Class 10th

Science and Technology : Part - I

Chapter 6 :: Refraction of Light

REFLECTION

Incident ray : It is incoming ray on the refracting surface.

Refracted ray : It is an outgoing ray from the refracting surface.

An angle of incidence (i) : It is the angle between incident rays and perpendicular line (normal) at the point of incidence.

An angle of refraction (r) : It is the angle between refracted rays and perpendicular line (normal) at the point of incidence.

- If the velocity of light in medium is more, then medium is called **rarer.**

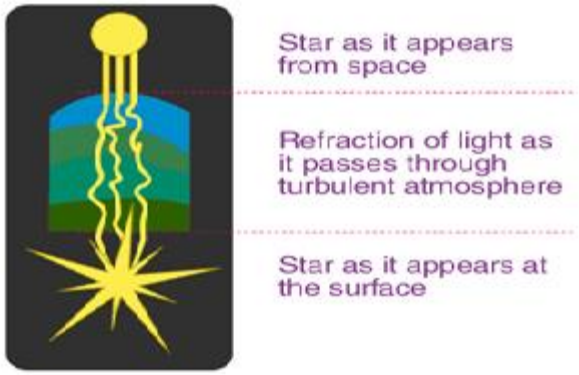
  Example, air or vacuum is more optical rarer.
- If the velocity of light in medium is less, then medium is called **denser.**

  Example, glass is more denser than air.

What is Refraction?

Refraction is the **bending of a wave** when it passes from one medium to another.

The bending is caused due to the **differences in density** between the two substances.



Defining Refraction

"Refraction is the change in the direction of a wave passing from one medium to another."

Refraction makes it possible for us to have optical instruments such as magnifying glasses, lenses and prisms.

Causes of Refraction

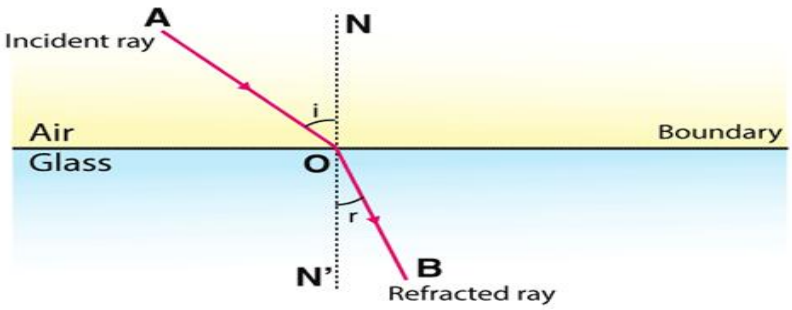
Change of Speed Results in Change in Direction

A light ray refracts whenever it travels at an angle into a medium of different refractive indices. This change in speed results in a change in direction.

As an example,

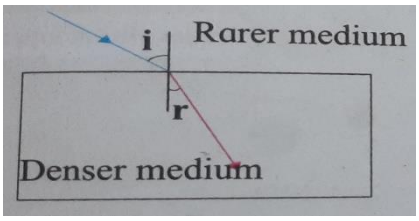
consider light travelling into water. The speed of light decreases as it continues to travel at a different angle.

The refraction of light in glass is shown in the figure

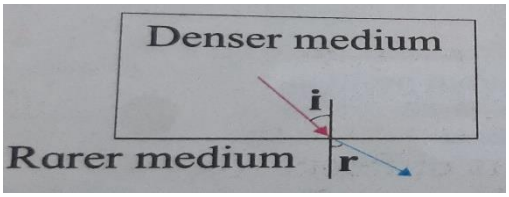


The refraction of light in different media :-

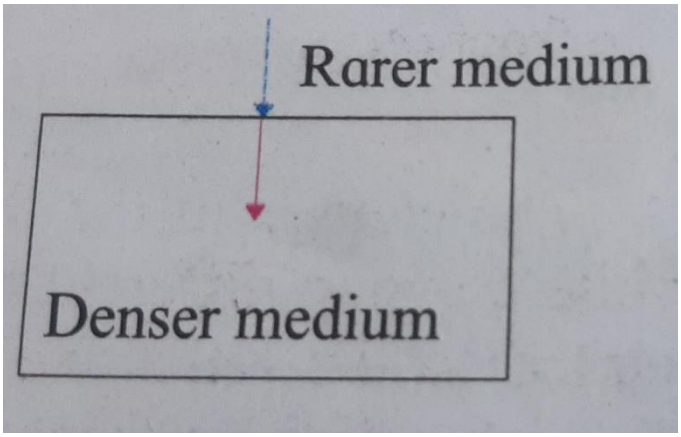
When light travels from air into glass, the light **slows down** and changes **direction** slightly. It bends towards the normal.



When light travels from a **less dense substance to a denser substance,** the refracted light bends more towards the normal line.



If the light wave approaches the boundary in a perpendicular direction, the light ray doesn't refract despite the change in speed.



Laws of Refraction of Light

Laws of refraction state that:

- The incident ray, refracted ray and normal at the point of incidence all lie in the same plane."
- The ratio of the sin of the angle of incidence to the sin of the angle of refraction is constant.
-

$$\frac{\sin i}{\sin r} = \text{constant}(\mu)$$

What is the Refractive Index?

The refractive index describes how fast light travels through the material.The refractive Index is dimensionless.

There are two types of refractive index

- Relative refractive index and
- Absolute refractive index.

Refractive index of medium with respect to other medium is called Relative Refractive Index.

Refractive index of medium 1 with respect to medium 2 =

$$\frac{\textbf{Speed of light in medium2 (V2)}}{\textbf{speed of light in medium 1 (V1)}}$$

Refractive index of medium with respect to air or vacuum is called Absolute Refractive Index.

Absolute refractive index of medium (m) =

$$\frac{\textbf{Speed of light in air (c)}}{\textbf{speed of light in medium (Vm)}}$$

Based on the refractive index of the medium, the light ray changes its direction. If the light ray travels from one medium to another of a higher refractive index, it bends towards the normal, else it bends away from the normal.

➢ Refraction of Light in Real Life

- Mirage and looming are optical illusions resulting from refraction of light.
- A swimming pool always looks shallower than it really is because the light coming from the bottom of the pool bends at the surface due to refraction of light.
- Formation of a rainbow is an example of refraction as the sun rays bend through the raindrops resulting in the rainbow.
- When white light passes through a prism it is split into its component colours – red, orange, yellow, green, blue and violet due to refraction of light.

❖ Applications of Refraction of Light

Refraction has many applications in optics and technology.

A lens uses refraction to form an image of an object for various purposes, such as magnification.

- Spectacles worn by people with defective vision use the principle of refraction.
- Refraction is used in peepholes of house doors, cameras, movie projectors and telescopes.

THANK YOU

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