Refraction through a prism

Lecture 4

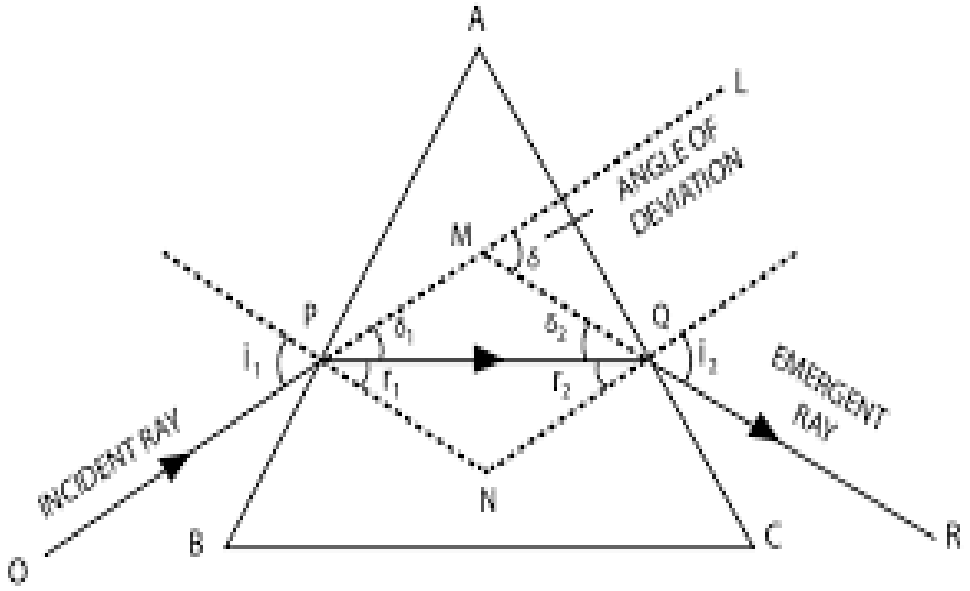
Minati Barman

Head, Department of physics

J N College, Boko

Refraction through a prism:

When a ray of light passes through a glass prism, refraction of light occurs both, when it enters the prism as well as when it leaves the prism. Since the refracting surfaces are not parallel, therefore, the emergent ray and incident ray are not parallel to one another. In this case the ray of light is deviated on passing through the prism.



Here A is the refracting angle .
δ is the angle of deviation
Angle of deviation is the angle between the incident ray and emergent ray

From the figure we have

$$\delta = \delta_1 + \delta_2$$
$$= (i_1 - r_1) + (i_2 + r_2)$$
$$= (i_1 + i_2) - (r_1 + r_2) \quad \text{.....(1)}$$

From the triangle Δ APQ we have

$$\angle APR + \angle A + \angle AQR = 180^\circ$$
$$(90^\circ - r_1) + \angle A + \angle(90^\circ - r_2) = 180^\circ$$
$$180^\circ + \angle A - (r_1 + r_2) = 180^\circ$$
$$(r_1 + r_2) = \angle A \quad \text{.....(2)}$$

Putting the value of (2) in (1) we get,

$$\delta = (i_1 + i_2) - A \quad \text{.....(3)}$$

For minimum deviation

$$i_1 = i_2 = i \quad \text{and} \quad r_1 = r_2 = r$$

Putting this value in equation (3) we get

$$\delta_m = 2 i - A$$
$$i = (\delta_m + A)/2 \quad \text{and} \quad r = A/2$$

Therefore for minimum deviation angle, the refractive index of the medium of the prism

$$n = \frac{\sin(\delta_m + A)/2}{\sin A/2} \quad \text{.....(4)}$$

Graphical representation of angle of incidence with angle of minimum deviation:

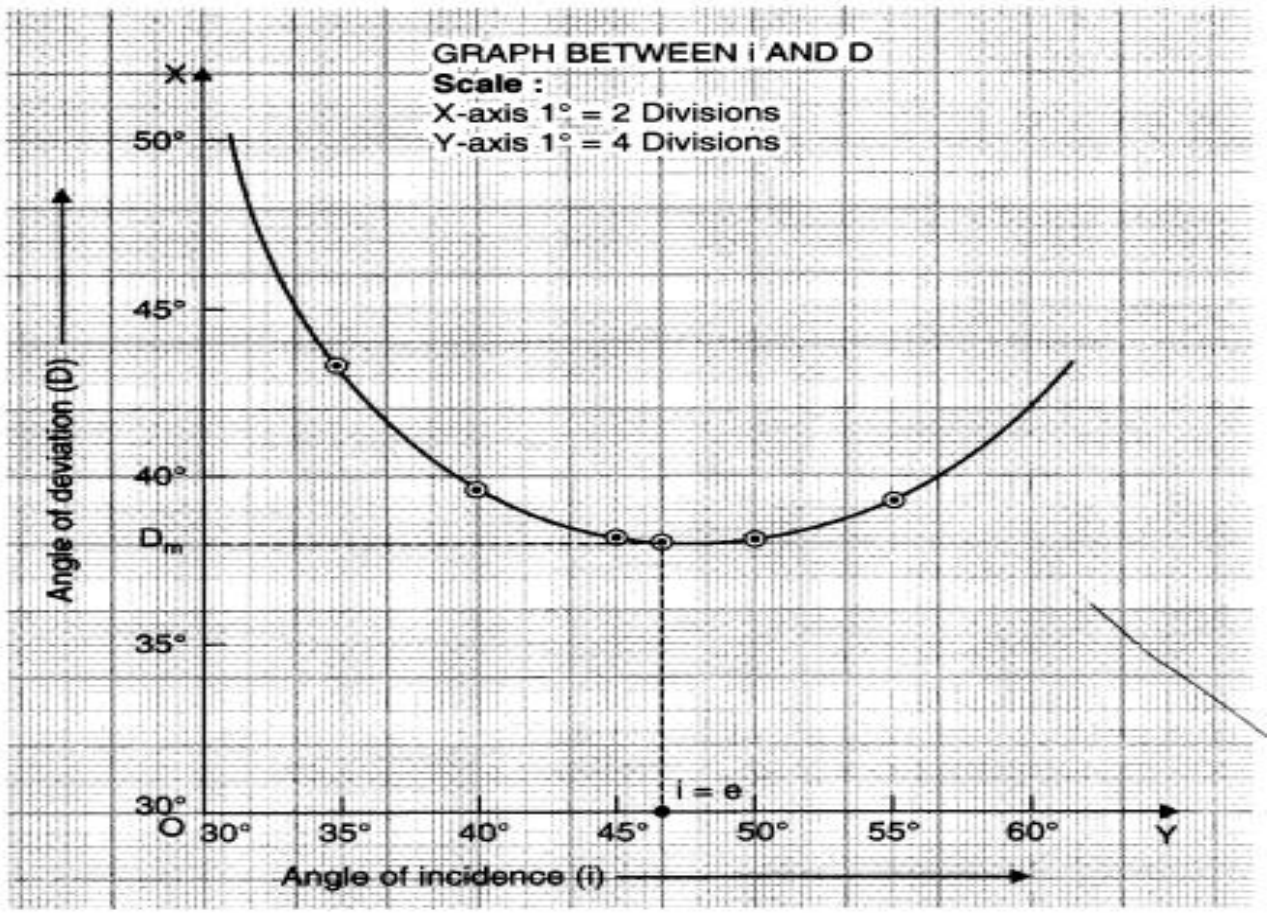
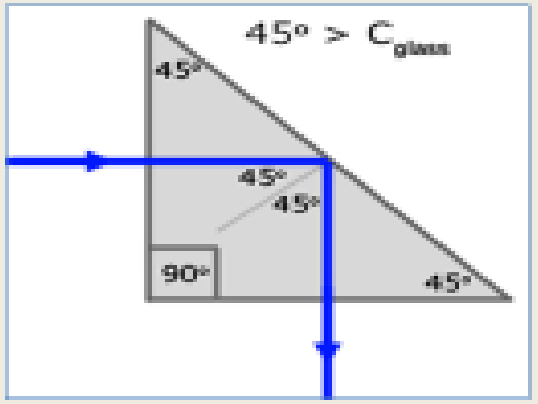


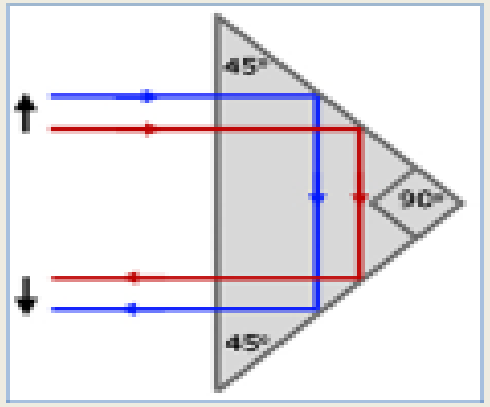
Fig. Graph between angle of incidence and angle of deviation.

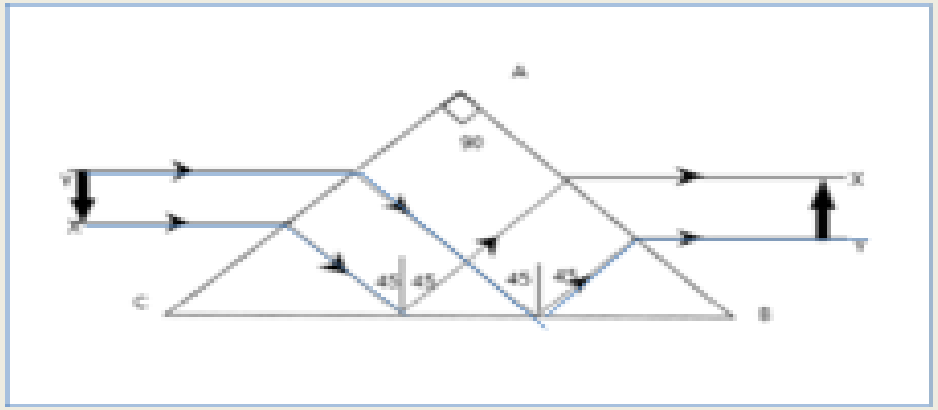
Totally reflecting prism:

Here, angle of incidence>critical angle of glass.

Hence light rays suffer total internal reflection.







Any questions ?

Thank You