# Physics
## 7.5 Refraction of light

Review

### Gravity (g)

Acceleration due to gravity = 9.81 m/s²

Gravitational Force = mass · gravitational field strength (g)

$F_g = m \cdot g$ $g = 9.81\ N/kg$

Universal Gravitation $F_g = G\frac{m_1 m_2}{r^2}$

r = distance between 2 objects (centres)

G = universal gravitational constant = $6.67 \times 10^{-11}\ N \cdot \frac{m^2}{kg^2}$

New Refraction occurs when light travels thru 1 medium into another - light travels slower thru different media

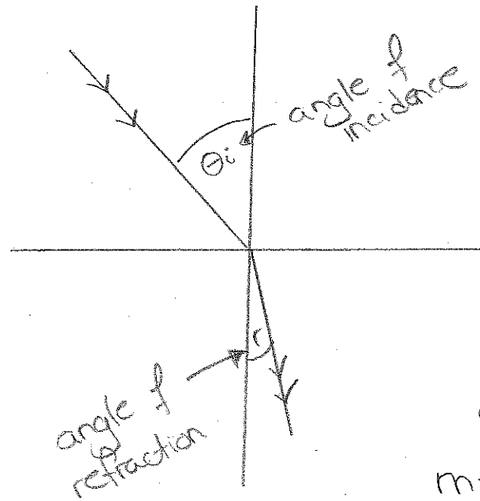
How much it bends depends on ↑ refractive index (n) of ↑ medium

$$n = \frac{\text{speed of light in a vacuum}}{\text{speed of light in a medium}} = \frac{c}{v}$$

$c = 3.00 \times 10^8$ m/s

* Generally - when light travels from low → high (n) ↑ light bends towards ↑ normal and high → low (n) it bends away from ↑ normal

# Snell's Law of Refraction




medium 1

| medium | n |
|---|---|
| $H_2O$ [@ 20°C] | 1.33 |
| diamond | 2.42 |
| air | 1.00029 |
| quartz | 1.54 |
| glass [depends] | 1.5 - 1.9 |

medium 2

normal

$$n_1 \sin\theta_i = n_2 \sin\theta_R$$

**Critical Angle** You can ↑ ≠ angle of incidence ($i$) of light going from $H_2O$ → Air until you can no longer observe refraction: This angle = critical angle $\theta_{ic}$
All angles ≥ $\theta_{ic}$ ≠ boundary acts as a perfect mirror.

$$\sin\theta_{ic} = \frac{1}{n} \rightarrow \sin^{-1}\left(\frac{1}{n}\right)$$

**Rainbows**: Sun behind you, rain in front of you
light is diffracted thru millions of droplets...

1° rainbow = ROYGBIV

2° rainbow = VIBGYOR

## Examples

1) light entering glass @ $\angle_i = 18.5°$ leaves ≠ glass @ an $\angle_R = 12.0°$. What is ≠ ($n$) for this glass?

$$n_1 \sin\theta_i = n_2 \sin\theta_R$$

air
$n_1 = 1.00$
$\theta_i = 18.5°$
$n_2 = ?$
$\theta_R = 12.0°$

$1.00(\sin 18.5°) = n_2(\sin 12.0°)$

$0.3173 = n_2(0.2079)$

$1.53 = n_2$

2) What is ≠ critical angle for a glass that has an index of refraction of 1.5?

$\theta_{ic} = ?$
$n = 1.5$

$\sin\theta_{ic} = \frac{1}{n}$

$\sin\theta_{ic} = \frac{1}{1.5}$

$\sin\theta_{ic} = 0.66\overline{6}$

$\theta_{ic} = \sin^{-1}(0.66)$

$\theta_{ic} = 41.8°$