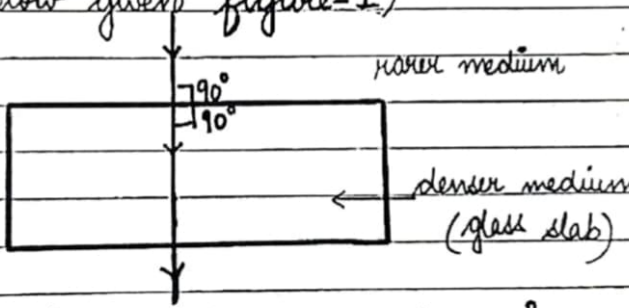
CLASS- IX SUBJECT- PHYSICS

CHAPTER-4 TEACHER= CHARANJEET KAUR

Good Morning Students! Students this lesson is of class-IX for the subject of 'Physics', Topic - 'Refraction of light at Plane Surfaces' which is covered in Chapter-4, given on Page Number -70 of your textbook, titled- 'Concise Physics - Selina Publications' and is submitted to you on 9th October, 2023. Students we have studied last week that the cause of refraction is change in speed of light when it changes its medium.

Students, in case of normal incidence, i.e - when light from one medium is incident normally on the other medium, then the path of light does not changes but its speed changes as it goes from one medium to another. (See the below given figure-1)

FIGURE-1




But $\angle i = 0°$ and even $\angle r = 0°$
(speed of light decreases when it enters glass slab).

**Cause of Refraction**: When a ray of light passes from one medium to another medium, its direction (or path) changes because of the change in speed of light in going from one medium to another.

## LAWS OF REFRACTION

1) The incident ray, refracted ray and the normal at the point of incidence, all lie in the same plane.
2) The ratio of the sine of the angle of incidence

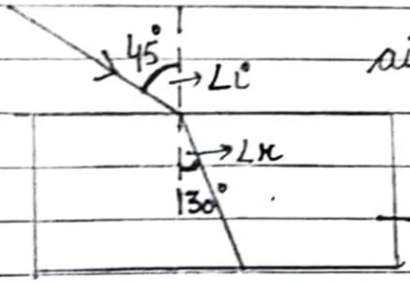
(∠i) to the sine of the angle of refraction (∠r) is constant for the pair of given media, i.e.

$$\frac{\sin i}{\sin r} = \text{constant} = {}_1\mu_2$$

where, ${}_1\mu_2$ is called refractive index of the second medium with respect to the first medium. i.e. $(\mu_2/\mu_1)$

So, we can define Refractive index as: Refractive Index of Second Medium with respect to the first medium is defined as the ratio of the sine of angle of incidence in first medium to the sine of angle of refraction in the second medium.

For Example : Observe figure-2




Now, if we have to find $\mu$ of glass, then

$$\frac{\mu_{glass}}{\mu_{air}} = \frac{\sin i}{\sin r} = \frac{\sin 45^\circ}{\sin 30^\circ}$$

$$\frac{\mu_{glass}}{\mu_{air}} = \frac{1/\sqrt{2}}{1/2} = \frac{2}{\sqrt{2}} = \frac{\sqrt{2} \times \sqrt{2}}{\sqrt{2}}$$

As, $\mu_{air} = 1$, so

$$\mu_{glass} = \sqrt{2} = 1.414$$

Now students, remember that frequency ($\nu$) of light depends on the source of light, so it doesnot depend on the medium in which light is travelling and hence it does not change on refraction.

As, we have studied that, $v = \nu\lambda$

or, $\lambda = v/\nu$

- Now, when light passes from a rarer to denser medium, $\lambda$ decreases - since $v$ (speed) of light decreases, but its frequency remains unchanged.
- When light passes from a denser to rarer medium, $\lambda$ increases - since speed of light increases and its frequency remains unchanged.

- **CONDITIONS FOR LIGHT RAY TO PASS UNDEVIATED ON REFRACTION**

1.) If light is incident normally, that is, when $\angle i = 0°$ such that $\angle r = 0°$

2.) When the refractive index of medium 2 is same as that of medium 1.

- Relationship between wavelength in the two medium

$$\left[\lambda_{medium} = \frac{\lambda_{air}}{\mu}\right]$$

Note - ① When light passes from a rarer to denser medium ($\mu > 1$), so $\lambda_{medium}$ decreases

② When light passes from a denser to rarer medium ($\mu < 1$), its wavelength increases

With this I conclude this session for today and I want you all to try to find answers of Questions-5, 9, 13, 17, 21, 22 and 25 of Exercise - 4(A) on Page Number - 80 and 81 in your Physics Notebook.

Students try to solve the marked numericals given on Page Number - 82 using formula, $\mu = c/v$ and ${}_1\mu_2 = \frac{1}{{}_2\mu_1}$

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