UDAAN

2025

LIGHT

- Reflection & Refraction

PHYSICS | Lecture - 05

By - ER. RAKSHAK SIR

Topics to be covered

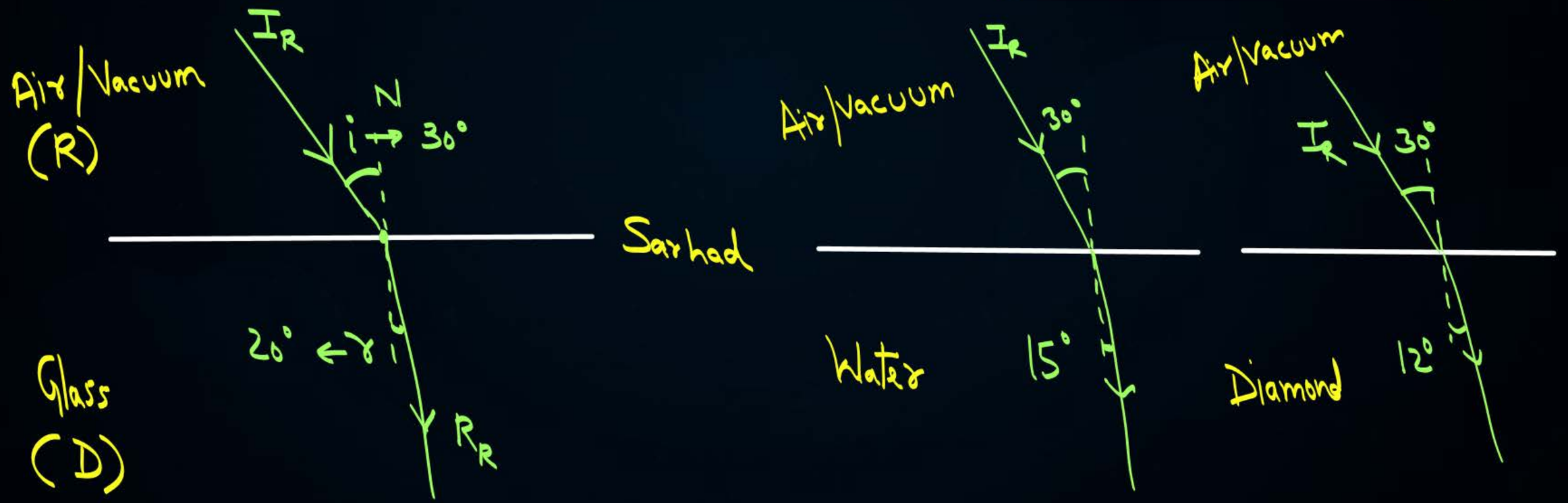
1. Power of the Lens
2. Combination of Lenses
3. Questions on Power of the Lens
4. Refractive Index (Absolute and Relative)

Baad Me

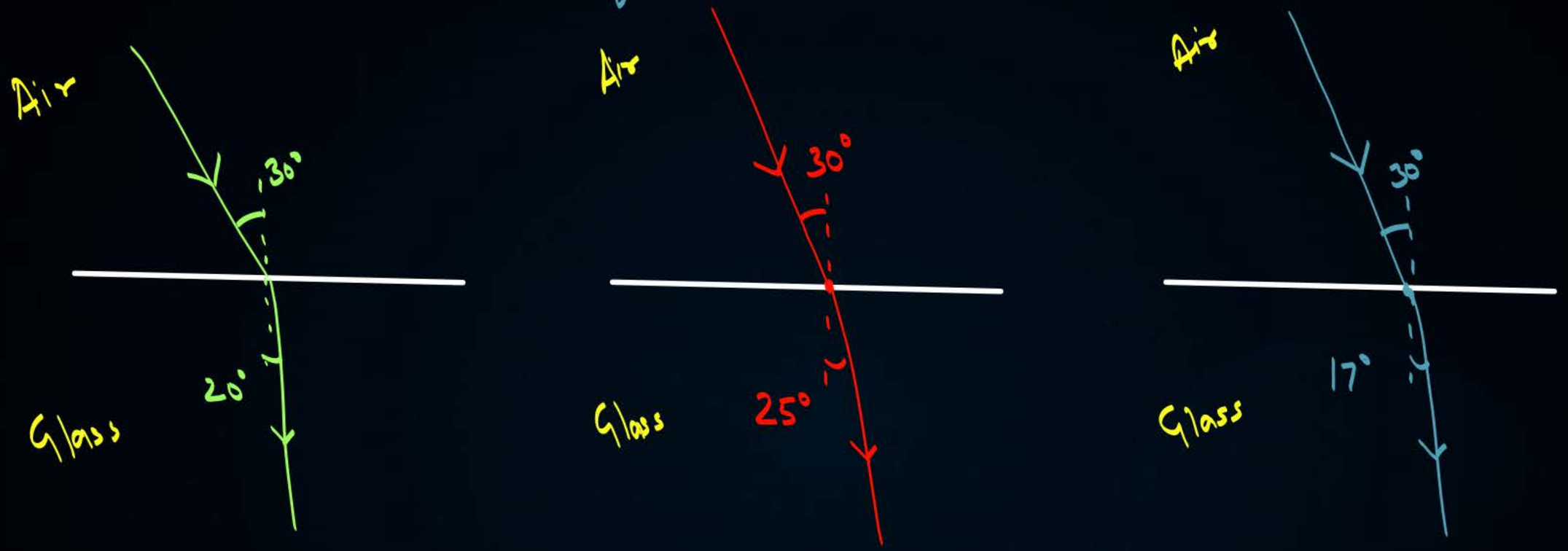
Aaj Ka Main Topic

* **Snell's Law** states that **Ratio** of **Sine** of **Angle of Incidence** to the **Sine** of **Angle of Refraction** is always **Constant** for a given **pair of media** and for a **particular Wavelength**.

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



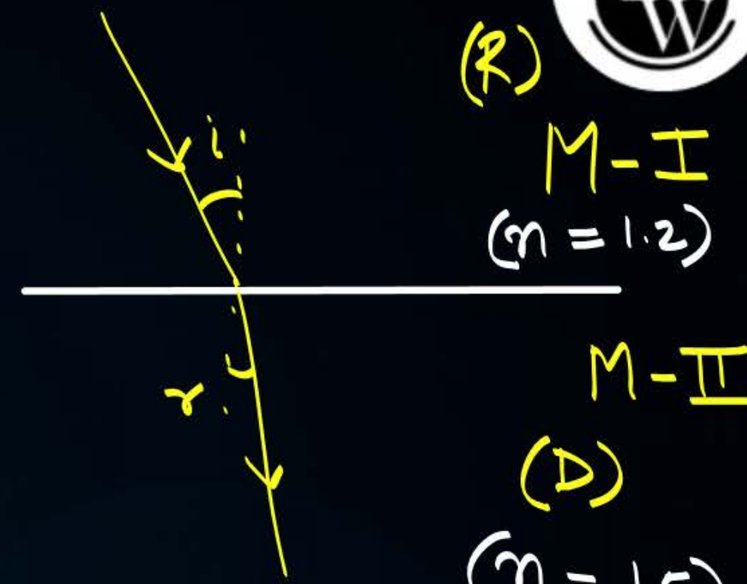
* for different wavelengths :-



Refractive Index (n or μ)

μ (mu) (XII)

→ Ratio of speed of light in Medium 1 to the speed of light in Medium 2



Class 9th

Speed of Wave = Wavelength × frequency

$V = \lambda \times \nu$

ν → Constant: Source dependant

$V \uparrow\downarrow \propto \lambda \uparrow\downarrow$

R → D : speed ↓ wavelength ↓

D → R : speed ↑ wavelength ↑

$n \uparrow$ Denser

$n \downarrow$ Rarer

Refractive Index (n or μ)

n ← X

μ → mu (XII)

→ Ratio of speed of light in Medium 1 to the speed of light in Medium 2

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

V_1 → Incoming

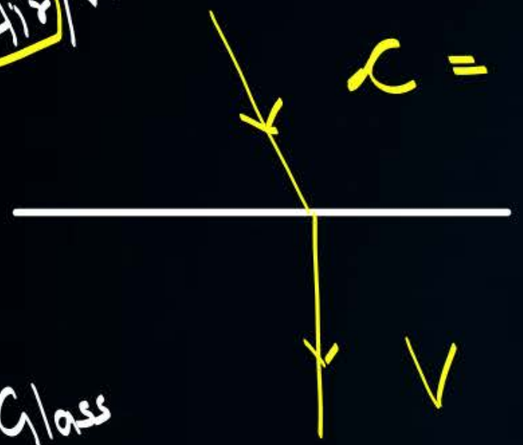
V_2 → outgoing

$n_{2,1}$ → R.I. of 2 with respect to 1 (w.r.t.)

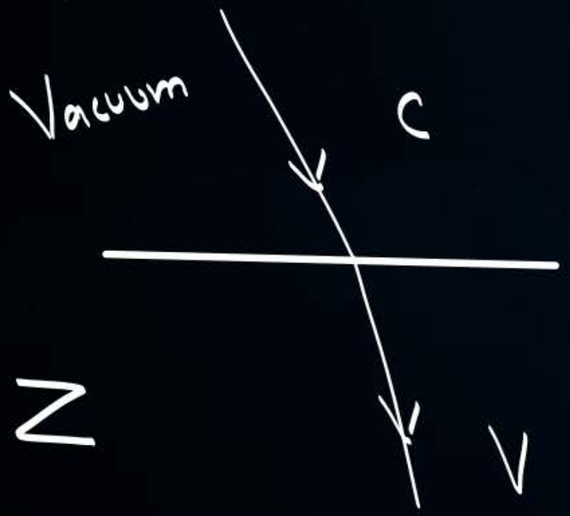
Absolute R.I.

Air/Vacuum

$c = 3 \times 10^8 \text{ m/s}$



$$n_{glass} = \frac{c}{v}$$

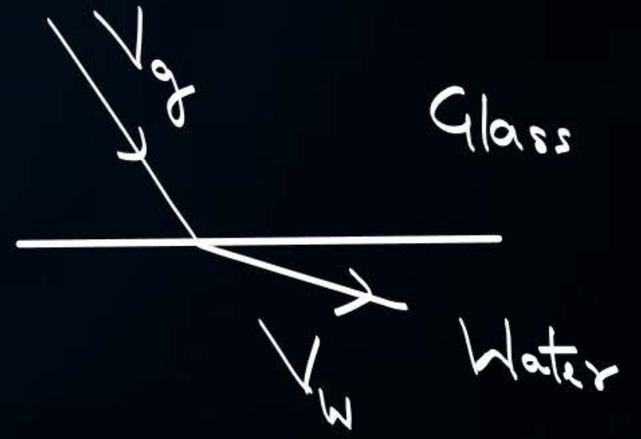


$$n_z = \frac{c}{v}$$

Relative R.I.

$$n_{y,x} = \frac{V_x}{V_y}$$

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



Refractive index/Optical density (The idea behind)

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 :**

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

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}.

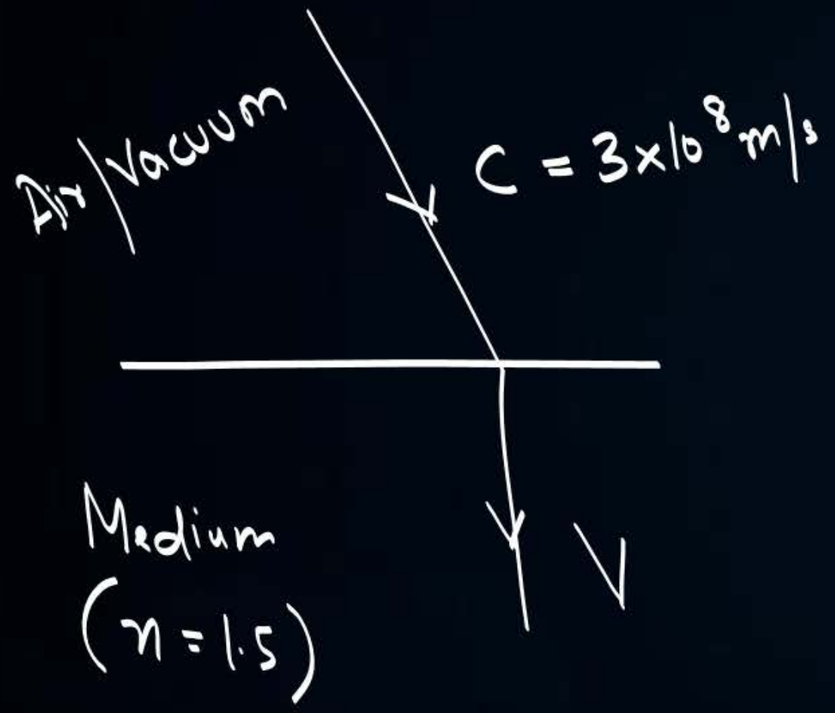
⇒ **Formula :**

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

QUESTION

NoTE- Agar Ques Me "With respect to" Dikhe → Relative

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



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

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

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

QUESTION

A ray of light enters a rectangular glass slab of refractive index 1.5. It is found that the ray emerges from the opposite face of the slab without being displaced. If its speed in air is 3×10^8 ms^{-1} then what is its speed in glass?

$c = 3 \times 10^8$

glass $(\eta = 1.5)$

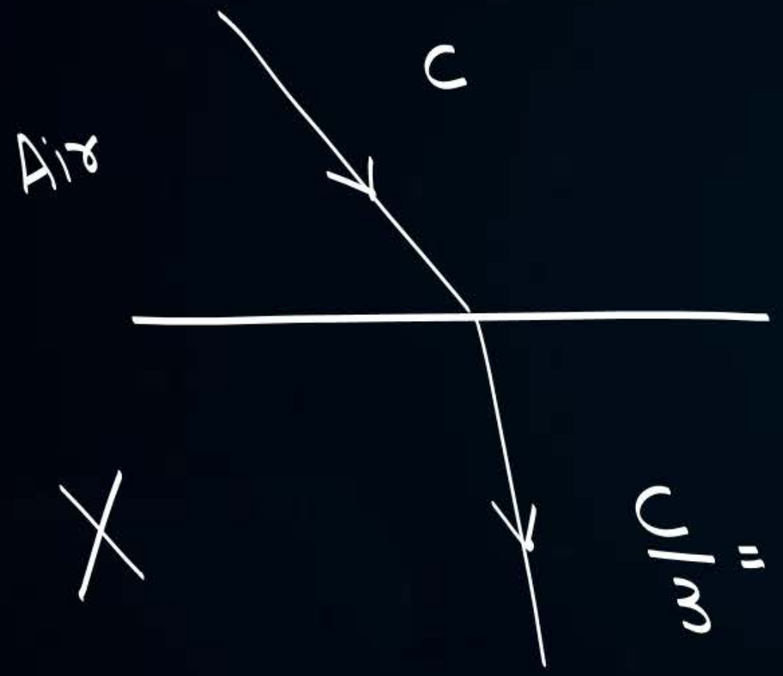
$$\eta = \frac{c}{v}$$

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

$$v = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s}$$

QUESTION

Find the Refractive index of the medium X, when the speed of light in that medium becomes 1/3rd of that of speed of light in air.



$\frac{c}{3} = v$

↳ unitless qty.

$n = \frac{c}{v}$ → ~~m/s~~

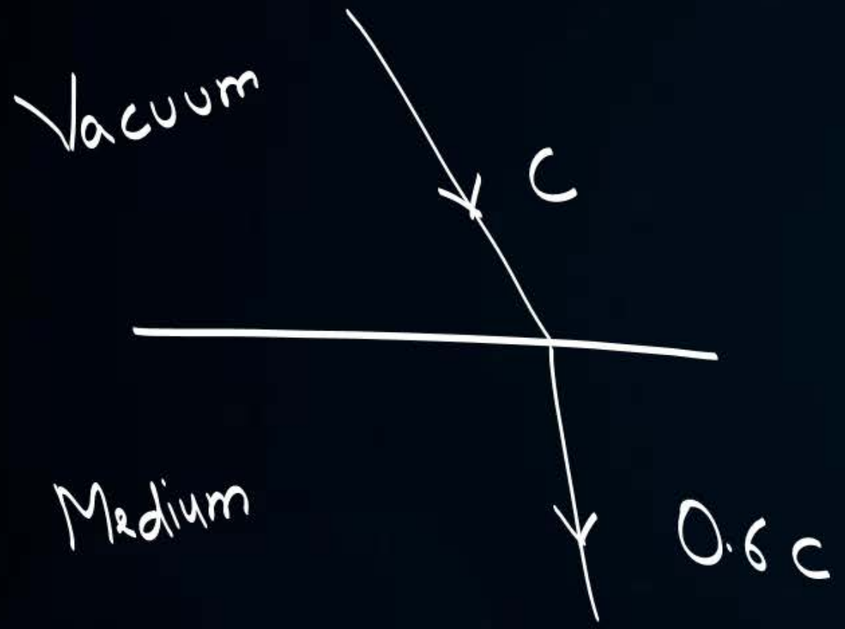
v → ~~m/s~~

$n = \frac{c}{\frac{c}{3}} = \frac{3x}{x} = 3$

$\boxed{n = 3}$

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?



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

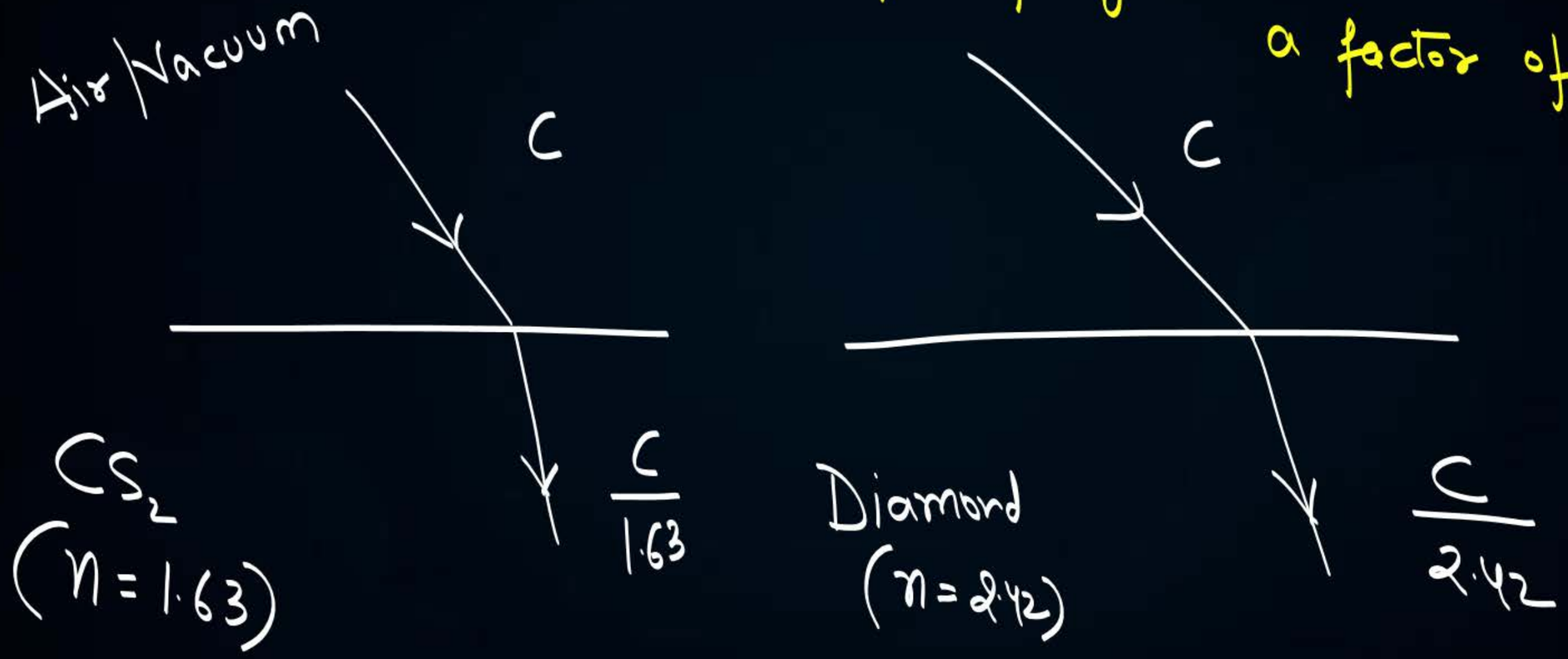
$$\eta = \frac{c}{0.6c} = \frac{10}{6} = \frac{5}{3} = 1.666..$$

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?

→ Speed of light will be decreased by a factor of 1.63.



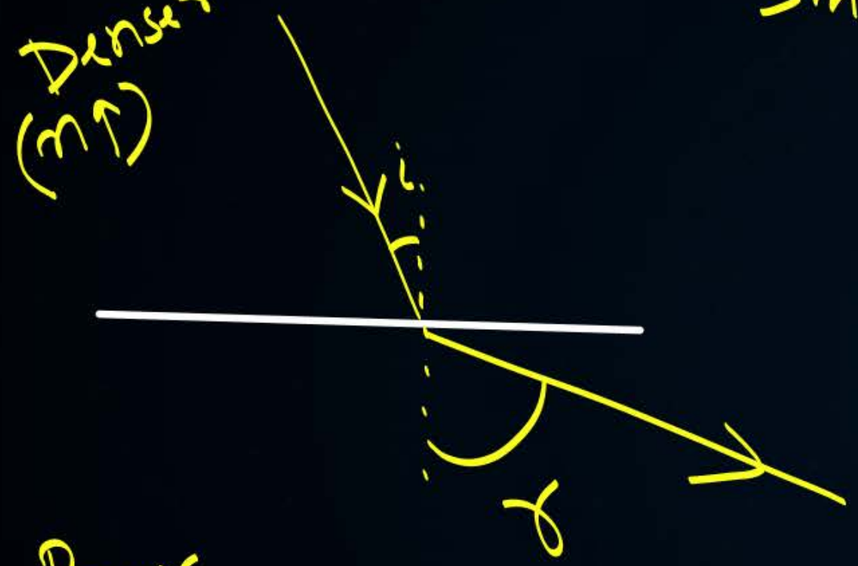
* R/L B/w Snell's Law and R.I.

$$\frac{\sin i}{\sin r\downarrow} = n\uparrow = \frac{c}{v_{glass}\downarrow} = \frac{\lambda_{air}}{\lambda_{glass}\downarrow}$$

$n\uparrow$ Denser $v\downarrow$ $\lambda\downarrow$ $\gamma\downarrow$ ν → Const.

① Bending towards N
② $\gamma\downarrow$ $n\uparrow$
③ Speed ↓ ④ Wavelength ↓

$$\frac{\sin i}{\sin r} = n\downarrow = \frac{v_1}{v_2}\uparrow = \frac{\lambda_1}{\lambda_2}\uparrow$$



$n\downarrow$ Rarer $v\uparrow \lambda\uparrow \gamma\uparrow$

THANK YOU