

Total Internal Reflection

Physics

The critical angle, and the technology built on it.

Total internal reflection occurs above the critical angle when travelling into a less dense medium.

$$\sin C = n_2/n_1 \quad (n_1 > n_2)$$

Glass to air

$n = 1.5.$

$C \approx 42^\circ$

Water to air

$n = 1.33.$

$C \approx 49^\circ$

Below C

Partial refraction and reflection

THE COMMON MISTAKE

✗ **Expecting TIR going into a denser medium**

✓ **Only dense to less dense**

Refraction away from the normal is what allows the refracted ray to reach 90° .
Going the other way it never can.

Optical fibres use TIR at the core-cladding boundary. The cladding has a slightly lower refractive index, by design.