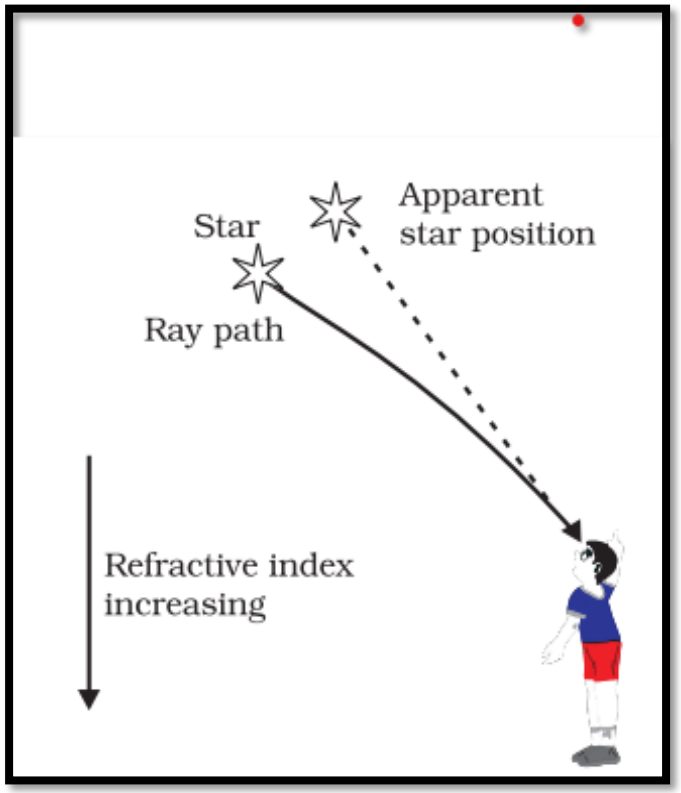
h → height of object

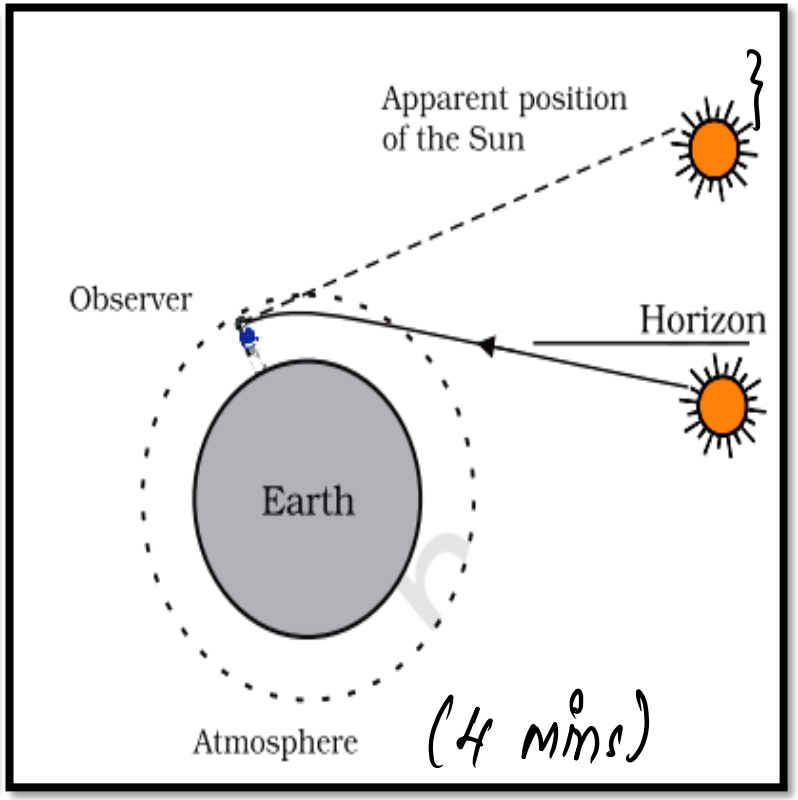
$$m = \frac{h'}{h} = -\frac{v}{u}$$

REFRACTION IN NATURE

- **Twinkling of Stars.**
- **Advanced Sunrise and Delayed Sunset**

} Atmospheric refraction —— Every layer in atmosphere has different refractive index.



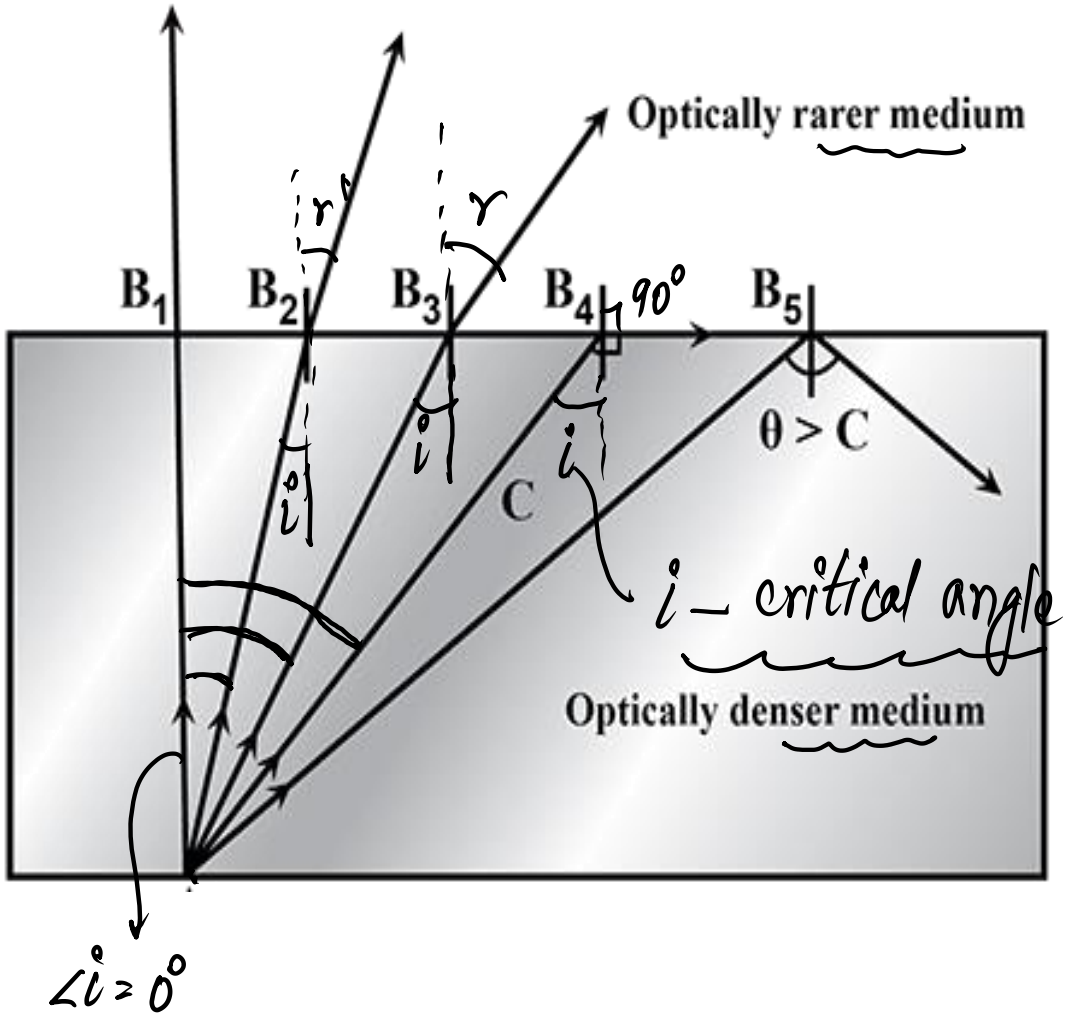


} 2 mins late

} 2 mins early

(4 mins)

TOTAL INTERNAL REFLECTION (TIR)



As i increases, r increases.

$\frac{\sin i}{\sin r}$ ⟶ has to be constant.

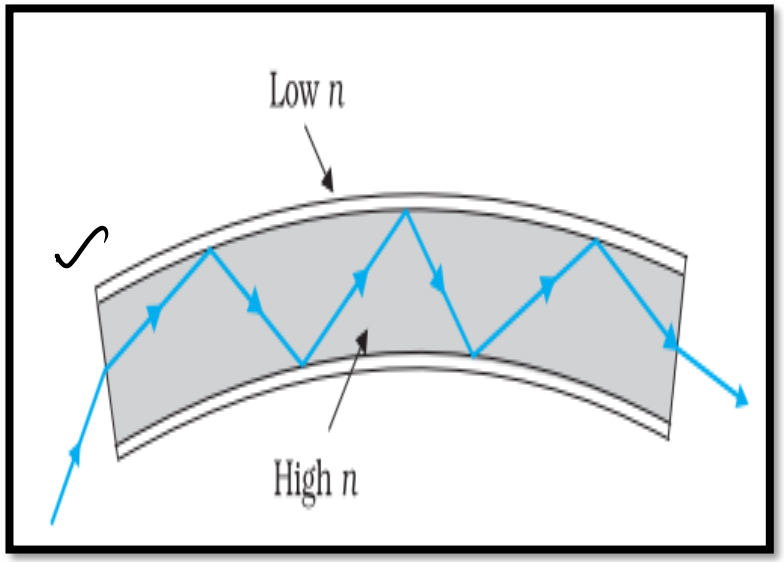
So, $\frac{i}{r}$ " " "

⇒ with $i \uparrow$, $r \uparrow$

$i_c \propto \frac{1}{\mu}$

APPLICATIONS OF TIR

- **Optical Fibres**



Sparkling of Diamond

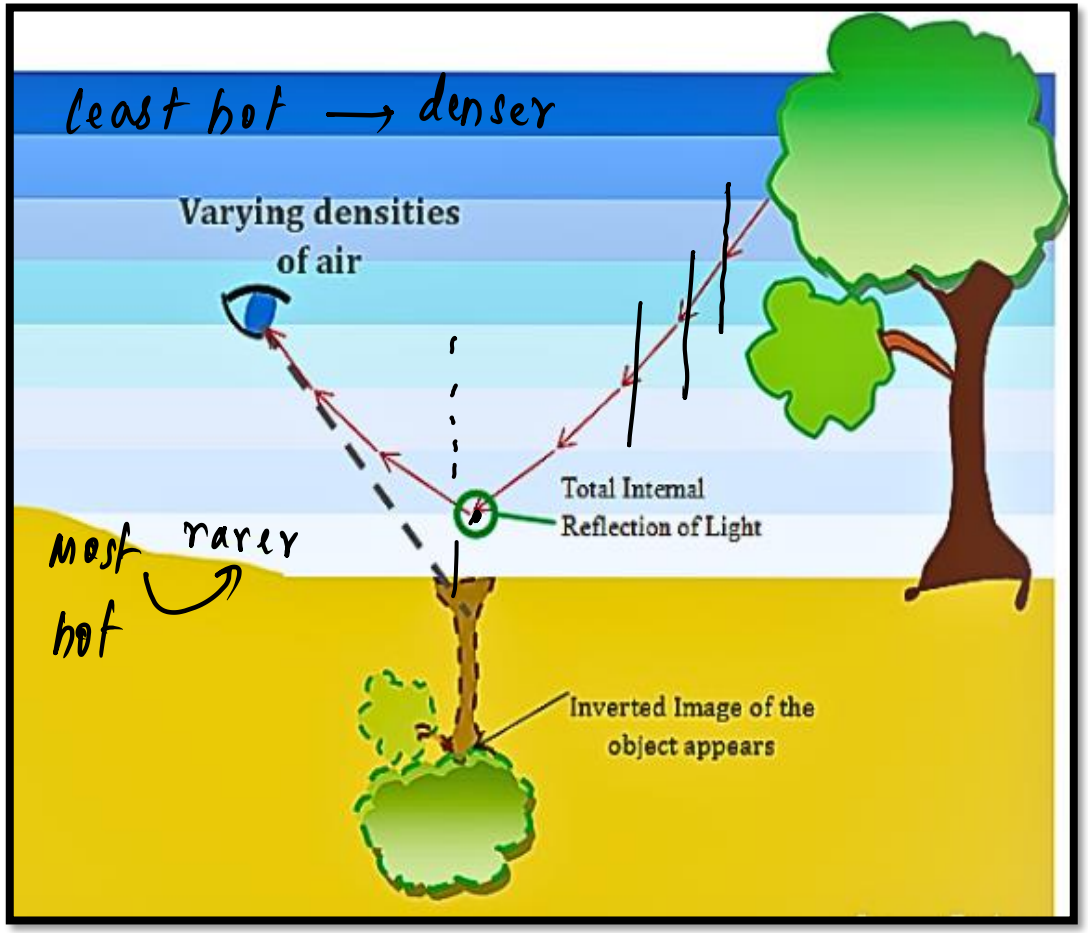
$\mu = 2.42$

$i_c = 24.2^\circ$

APPLICATIONS OF TIR

(Atmospheric refraction + TIR)

- **Mirage**



SUMMARY

- Refraction of Light
- Refractive Index and speed of light in media
- Lenses and Image Formation
- Lens Formula
- Atmospheric Refraction
- Total Internal Reflection

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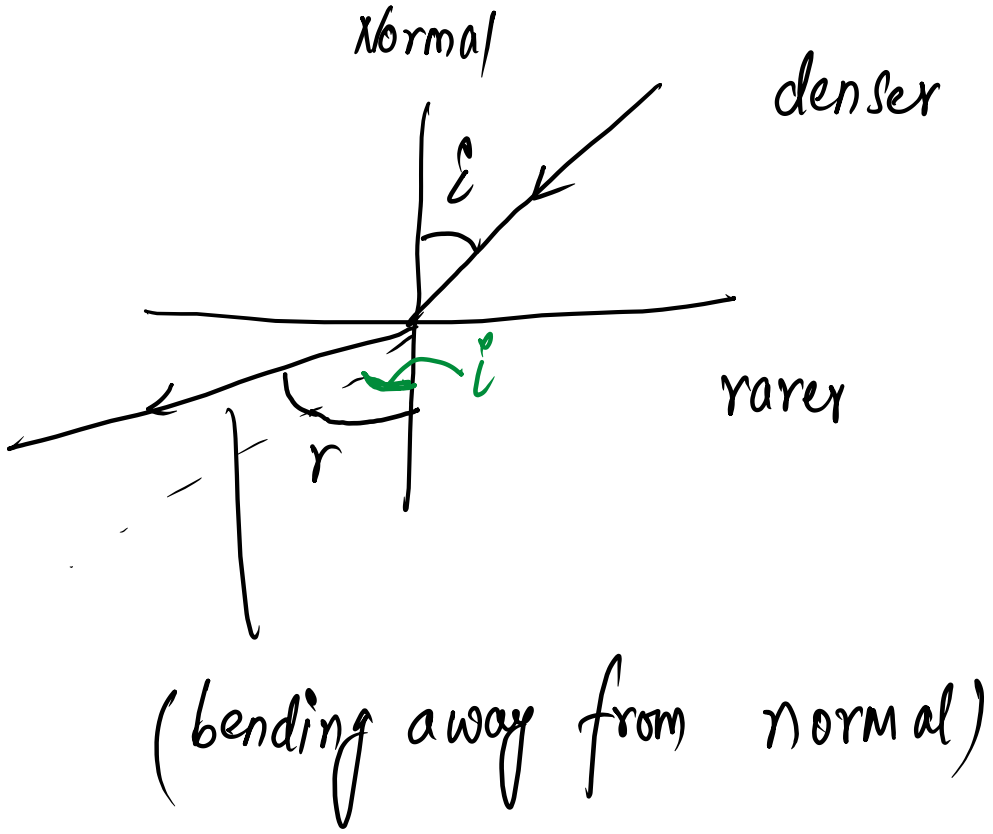
1. **When A Light Ray Passes From A Denser Medium To A Rarer Medium , Which Angle Is Greater ?**

A. Angle Of Incidence

B. Angle Of Refraction

C. Both

D. None Of The Above



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C. Both

D. None Of The Above

2. The Power Of A Lens Is - 4.0 D. Which Lens Is It ?

A. Convex

B. Concave ✓

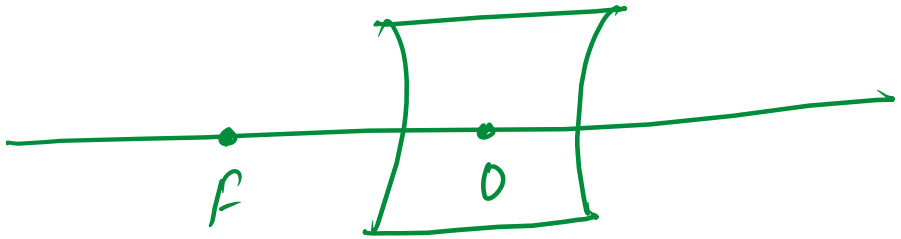
C. Both

D. None Of The Above

power = -ve ⇒ f is negative

↓

Concave lens



2. The Power Of A Lens Is -4.0 D. Which Lens Is It ?

A. Convex

B. Concave

C. Both

D. None Of The Above

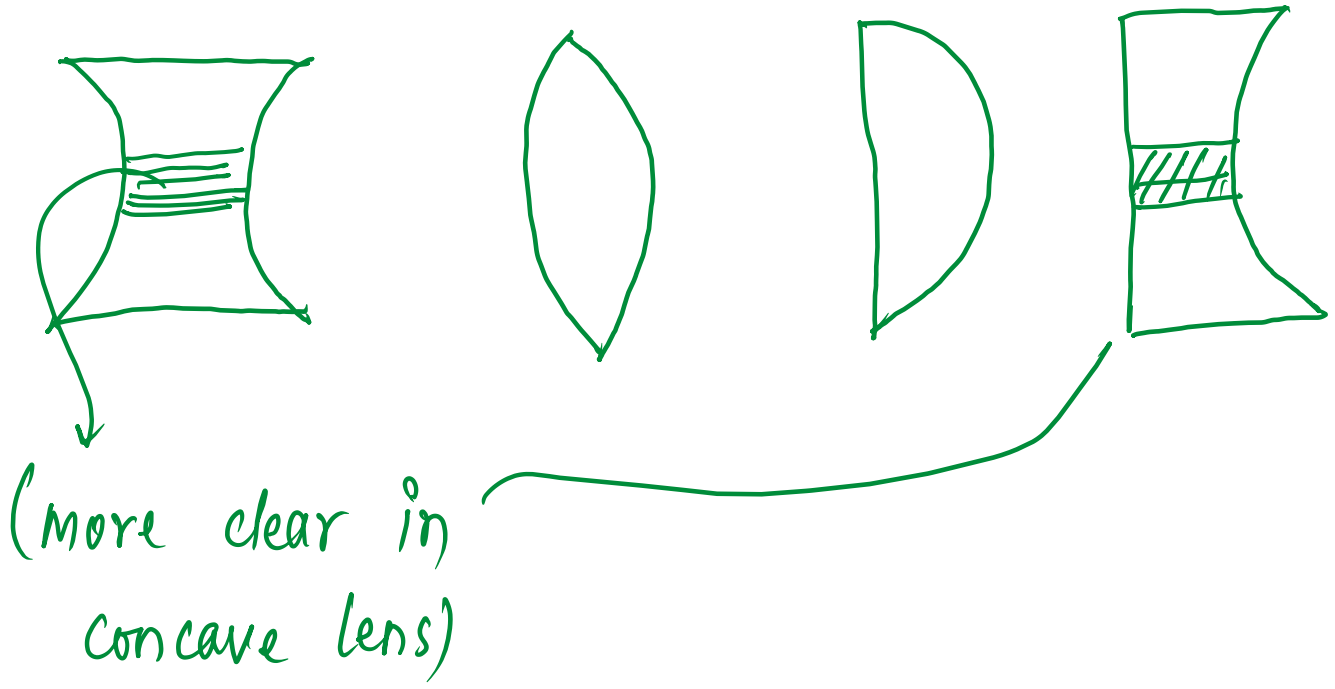
3. A Lens That Is Thinner At The Middle Than Edges Is

A. Concave

B. Convex

C. Plano-concave

D. Plano-convex



3. A Lens That Is Thinner At The Middle Than Edges Is

A. Concave

B. Convex

C. Plano-concave

D. Plano-convex

4. Formula To Find The Refractive Index Of A Medium Is

A. n = Speed Of Light In Medium / Speed Of Light In Air

B. n = 1 / Speed Of Light In Medium

C. n = Speed Of Light In Air / Speed Of Light In Medium

D. n = 1 / Speed Of Light In Air

4. Formula To Find The Refractive Index Of A Medium Is

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B. n = 1 / Speed Of Light In Medium

C. n = Speed Of Light In Air / Speed Of Light In Medium

D. n = 1 / Speed Of Light In Air

5. If A Light Ray Passes From Glass Into Air

A. It Does Not Bend
B. It Bends Away From The Normal
C. It Continues Along The Normal
D. It Bends Towards The Normal

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A. It Does Not Bend

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D. It Bends Towards The Normal

6. What Is The Unit Of Refractive Index ?

A. m/s

B. cm/s

C. No units

D. None of the above

6. What Is The Unit Of Refractive Index ?

A. m/s

B. cm/s

C. No units

D. None of the above

7. The refractive indices of two media are denoted by n_1 and n_2, and the velocities of light in these two media are respectively v_1 and v_2. If n_2/n_1 is 1·5, which one of the following statements is correct?

(a) v_1 is 1·5 times v_2.

(b) v_2 is 1·5 times v_1.

(c) v_1 is equal to v_2.

(d) v_1 is 3 times v_2.

$\mu \propto \frac{1}{v}$

$\frac{n_2}{n_1} = 1.5$ ——

$\{ n_2 = \frac{c}{v_2} \}$ $\{ n_1 = \frac{c}{v_1} \}$

absolute

$\frac{\frac{c}{v_2}}{\frac{c}{v_1}} = \frac{v_1}{v_2} = 1.5 \Rightarrow v_1 = 1.5\, v_2$

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(d) v_1 is 3 times v_2.

ANSWER : (A)

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8. Which one of the following statements about the refractive index of a material medium with respect to air is correct ?

(a) It can be either positive or negative

(b) It can have zero value

(c) It is unity for all materials

(d) It is always greater than one

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(b) It can have zero value

(c) It is unity for all materials

(d) It is always greater than one

ANSWER : (D)

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9. If the focal length of a convex lens is 50 cm, which one of the following is its power?

(a) +2 dioptre

(b) +0·02 dioptre

(c) –0·5 dioptre

(d) +0·5 dioptre

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(b) +0·02 dioptre

(c) –0·5 dioptre

(d) +0·5 dioptre

ANSWER : (A)

10. The Sun is seen little before it rises and for a short while after it sets. This is because of

(a) total internal reflection

(b) atmospheric refraction

(c) apparent shift in the direction of Sun

(d) dispersion

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(a) total internal reflection

(b) atmospheric refraction

(c) apparent shift in the direction of Sun

(d) dispersion

ANSWER : (B)

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11. Which one of the following statements regarding lenses is ***not*** correct ?

(a) A convex lens produces both real and virtual images.

(b) A concave lens produces both real and virtual images.

(c) A convex lens can produce images equal, greater and smaller than the size of the object.

(d) A concave lens always produces images smaller than the size of the object.

NDA & CDS 2 2024 LIVE - PHYSICS - CLASS 3

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ANSWER : (B)

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12. Light rays move in straight lines. But through an optical fibre, they can move in any type of zigzag path because

(a) the holes through the fibre are extremely fine.

(b) light rays are absorbed at the entry end and relieved at the exit end of the fibre.

(c) scattering of light occurs inside the fibre.

(d) successive total internal reflections occur as a ray moves through the fibre.

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(b) light rays are absorbed at the entry end and relieved at the exit end of the fibre.

(c) scattering of light occurs inside the fibre.

(d) successive total internal reflections occur as a ray moves through the fibre.

ANSWER : (D)

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13. A lemon kept in water in a glass tumbler appears to be larger than its actual size. It is because of

(a) reflection of light

(b) scattering of light

(c) refraction of light

(d) polarization of light

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(a) reflection of light

(b) scattering of light

(c) refraction of light

(d) polarization of light

ANSWER : (C)

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14. A lens has a power of +2·0 Dioptre. Which one of the following statements about the lens is true ?

(a) The lens is concave and has a focal length of 0·5 metre

(b) The lens is convex and has a focal length of 2·0 metre

(c) The lens is convex and has a focal length of 0·5 metre

(d) The lens is concave and has a focal length of 2·0 metre

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(d) The lens is concave and has a focal length of 2·0 metre

ANSWER : (C)

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15. The refractive index of fused quartz is 1·46 and that of sapphire is 1·77. If v_q is the speed of light in quartz and v_s is the speed of light in sapphire, then which one of the following relations is correct ?

(a) $v_q > v_s$

(b) $v_s > v_q$

(c) $v_s = v_q$

(d) $v_s = \frac{v_q}{2}$

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(b) $v_s > v_q$

(c) $v_s = v_q$

(d) $v_s = \frac{v_q}{2}$

ANSWER : (A)

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16. Twinkling of stars is due to

(a) particular frequencies of the starlight.

(b) reflection of starlight from the oceanic surface.

(c) atmospheric refraction of starlight.

(d) magnetic field of Earth.

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16. Twinkling of stars is due to

(a) particular frequencies of the starlight.

(b) reflection of starlight from the oceanic surface.

(c) atmospheric refraction of starlight.

(d) magnetic field of Earth.

ANSWER : (C)

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17. Power of a lens of focal length 25 cm is

(a) +2·5 Dioptre

(b) +3 Dioptre

(c) +4 Dioptre

(d) +5 Dioptre

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17. Power of a lens of focal length 25 cm is

(a) +2·5 Dioptre

(b) +3 Dioptre

(c) +4 Dioptre

(d) +5 Dioptre

ANSWER : (C)

18. When A Ray Of Light Enters From One Medium To Another , Which Of The Following Does Not Change ?

A. Speed

B. Frequency

C. Both

D. None Of The Above

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A. Speed

B. Frequency

C. Both

D. None Of The Above

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

A. Glass

B. Water

C. Clay

D. Plastic

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

A. Glass

B. Water

C. Clay

D. Plastic

20. The Refraction Of Light Is Commonly Known As ?

A. Bending

B. Scattering

C. Reflection

D. Interference

20. The Refraction Of Light Is Commonly Known As ?

A. Bending

B. Scattering

C. Reflection

D. Interference

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21. Mirage is an illustration of

(a) only dispersion of light.

(b) only reflection of light.

(c) only total internal reflection of light.

(d) both refraction and total internal reflection of light.

21. Mirage is an illustration of

(a) only dispersion of light.

(b) only reflection of light.

(c) only total internal reflection of light.

(d) both refraction and total internal reflection of light.

ANSWER : (D)