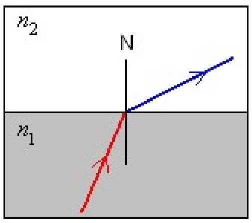
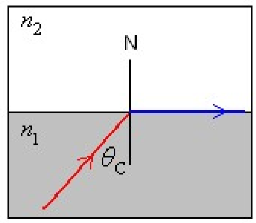
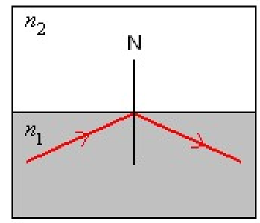
Total Internal Reflection

We know that whenever light travels from one material to another, the majority of the light refracts but a small proportion of the light also reflects off the boundary and stays in the first material.
When the incident ray strikes the boundary at an angle *less than* the critical angle, the light refracts into the second material.
When the incident ray strikes the boundary at an angle *equal to* the critical angle, all the light is sent along the boundary between the two materials.
When the incident ray strikes the boundary at an angle *greater than* the critical angle, all the light is reflected and none refracts, we say it is total internal reflection has occurred.







Critical Angle

We can derive an equation that connects the critical angle with the refractive indices of the materials.

$\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$ but at the critical angle θ_2 is equal to 90° which makes $\sin\theta_2 = 1$ → $\frac{\sin\theta_1}{1} = \frac{n_2}{n_1}$

θ_1 is the critical angle which we represent as θ_C making the equation: $\boxed{\sin\theta_C = \frac{n_2}{n_1}}$

When the second material is air $n_2 = 1$, so the equation becomes: $\boxed{\sin\theta_C = \frac{1}{n_1}}$ or $\boxed{n_1 = \frac{1}{\sin\theta_C}}$

Optical Fibres/Fibre Optics

An optical fibre is a thin piece of flexible glass. Light can travel down it due to total internal reflection. Thier uses include:
*Communication such as phone and TV signals: they can carry more information that electricity in copper wires.
*Medical endoscopes: they allow us to see down them and are flexible so they don't cause injury to the patient.