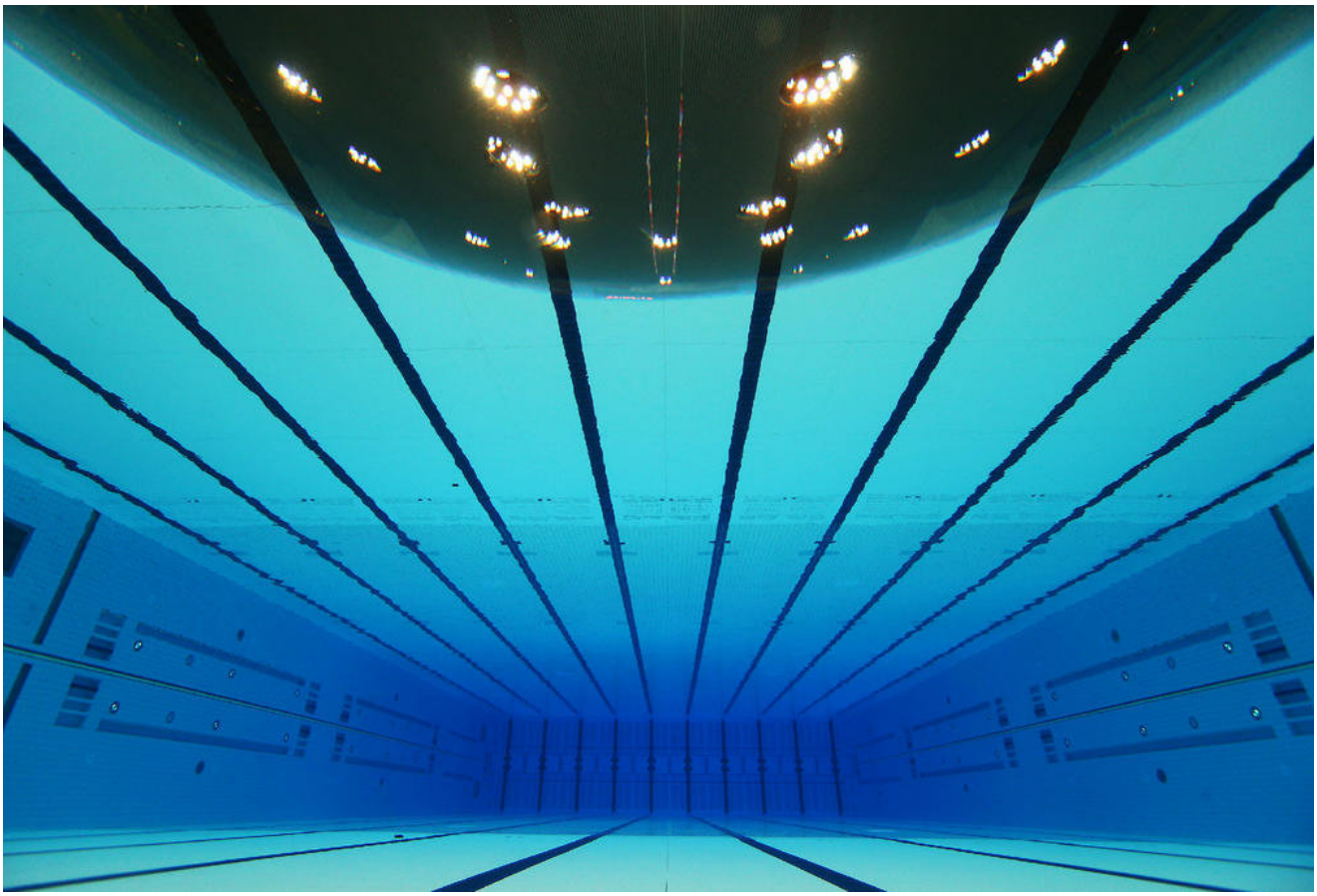
TOTAL INTERNAL REFLECTION

Goal:

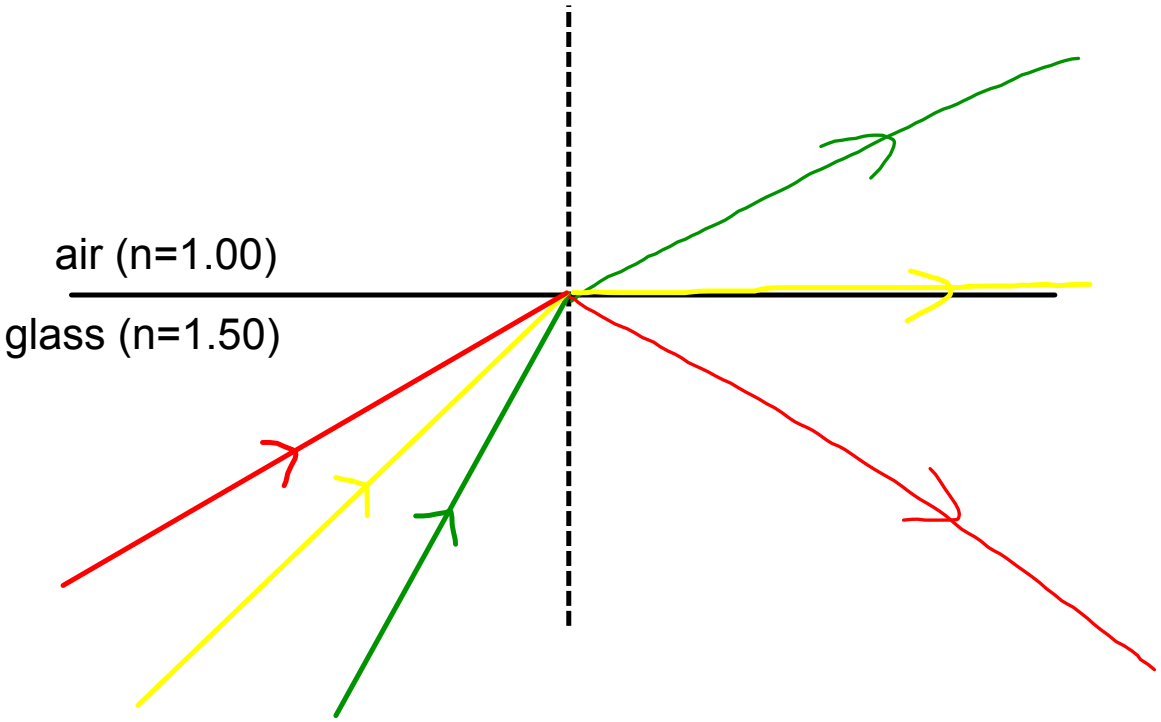
- to become familiar with the phenomenon of total internal reflection
- to calculate the critical angle for two given mediums

What are we looking at here?

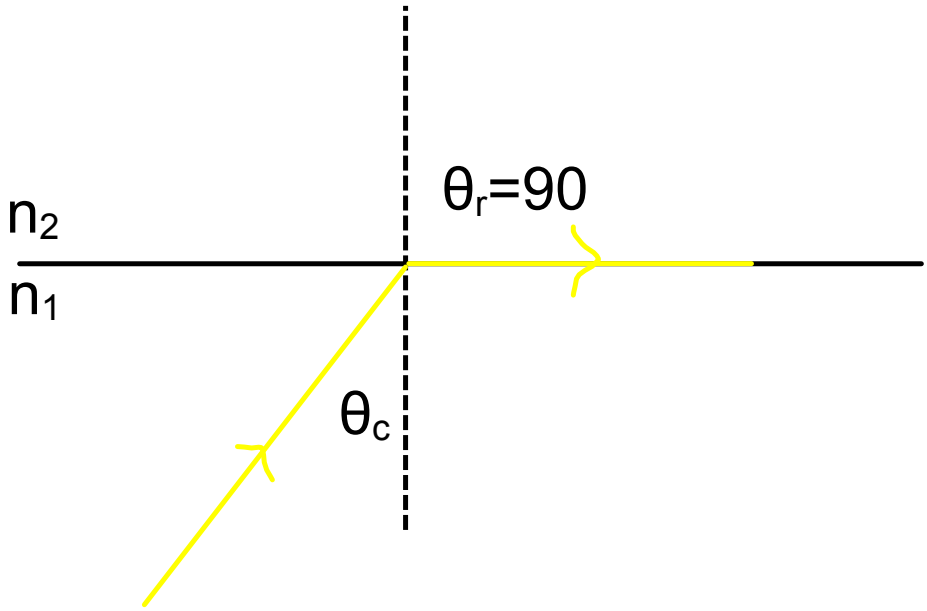


http://phet.colorado.edu/en/simulation/bending-light

Total Internal Reflection only occurs when light travels from a more dense medium (higher index) to a less dense medium (lower index).


air (n=1.00)
glass (n=1.50)

The critical angle between two mediums is the angle of incidence that results in an angle of refraction of 90^0.

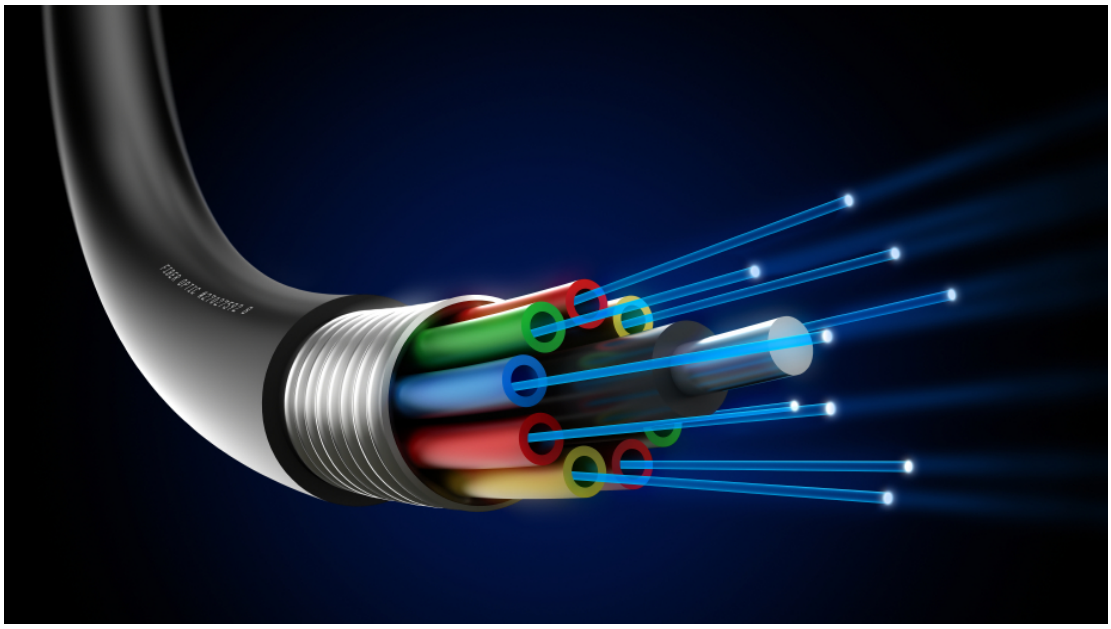


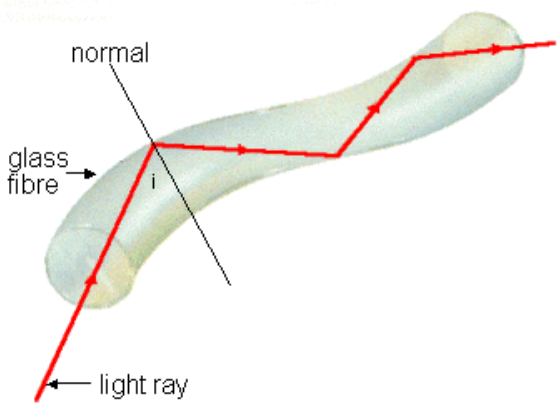
To find the critical angle: set angle of refraction to 90°

$$n_1 \sin\theta_c = n_2 \sin 90^\circ$$

$$\sin\theta_c = \frac{n_2}{n_1}$$

Fibre optic cables





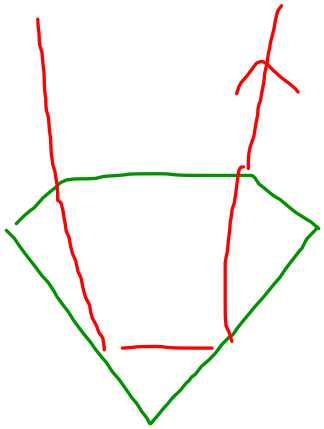
A light ray inside a zircon block ($n = 2.10$) hits the surface as if it was to enter in air. For what angle of incidence will total internal reflection occur?

$$\sin\theta_c = \frac{n_2}{n_1}$$

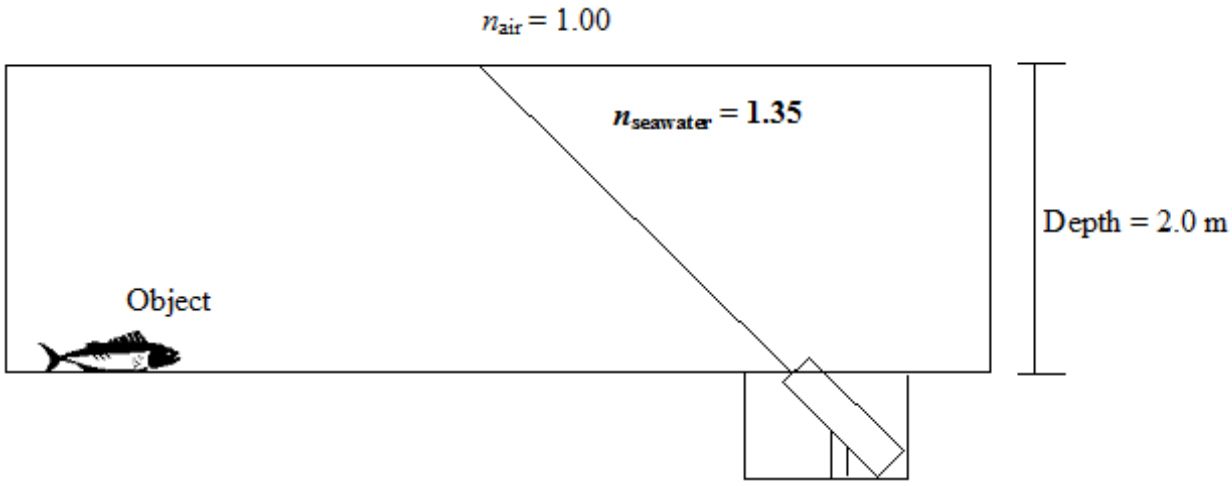
$$\sin\theta_c = \frac{1.00}{2.10}$$

$$\theta_c = \sin^{-1}\left(\frac{1}{2.1}\right)$$

$$= 28.4^\circ$$



An adjustable laser is attached to the bottom of a reservoir containing seawater (***n*** **=1.35**). The laser is adjusted so that the reflected light illuminates an object (the fish) placed on the bottom of the reservoir



What minimum distance must there be between the laser light source and the object so that the ray of light does not exit the surface of the seawater?