Refraction & Reflection of light different view

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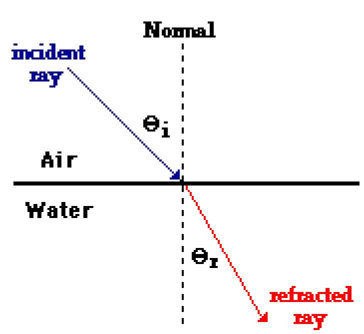
Abstract
We daily observe different phenomenon of reflection and refraction.

Introduction

What is the meaning of refraction of light ?
Phenomenon of light , radio waves etc. being deflected in passing obliquely through the interface between one medium and another or through a medium of varying density.

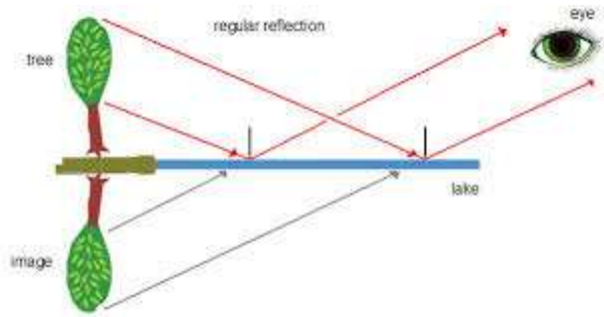
In case of refraction medium also change ,this phenomenon is explained by the conservation of energy and the conservation of momentum.
Refraction of light caused by the differencein speed of light in different media. eg. Speed of light in air is 3 X 10 m/s
Diagram :



some example of light refraction in daily life :

Your eyes , Rainbow , Light bending in a glass of water , Camera lenses , Binoculars , Multicolor sparkle of a diamond .
When light refracts in a prism , it splits into colours of the rainbow because some wavelengths bend more than others.

What is the meaning of reflection of light ?
The throwing back by a body or surface of light , heat or sound without absorbing it .
Diagram :



Some example of light reflection in daily life :

We look our image in the plane mirror , Light scatters in different directions when it shines on dust particles , Things just before the sunrise and just after the sunset due to the diffused reflection of light ,Watching every non-luminious body around you by reflection .

By using reflection and refraction we can determine phenomenon of total internal reflection . In case of total internal reflection whole light is reflected back into same medium .

Total internal reflection :

internal reflection is the phenomenon which occurs when a propagated wave strikes a medium boundary at an angle larger than a particular critical angle with respect to the normal to the surface. If the refractive index is lower on the other side of the boundary and the incident angle is greater than the critical angle, the wave cannot pass through and is entirely reflected. The **critical angle** is the angle of incidence above which the total internal reflection occurs. This is particularly common as an optical phenomenon, where light waves are involved, but it occurs with many types of waves, such as electromagnetic waves in general or sound waves. When a wave reaches a boundary between different materials with different refractive indices, the wave will in general be partially refracted at the boundary surface, and partially reflected. However, if the angle of incidence is greater (i.e. the direction of propagation is closer to being parallel to the boundary) than the critical angle – the angle of incidence at which light is refracted such that it travels along the boundary – then the wave will not cross the boundary, but will instead be totally reflected back internally. This can only occur when the wave in a medium with a higher refractive index (n_1) reaches a boundary with a medium of lower refractive index (n_2). For example, it will occur with light reaching air from glass, but not when reaching glass from air.

Diagram :

Some example of Total internal reflection in daily life :

Ex. Reflecting prisms , Mirage , Sparkles in diamonds , Optic fibres , Endoscope .

Objectives

The present study in taken in hand keeping in mind the following objectives :-

1. To study Optical fiber works on the principle of total internal reflection .
2. To determine the refractive index of glass with respect to air .

HYPOTHESES

Refraction through a prism

Prism

A prism is an optical element. It has polished flat surfaces that refract light. The traditional geometric shape of a prism has a triangular base and two rectangular sides. It is called triangular prism.

A prism can be made from materials like glass, plastic and fluorite. It can be used to split light into its components.

How a Prism Works

When light travels from one medium to another medium, it is refracted and enters the new medium at a different angle. The degree of bending of the light's path depends on the angle that the incident beam of light makes with the surface of the prism, and on the ratio between the refractive indices of the two media. This is called Snell's law.

$$i.e, n = \frac{sin\ i}{sin\ r}$$

where, n is the refractive index of the material of the prism.

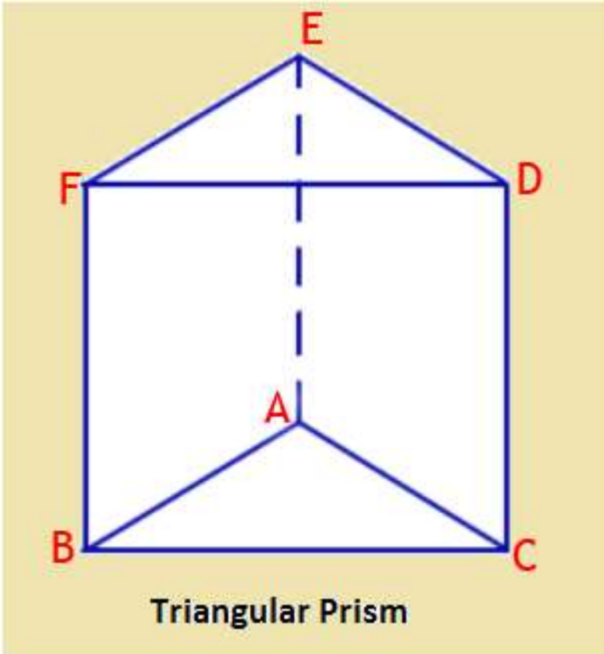
i is the angle of incidence.

r is the angle of refraction.

The refractive index of many materials varies with the wavelength of the light used. This phenomenon is called dispersion. This causes light of different colors to be refracted differently and to leave the prism at different angles, creating an effect similar to a rainbow. This can be used to separate a beam of white light into its constituent spectrum of colors.

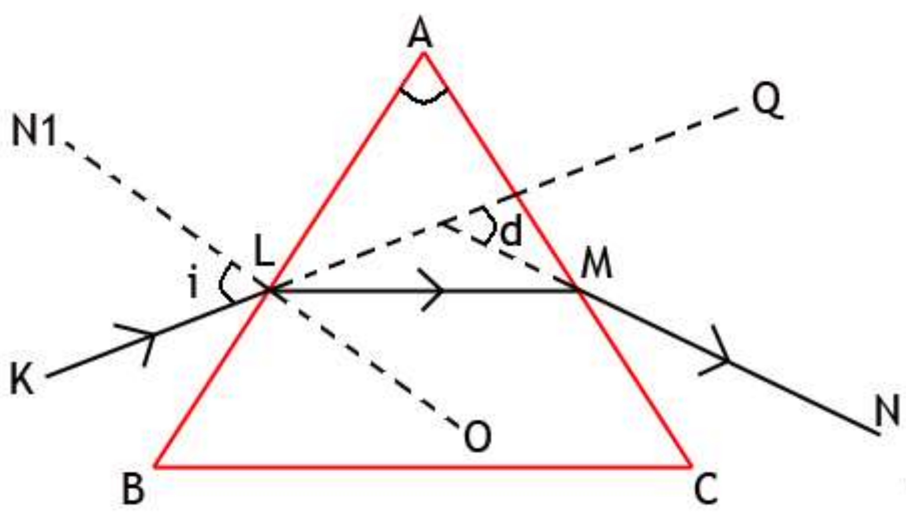
The relation between Refractive Index (n), Angle of Prism (A) and Angle of Minimum Deviation (D)

Consider the following triangular prism.



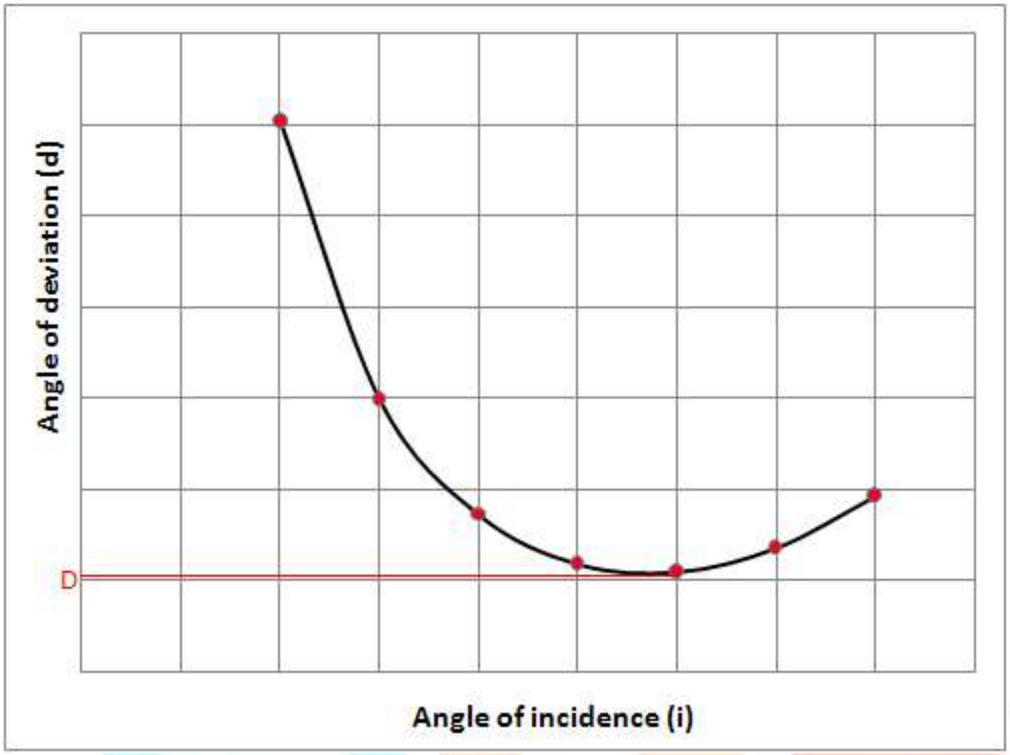
The angle A between the two refracting surfaces ABFE and ACDE is called the angle of prism.

A ray of light suffers two refractions on passing through a prism. If KL be a monochromatic light falling on the side AB, it is refracted and travels along LM. It once again suffers refraction at M and emerges out along MN. The angle through which the emergent ray deviates from the direction of incident ray is called angle of deviation 'd'.



As the angle of incidence is increased, angle of deviation 'd' decreases and reaches minimum value. If the angle of incidence is further increased, the angle of deviation is increased.

A graph is drawn between angle of incidence (i) and angle of deviation (d) by taking angle of incidence (i) along X-axis and angle of deviation (d) along Y-axis. It should be a curved graph.



The angle of minimum deviation is obtained from the graph. Let D be the angle of minimum deviation, then the refractive index (n) of the material of the prism is calculated using the formula,

$$n = \frac{sin\frac{(A+D)}{2}}{sin\frac{A}{2}}$$

EDUCATIONAL IMPLICATIONS

- Students understand the working of a prism.
- Students will be better able to do the experiment in a real laboratory by understanding the procedure.

SUGGESTIONS FOR FURTHER RESEASRCH

1. Refractive Index is commonly used for calculating the concentration of dissolved substances in water.
2. Refractive Index measurement is often the simplest, most convinent and most rapid procedure for evaluating the composition of a binary liquid or a gaseous mixture.

REFERENCES

1) The Physics Quick Reference Guide :Book by E.Richard Cohen .
2) Principles of Optics : Book by Emil Wolf and Max Born