

① Phys 2426 2016-11-17 Lec 25

No Class Next Week - Reading Days

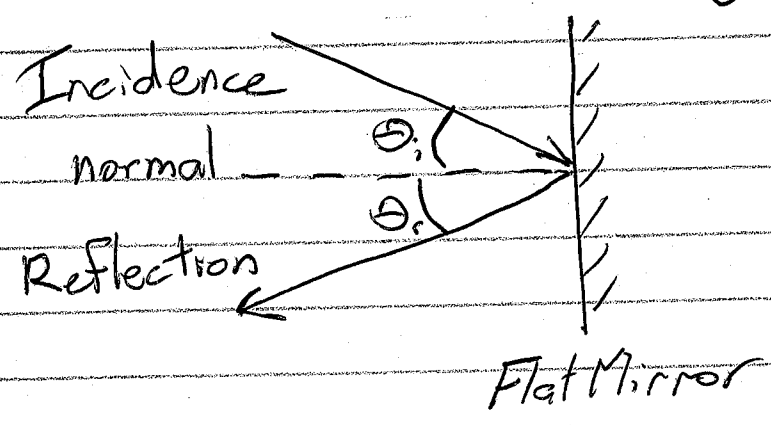
Office Hours: Mon 1-3 (Usual)
Tue 11-5 (Text or Email or Chat)

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361-445-4602

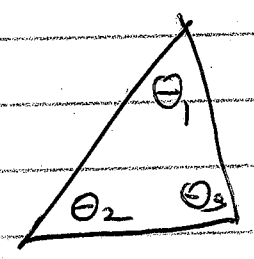
Suggested App: www.camscanner.com from INTSIG
Makes nice PDF's from camera.

Final: Tue 12/13 11am

Reflection - Bouncing waves off a surface

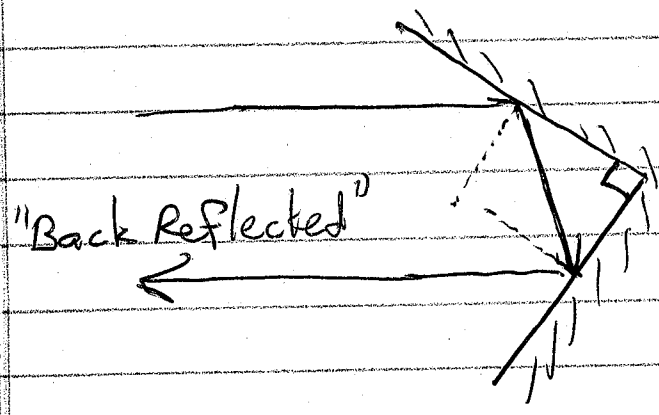


$$\theta_i = \theta_r$$



Cubic Reflector

$$\theta_1 + \theta_2 + \theta_3 = 180$$



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Refraction - Bending due to slowing

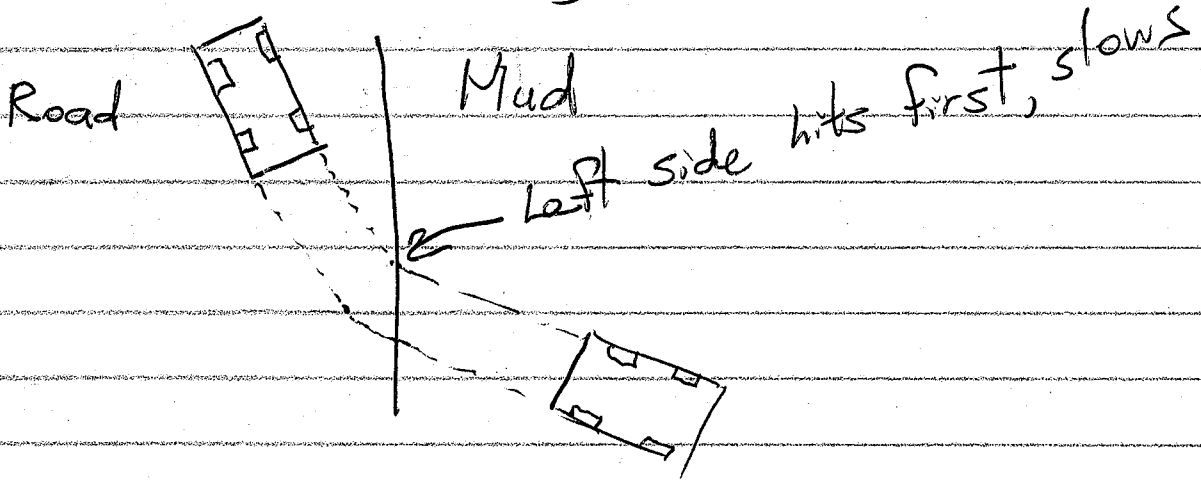
Speed in material $v = \frac{c}{n}$

Ex: $n_{air} = 1.0003$

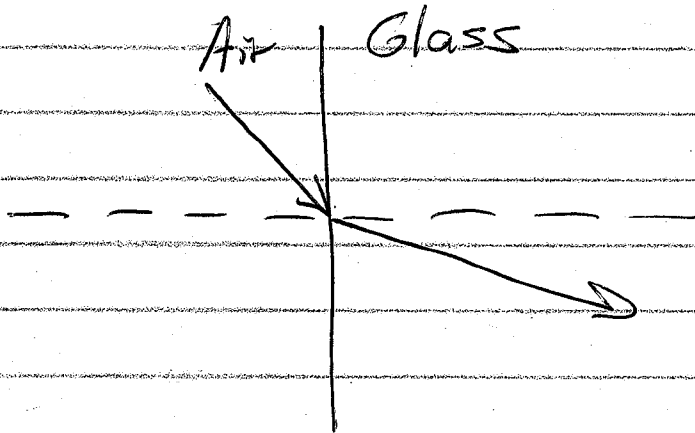
$$v = \frac{3 \times 10^8}{1.0003} = 3 \times 10^8 \text{ m/s}$$

off by 0.03%

Side-Effect: Bending



Air Glass



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

③

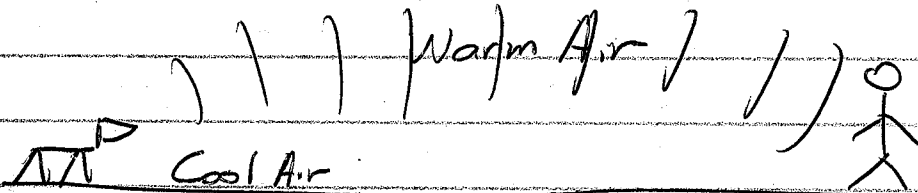
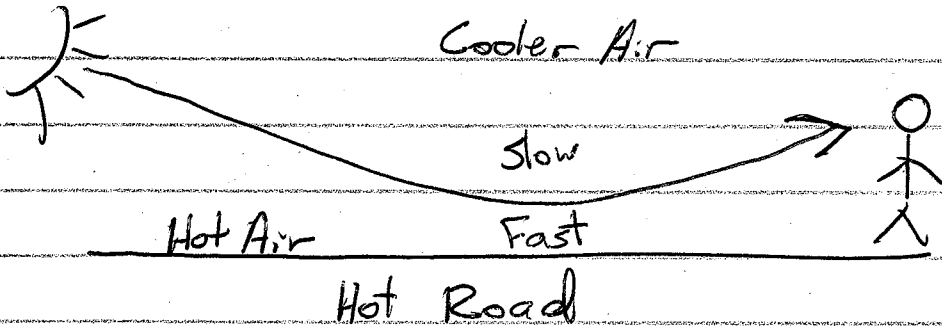
Total Internal Reflection

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

$\sin \theta_2$ must be ≤ 1

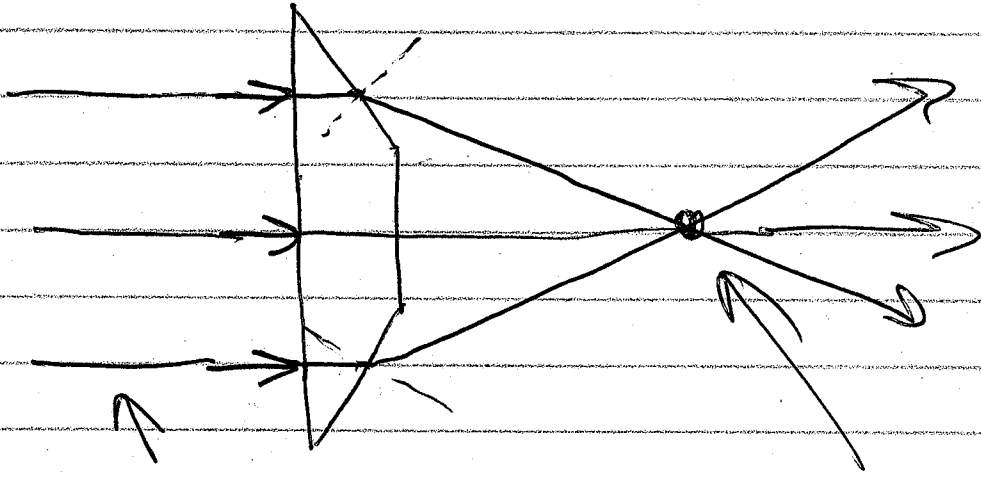
Try to make $\sin \theta_2 > 1$, no refraction.

Refraction in Air

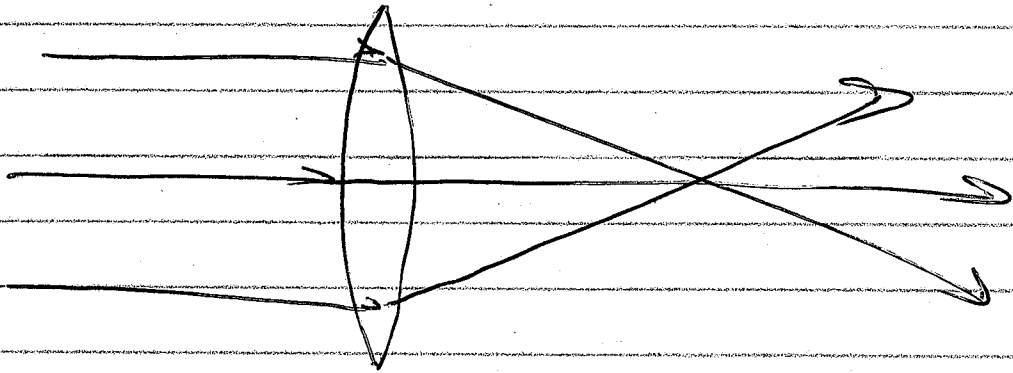


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Lenses Use Refraction



Parallel Rays Meet at Focal Point



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Lens/Mirror Egn

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

d_o = object - lens distance

d_i = image - lens distance

f = focal length of lens

$$M = -\frac{d_i}{d_o} = \frac{h_i}{h_o}$$

d_i = negative

Virtual Image
Upright

If f is positive

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$

$$\frac{1}{d_o} = \frac{1}{f} - \frac{1}{d_i}$$

↑
positive

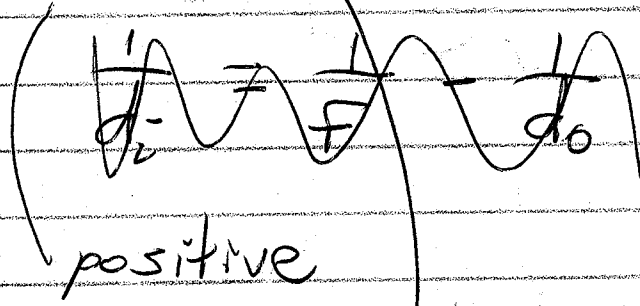
↑
bigger

↓
smaller

$d_i > f$ if positive

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$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$



positive for
converging

If negative, "loses" to $\frac{1}{d_o}$

$$\left| \frac{1}{d_o} \right| > \left| \frac{1}{d_i} \right|$$

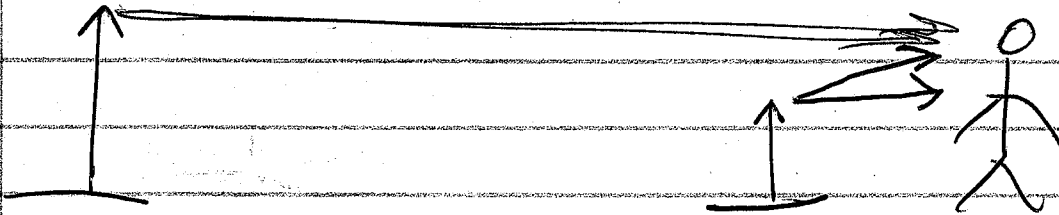
$$|d_o| < |d_i|$$

Virtual Image from
converging lens
is magnified

②

Vision Correction

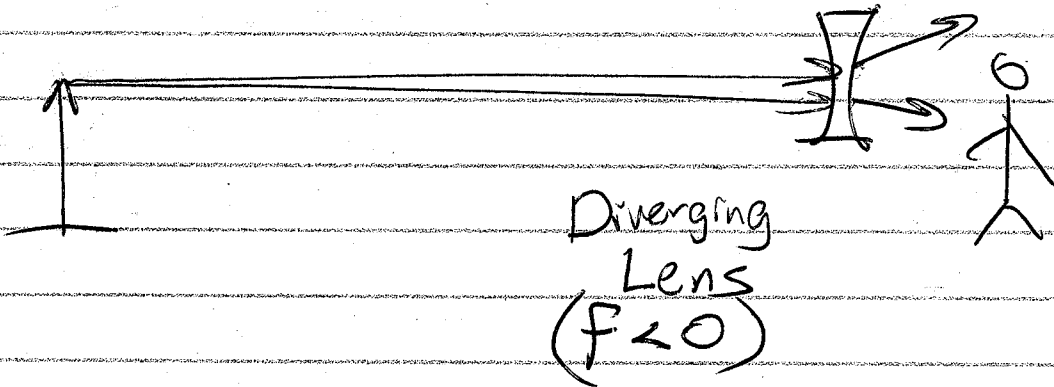
Nearsighted - can only see nearby objects



Far object
Rays Diverge
Weakly

Near Object
Rays Diverging Rapidly

Corrected



$$\text{Lens Power} = \frac{1}{f}$$