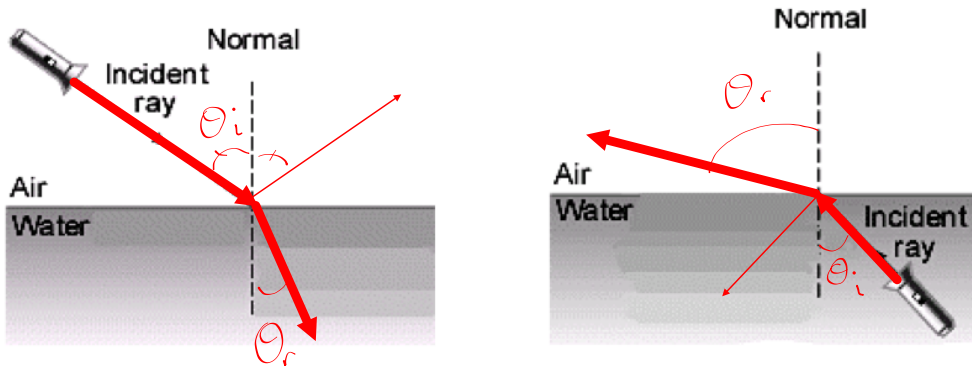


**Refraction of Light**

**Refraction:** the change in direction of a wave due to a change in speed when it crosses a boundary at an angle

Complete the path of each light ray shown below.



Angle of refraction: angle between the refracted ray and the normal line

In which substance does light travel faster – air or water?

**Rule for Refraction:** into Fast -> bend Away, into Slow -> bend Towards

**Index of refraction:** ratio of speed of light in a vacuum to speed of light in a substance

**Formula:**

$$n = c/v$$

Variable:	<b>n</b>	<b>c</b>	<b>v</b>
Quantity:	index of refraction (optical density)	speed of light in a vacuum	speed of light in a medium
Units:	—	[m/s]	[m/s]
Type:	scalar		

Examine the tables of **Absolute Indices of Refraction** in your Reference Tables.

- In which substance will light travel the fastest? What is its index of refraction? P4846  
 $c = 3.00 \times 10^8 \text{ m/s}$     air     $n = 1.000293$
- In which substance will light travel the slowest? What is its index of refraction?  
 diamond     $n = 2.42$
- What is the relationship between the index of refraction of a substance and the speed of light in that substance?  
 inverse - as 'n' increases, speed decreases
- Calculate the speed of light in water.  
 $n = c/v$      $v = \frac{c}{n} = \frac{3 \times 10^8 \text{ m/s}}{1.33} \approx 2.26 \times 10^8 \text{ m/s}$

5. Will light slow down if it travels from corn oil to glycerol? Explain.

no - they have the same index

6. If light crosses a boundary between two substances with very different indices of refraction . . .

it will change speed (and therefor refract) a lot

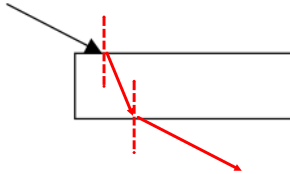
7. If light crosses a boundary between two substances with very similar indices of refraction . .

it will not change speed or refract) much

8. Why does the table indicate ( $f = 5.09 \times 10^{14}$  Hz)?

average frequency of visible light - each frequency has a slightly different index

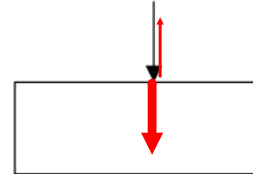
Complete the path of the light ray through the Glass block in each diagram below.



**Rule for Refraction:**

Low to High - bends toward normal

High to Low - bends away from normal



### Snell's Law of Refraction

**Snell's Law (Law of Refraction)**

Use Snell's law to construct the refracted ray on the diagram at right.

