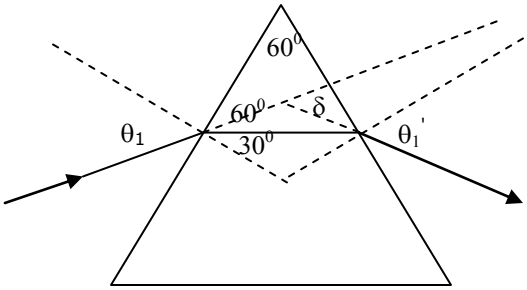
Q- A triangular glass prism with apex angle 60 degree has refractive index 1.50. Find:
a) The angle of incident on the first surface so that the light will pass symmetrically through the prism.
b) The angle of deviation for this symmetric refraction.
c) The angle of deviation if the angle of incidence at the first surface is 45 degree

a) If the angle of incidence is θ_1, for symmetrical refraction angle of refraction will be 30^0 thus by Snell's law we get

$$\mu = \frac{\sin\theta_1}{\sin 30^0}$$

Or $\sin\theta_1 = \mu * \sin 30^0 = 1.5 * 0.500 = 0.75$

Gives = $\sin^{-1}$ 0.75 = **48.6 deg**.



b) The angle of deviation (which is minimum) for a symmetric ray is given by

$A + \delta = 2\theta_1$

Gives $\delta = 2\theta_1 - A = 2*48.6 - 60 =$ **37.2 deg.**

c) If the angle of incidence at the first surface $\theta_1 = 45^0$, the angle of refraction θ_2 for the first surface is given by using Snell's law as

$$\mu = \frac{\sin\theta_1}{\sin\theta_2}$$

Or $$\sin\theta_2 = \frac{\sin\theta_1}{\mu} = \frac{\sin 45^0}{1.5} = 0.4714$$

Or $\theta_2 = \sin^{-1}(0.4714)$

Gives $\theta_2 = 28.13$ deg

Now the two refractive (inner) angles are related as

$\theta_2 + \theta_2' = A$

Hence the angle of incidence at the second surface will be

$\theta_2' = A - \theta_2 = 60 - 28.13 = 31.87$ deg

Hence angle of emergence θ_1' is given by using Snell's law again as

$$\sin\theta_1' = \frac{\sin\theta_2'}{(1/\mu)} = 5.25 * 1.5 = 0.792$$

Gives $\theta_1' = \sin^{-1}(0.792) = 52.37^0$

[$1/\mu$, because light is going from glass to air]

The angle of deviation in such case is given by the formula

$\theta_1 + \theta_1' = A + \delta$

Or $\delta = \theta_1 + \theta_1' - A = 45 + 52.37 - 60 =$ **37.37 deg**.