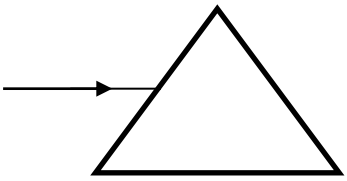
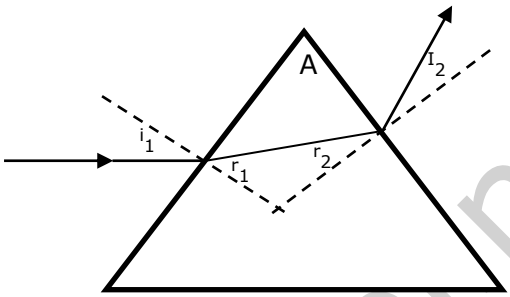
Q- A horizontal beam of light that is incident on an equilateral prism. The base of the prism is horizontal. The prism (μ = 1.40) is surrounded by a liquid whose index of refraction is 1.60. Determine the angle of emergence from the other surface. that the exiting light makes with the normal to the right face of the prism.



The prism (μ_2) is surrounded by liquid (μ_1) hence the effective refractive index is given by

$$\mu = \frac{\mu_2}{\mu_1} = \frac{1.4}{1.6} = \frac{7}{8} = 0.875$$

Here the refractive index is less than one as light Is going from denser to rarer medium. The situation is not as we used to derive the formula hence we use the refraction at both surfaces separately.



The prism is equilateral so the angle of prism is 60^0 and the angle of incidence i_1 at the first surface is 30^0 thus the angle of refraction at the first surface r_1 is given by

$$\text{Sin}\, r_1 = \frac{\sin i_1}{\mu} = \frac{\sin 30^0}{0.875} = \frac{0.5}{0.875} = 0.5714$$

Gives $r_1 = 34.850$

Now as we know

$$A = r_1 + r_2$$
$$r_2 = 60 - 34.85 = 25.15^0$$

and thus the angle of refraction at the right surface i_2 is given by (rarer to denser)

$$\text{Sin}\, i_2 = \frac{\sin r_2}{1/\mu} = \frac{\sin 25.15^0}{1/0.875} = \frac{0.425}{1.143} = 0.3718$$

This gives $i_2 = 21.83^0$

Hence the angle the emergent ray makes with the normal will be 21.83 degree.