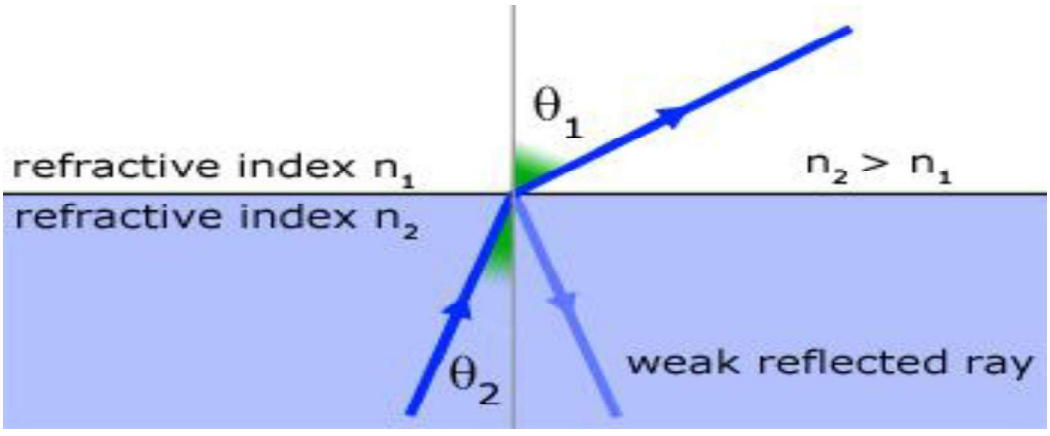
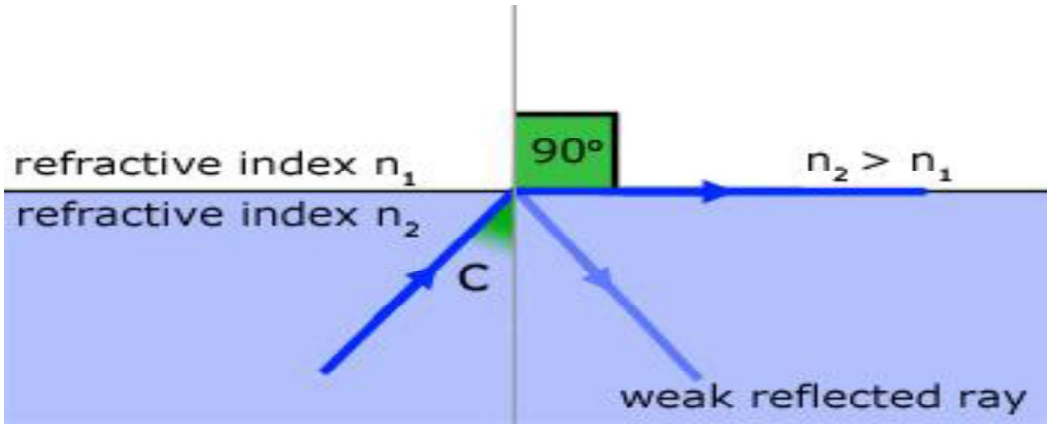
Material	n (λ = 589.29nm)
Water	1.3330
Diamond	2.419
Amber	1.55
Fused silica	1.458
Sodium chloride	1.50
Liquid Helium	1.025
Water ice	1.31
Acrylic glass	1.490 - 1.492
Polycarbonate	1.584 - 1.586
Crown glass	1.50 - 1.54
Flint glass	1.60 - 1.62
Crown glass	1.485 - 1.755
Flint glass	1.523 - 1.925
Pyrex	1.470
Cryolite	1.338
Rock salt	1.516
Sapphire	1.762–1.778
Cubic zirconia	2.15 - 2.18
Moissanite	2.65 - 2.69

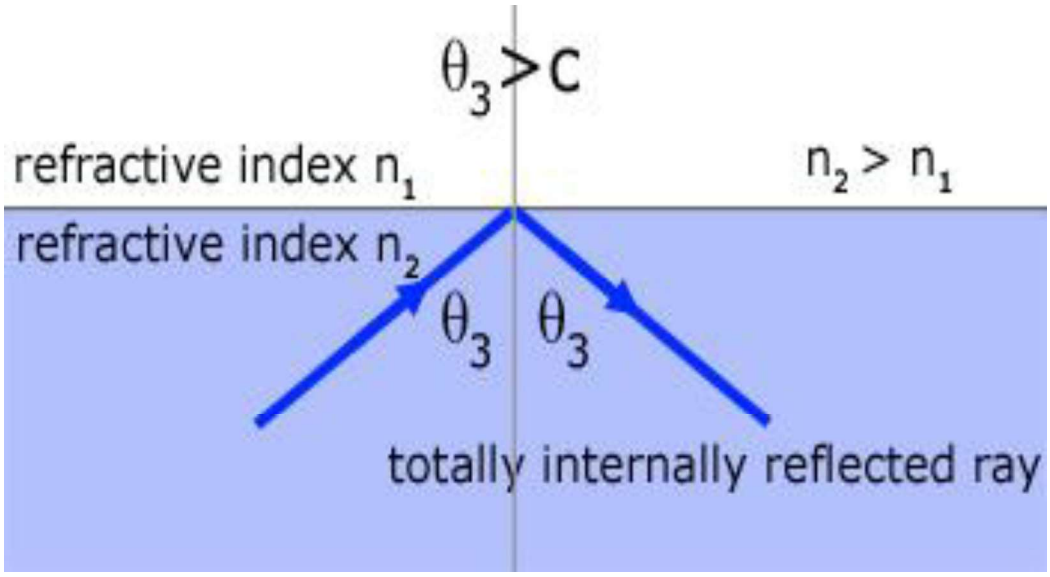
2-Critical Angle (c^o)

-The **Critical Angle** (c^o)is the angle of incidence in a dense medium, such that the angle of refraction in the less dense medium is 90^o .

-Looking at the diagrams(below), as the angle of incidence in the dense medium is increased, the angle of refraction increases towards 90^o. During this time a weak reflected ray is also observed.




refractive index n_1
refractive index n_2
90°
$n_2 > n_1$
C
weak reflected ray


$\theta_3 > C$
refractive index n_1
$n_2 > n_1$
refractive index n_2
θ_3
θ_3
totally internally reflected ray

We can formulate an equation for the critical angle using Snell's Law for two media of refractive index n_1 & n_2 .

$$\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

When $\theta_1 = 90^\circ$ and $\theta_2 = c^\circ$,

$$n_1 \sin(90^\circ) = n_2 \sin(c)$$

but $\sin(90^\circ) = 1$, therefore:

$$n_1 = n_2 \sin(c)$$

$$\sin(c) = \frac{n_1}{n_2}$$

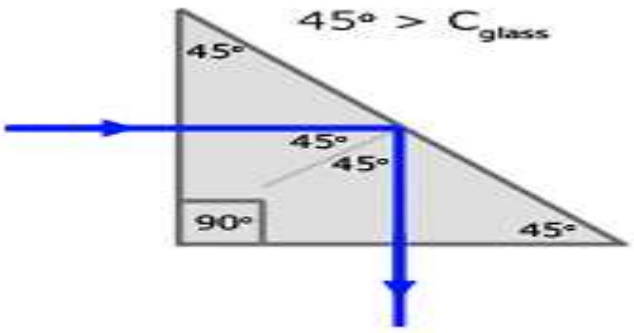
from work on relative refractive index

$$\frac{n_2}{n_1} = {}_1n_2 \qquad \frac{n_1}{n_2} = \frac{1}{{}_1n_2}$$

$$\therefore \sin(c) = \frac{1}{{}_1n_2}$$

90° deviation with a 90° prism

Total internal reflection in glass depends on the fact that its critical angle is approximately 42° . A light ray with an angle of incidence greater than this will be totally internally reflected. So a light ray with an angle of incidence of 45° will be reflected, and its angle of reflection will also be 45°. Hence the light ray is deviated through an angle of 90° .



For 90° deviation, a 90° isosceles glass prism is used. In this way the incident ray and the reflected rays are normal to the surfaces they enter and leave(and therefore unhindered). Total internal reflection occurs on the hypotenuse

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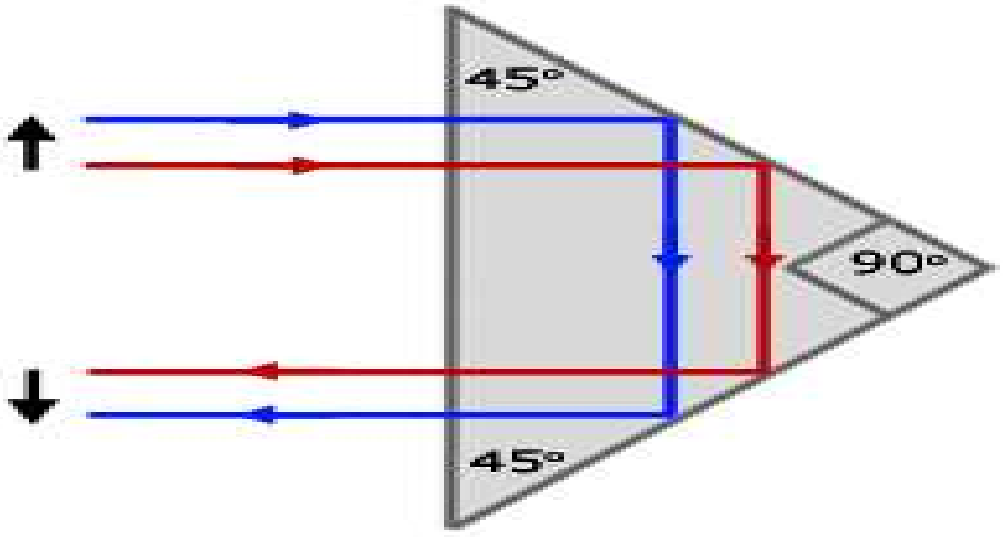
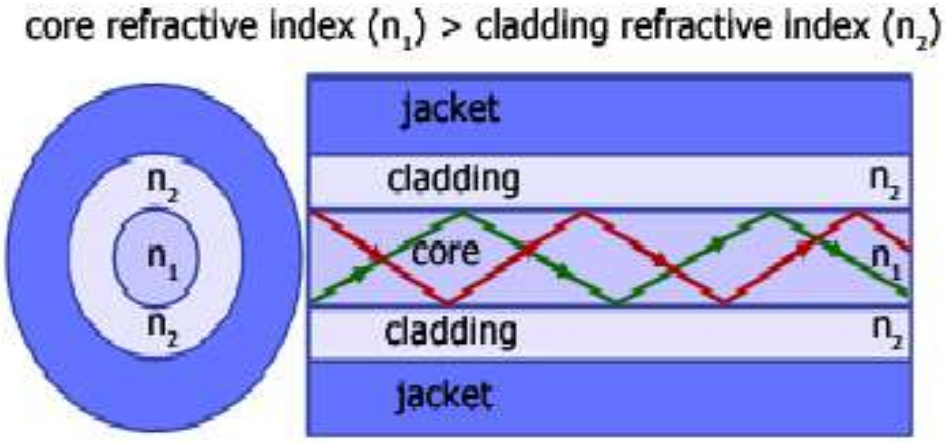
180°deviation with a 90° prism

Besides a 90° deviation, an isosceles prism is also used to produce a 180° deviation, but this time reflection occurs on the equal, adjacent sides of the prism and not on the hypotenuse



Optical Fibers

Optical fiber typically consists of a **core** of high refractive index surrounded by **cladding** with a lower refractive index. Light is totally internally reflected down the fiber at the boundary of the two media



Optical fiber has a number of advantages over copper wire:

1.less attenuation
2. can carry more information

3. safer - no fire risk as with electric currents
4. wire-tapping more difficult

3-Prisms

3-1.deviation

Deviation, measured in degrees, is the angle an incident ray is turned through after passing through a prism(or other optical component).