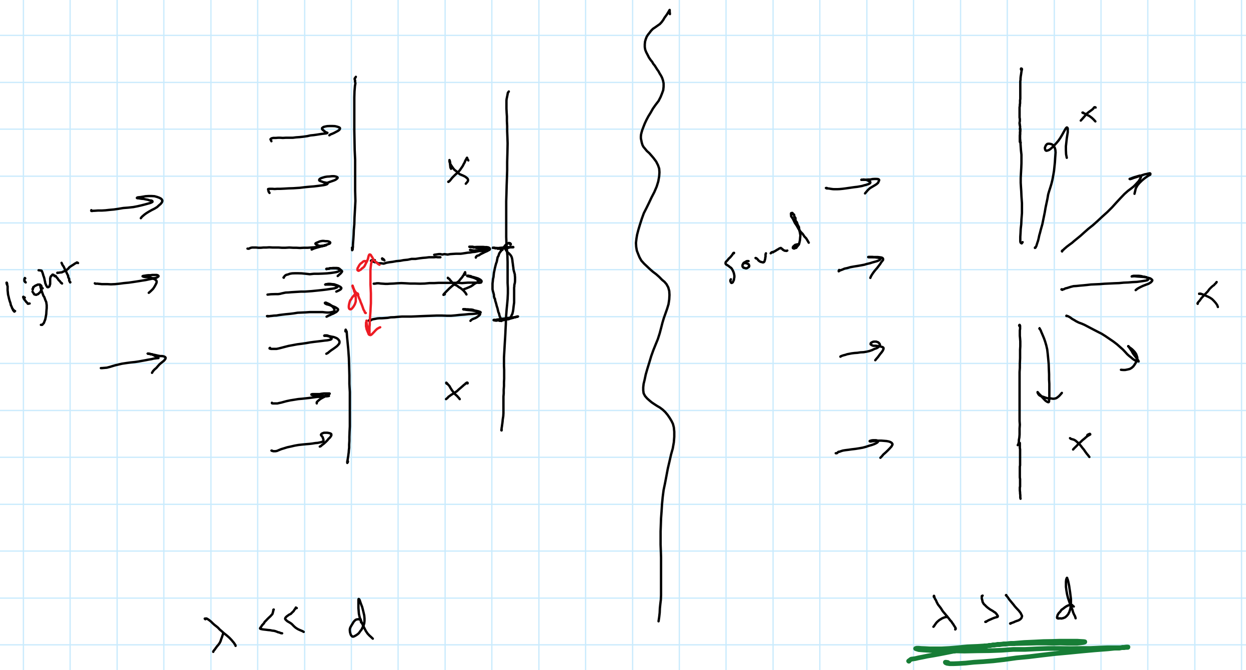
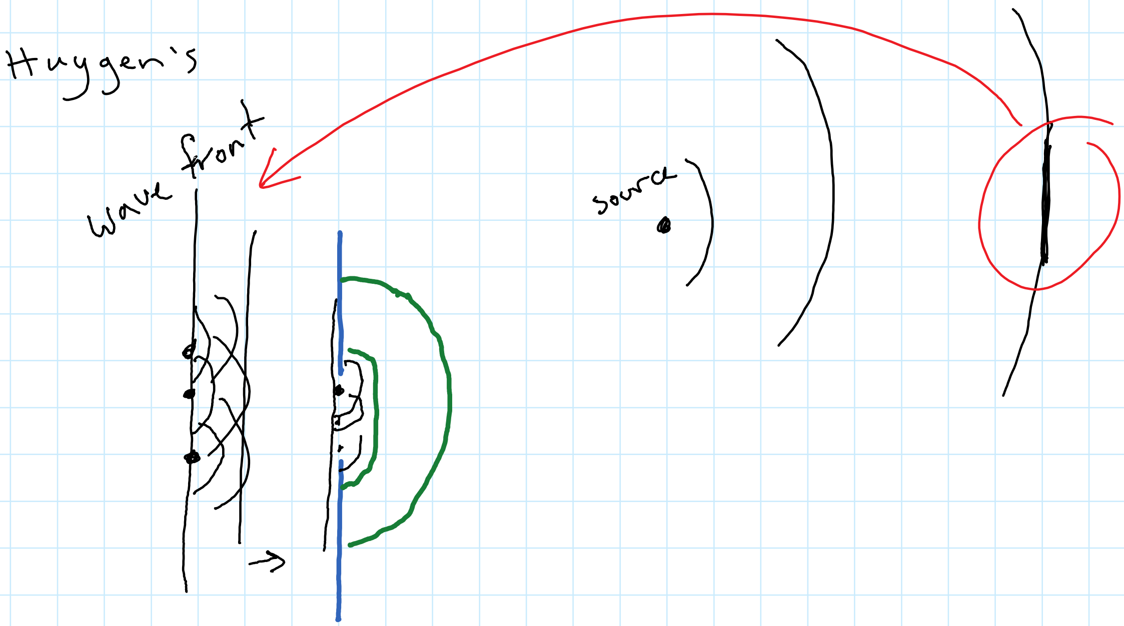
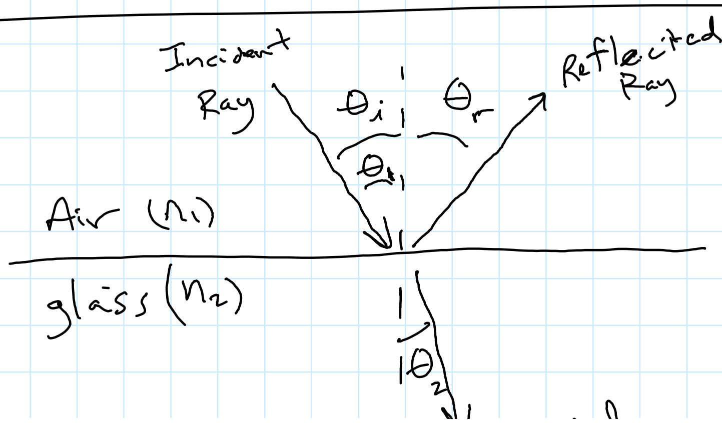
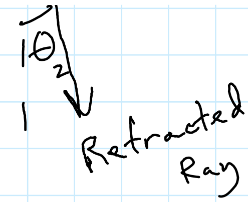






$\theta_i = \theta_r$



$$V_{air} > V_{glass} \qquad \theta_2 < \theta_i$$

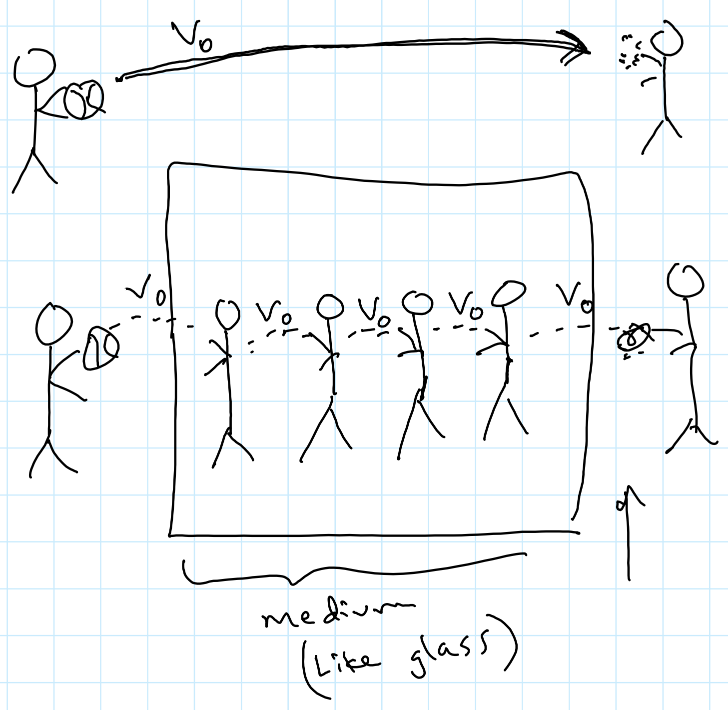
$$V_{air} > V_{glass} \qquad \theta_2 > \theta_i$$

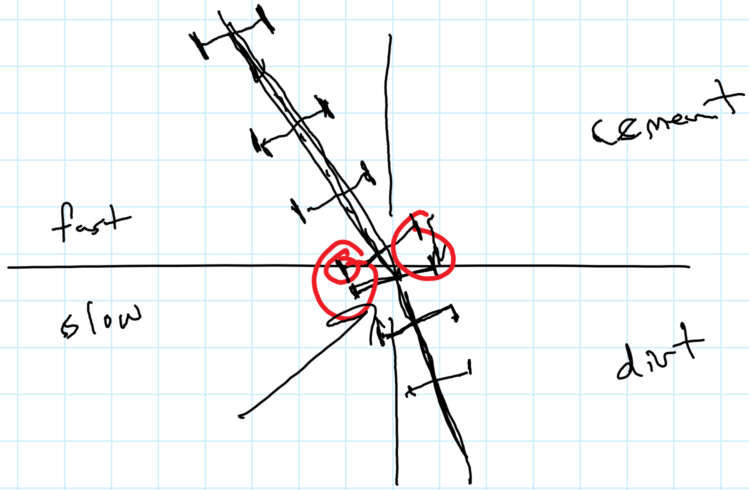
Snell's Law: $n_1 \sin\theta_1 = n_2 \sin\theta_2$

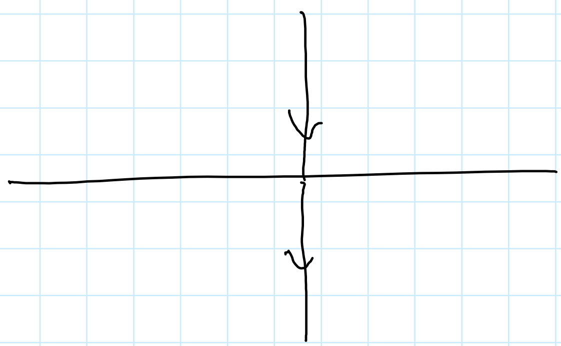
index of refraction: $n = \dfrac{\text{speed of Light in vacuum}}{\text{speed of light in medium}}$

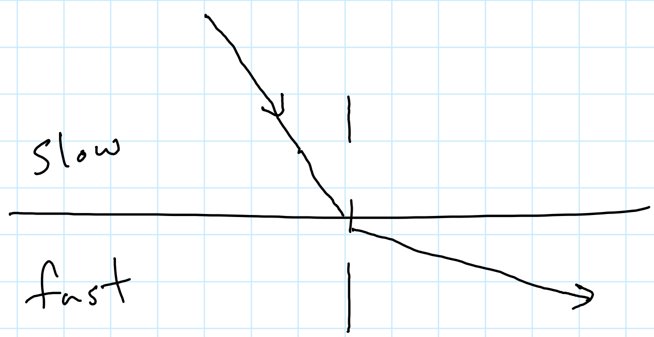
$$n \geq 1$$

why:

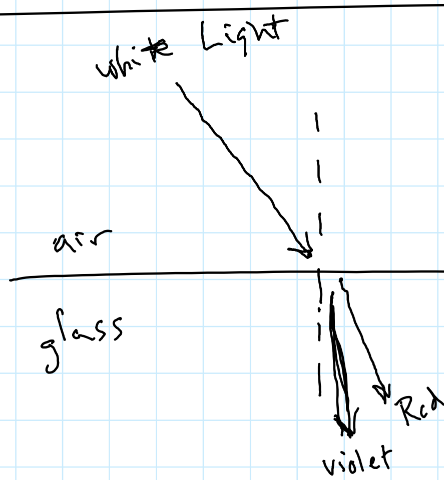



cement
fast
slow
dirt

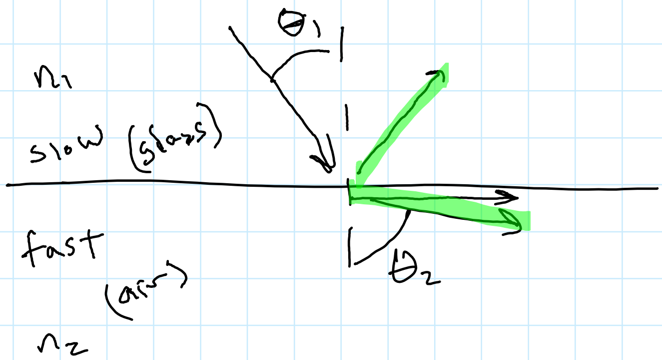



Slow
fast

Dispersion:


white Light
air
glass
Red
violet

Total internal reflection:

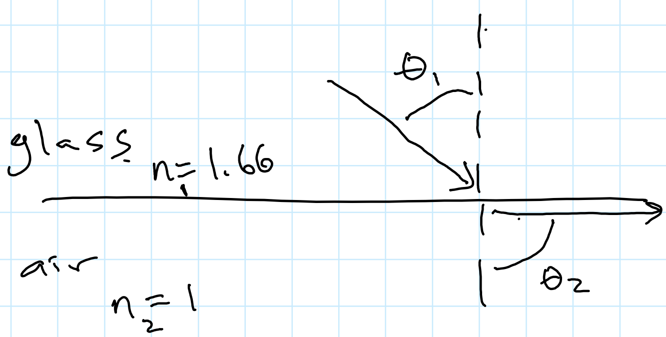


$$n_1 \sin\theta = n_2 \sin\theta_2$$

$$n_1 > n_2$$

when θ_2 gets to 90°
you no longer get transmission,
only reflection

Example:



find θ_1, such that we get total internal reflection

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

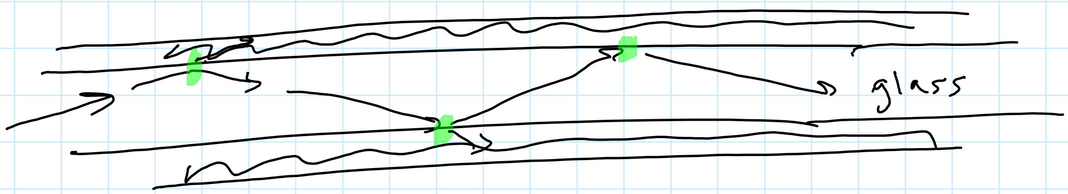
$$\theta_2 \to 90^\circ$$

$$\sin\theta_1 = \frac{n_2}{n_1} \cancel{\sin 90^\circ}^{1}$$

$$\theta_1 = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$

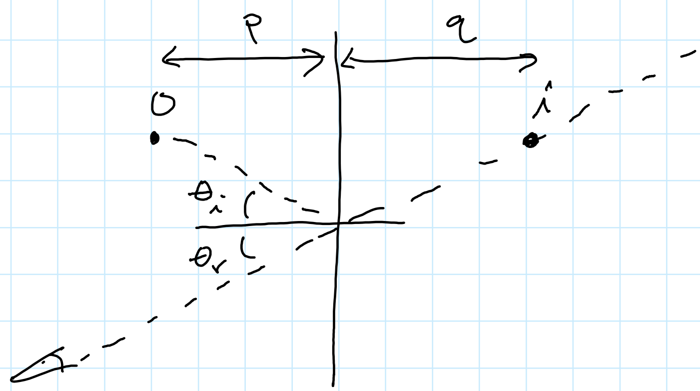
$$= \sin^{-1}\left(\frac{1}{1.66}\right)$$

any θ_1 larger than ↑ will be internally reflected



Mirrors:

Flat



$$\theta_i = \theta_r$$

$$M = \frac{h'}{h}$$

h': height of image

h: height of object

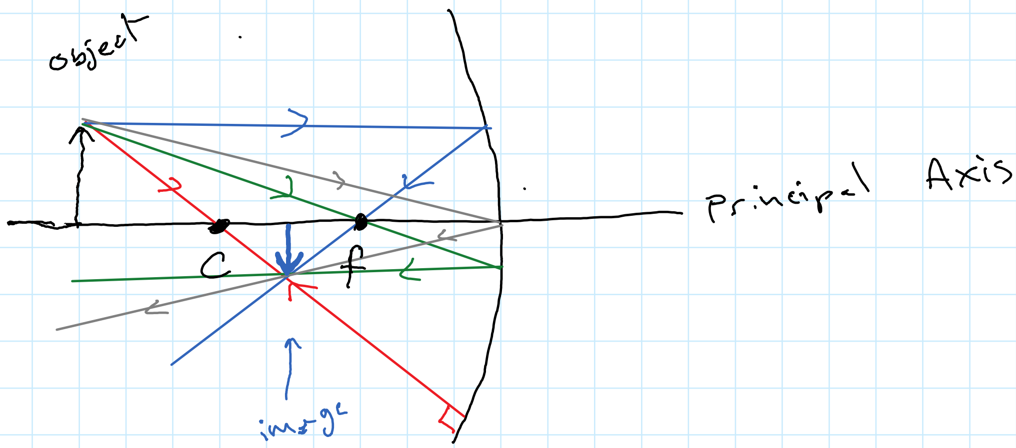
Flat mirror $\quad p = q$

$M = 1$

$h' = h$

Spherical Mirrors:

Concave:



$C = R =$ radius of curvature

$f = \frac{C}{2} = \frac{R}{2}$

Ray tracing:

1) In through C → out through C (red)
2) In parallel → out through f (blue)
3) In through f → out parallel (green)
4) Hits mirror at principal axis → out with same angle (gray)

mirror equation: $\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$

use $p = 9$

$c = 6$

$f = 3$

$h = 2$

$$\frac{1}{9} + \frac{1}{q} = \frac{1}{3}$$

$$q = \frac{9}{2}$$

$$M = \frac{h'}{h} = -\frac{q}{p}$$

$$M = -\frac{\frac{9}{2}}{9} = -\frac{1}{2}$$

inverted