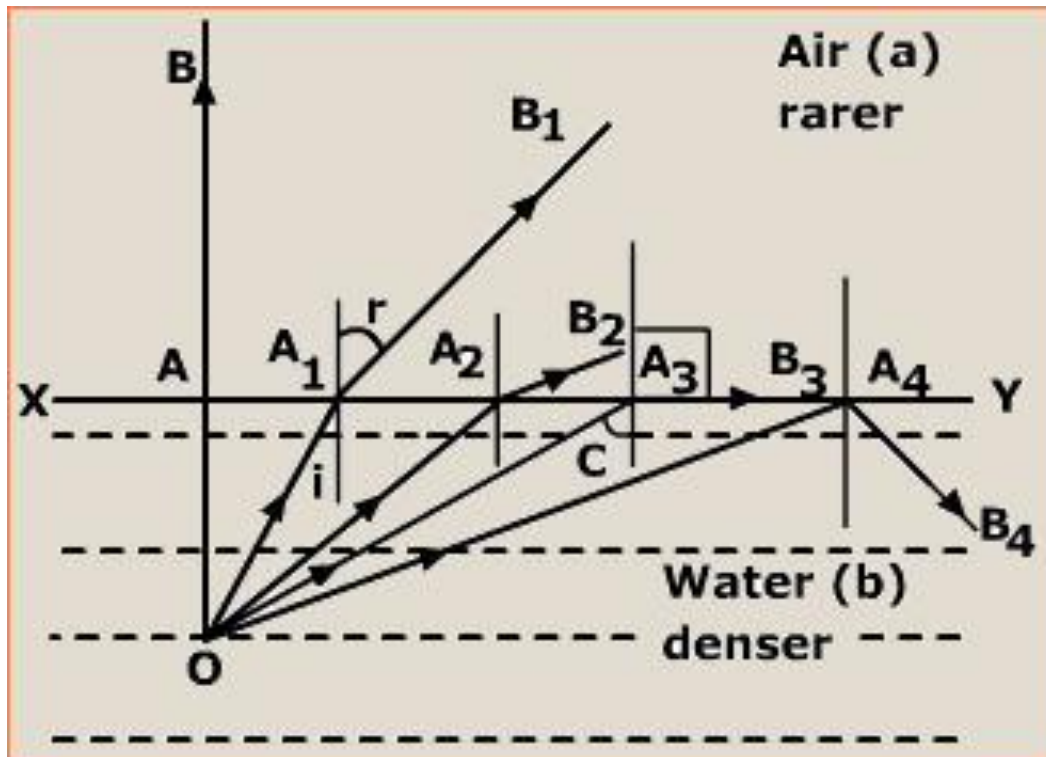


Total Internal Reflection and its Application:



Total Internal Reflection:

Consider an object at O in a denser medium.

A ray XY represents the boundary between two mediums.

As the angle of incidence increases, the angle of refraction also increases.

On increasing the angle of incidence for a particular value say $i = C$, the angle of refraction is found to be 90° .

When the value of angle of incidence is greater than critical angle the light ray does not suffer so longer ($i > C$), The light ray refracted back in the previous medium along a particular direction,

(The ray goes along A_4B_4 i.e., the ray is reflected into the denser medium itself). This phenomenon is called total internal reflection of light.

Conditions for Total Internal Reflection of light:

- Light should travel from a denser to rarer medium
- The value of angle of incidence must be greater than the critical angle ($i > C$).

Relation between Refractive Index and Critical Angle:

According to Snell's law

$$d_{\mu_r} = \frac{\sin i}{\sin r}$$

When $i = c$, $r = 90^\circ$

$$d_{\mu_r} = \frac{\sin i}{1}$$

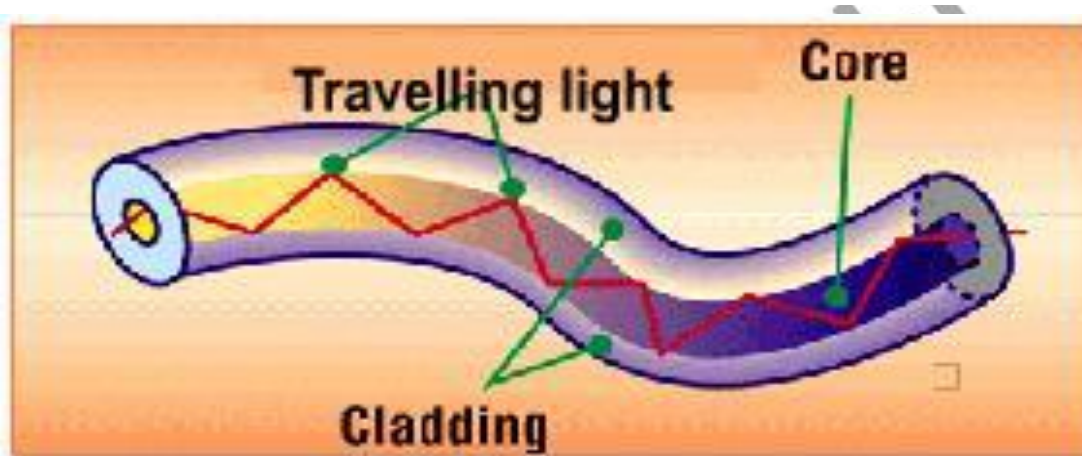
$$\text{or } r_{\mu_d} = \frac{1}{d_{\mu_r}} = \frac{1}{\sin c}$$

$$\text{or } \mu = \frac{1}{\sin c}$$

Applications of Total Internal Reflection:

Optical Fibers:

- Optical fibers consist of a very fine quality of glass or quartz fibers. They are coated with thin layer of material of lower refractive index than that of the fiber. The thickness of the strand is 10^{-4} . The optical fiber works on the principle of total internal reflection.



- The word total means that reflection in the above case occurs with no loss of intensity. This phenomenon enables doctors to inspect many internal body parts. A Bundle of fibers transmit an image of the internal organs that can be inspected visually outside the body.
- Optic fibers are as thick as a human hair. If a beam of light is send down a thin glass rod, total internal reflection traps the light inside the rod. This technique is called 'fiber optics'.

- Fiber optics is commonly used in the medical field. Endoscopes use fiber optics technique. A patient can swallow a tube containing a fine glass fiber through which a doctor can examine the internal stomach parts and hence unnecessary surgeries can be avoided.
- 'Fiber optics' is used to destroy tumors with out operation or surgery. If a fiber optic cable is passed into the organ laser light can be directed along it. The laser is directed at the tumor cells and kills them.
- Now these days telecommunication is widely used by optical fibers due to the process of total internal reflection in optical fibers data and voice communication is faster and easier than ever.
- The red plastic reflector on the back of a bicycle uses total internal reflection.

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