## Index of Refractions 12.4

We have experimentally shown that when light travels to a new medium, it bends at the interface between the 2 different mediums. This bending is called **refraction**.

Why does it happen?
Refraction happens because light slows down when it travels through mediums other than air.   Just like your car tires slow down when they hit gravel, light slows down when it hits glass, say. We say that glass is more optically dense than air.   Water is also more optically dense than air.   (Think: it's harder to run through water than air, yes? Water is more dense).   In fact, everything is denser than air.

Bending Rules:
*When light slows down, it bends towards the normal.
*When light speeds up, it bends away from the normal.

This is bending **away** from the normal

This is bending **towards** the normal
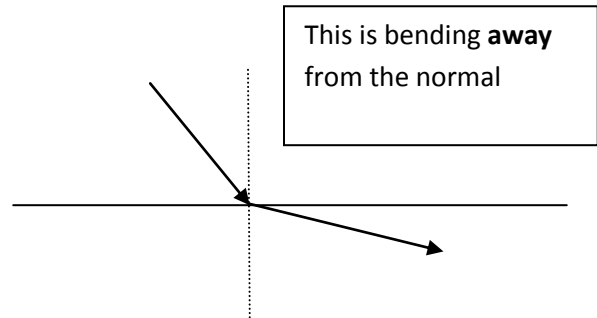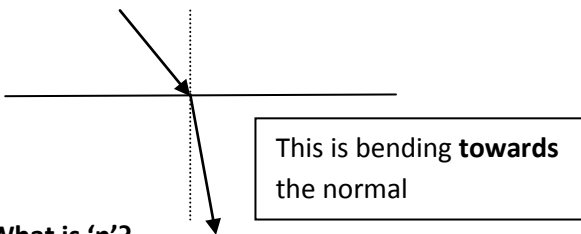
What is 'n'?
Experimentally (12.2) we discovered that the bending is predictable.   We measured the angle of incidence and the angle of refractions for a number of light rays travelling from air to plexiglass and then tried this operation: sin i / sin R   and we discovered for a plexiglass prism, it was almost always about 1.5.   Since this is a ratio, there are no units.   This ratio is a characteristic of plexiglass and is indeed the index of refraction.

$$n = \sin i\, / \sin R$$

Other experimenters also discovered that 'n' equals something else.

$$n_{medium} = c/v_{medium}$$ This is usually written $\boxed{n = c/v}$

where….   c = speed of light in vacuum/air = 3×10^8 m/s   always!
                        n = index of refraction for the medium
                        V = speed (velocity) of light in the medium

Interpretting value of 'n'
A larger 'n' value means the medium is more optically dense and the light slows down more.
Some examples

Medium	'n' value –refractive index
Air	1.0
Ice	1.3
Water	1.33
Glass	1.52
Diamond	2.42

We say that diamond is more optically dense than glass. Light would travel slower in diamond than glass.

Revisit the bending rules:
* When light slows down, it bends towards the normal. When is goes from small 'n' to larger 'n' value, it bends towards.   Ie: light would bend towards the normal going form water to diamond.

* When light speeds up, it bends away from the normal.   When is goes from a large 'n' to a small 'n' value, it bends away. Ie: light would speed up going from glass to air.

We will practice the formula introduced here for homework.   Complete questions # 1- 10 at end of 12.4