

① Phys 1402 2016-11-17 Lec 25

No class Next week - "Reading Days"

Office Hours: Mon 1-3 (Usual)

Tue ~~11-12~~ ~~12-1~~ 5 Text me or email!

Wed Avoid.

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Google: jspirko@tamucc.edu

Suggest: CamScanner INTSIG

Polarizers: Unpolarized Light

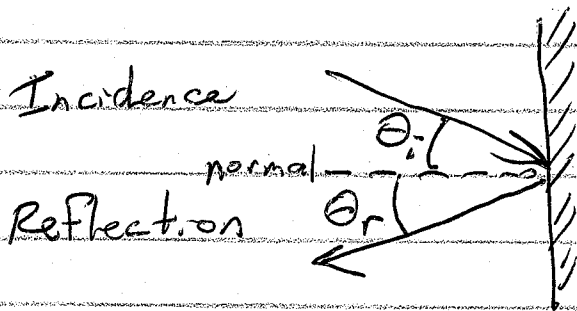
$$I = \frac{1}{2} I_0$$

Polarized Light

$$I = I_0 \cos^2 \theta$$

θ = angle between light's polarization and polarizer's polarization.

Reflection - Bouncing waves off a surface.

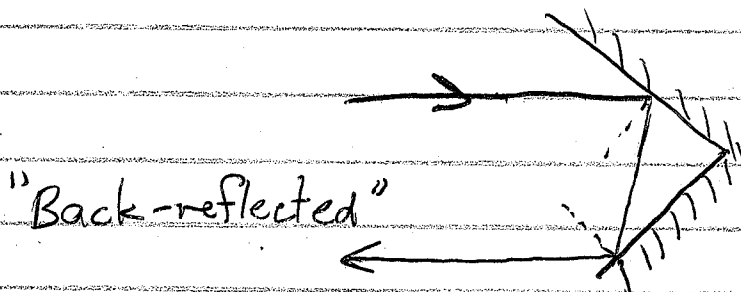


Also:

Triangle Angles Add to 180°

Flat mirror

Ex: Cubic Reflector



"Back-reflected"

②

Refraction - Bending of waves due to slowing.

Speed in material $v = \frac{c}{n}$ $c = 3 \times 10^8 \text{ m/s}$

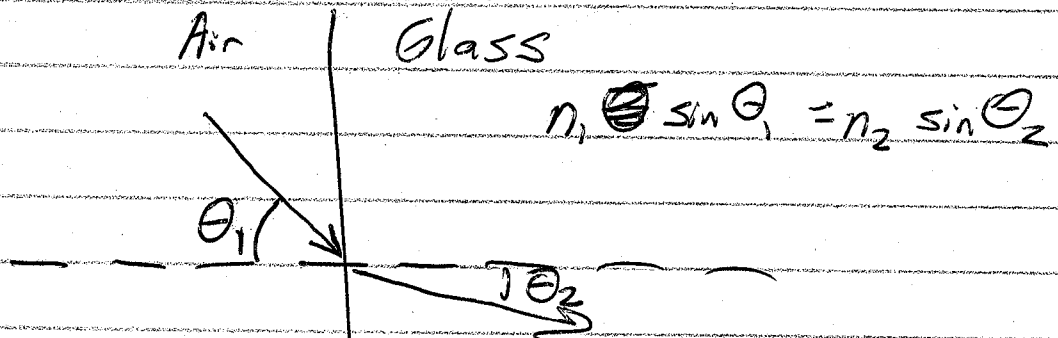
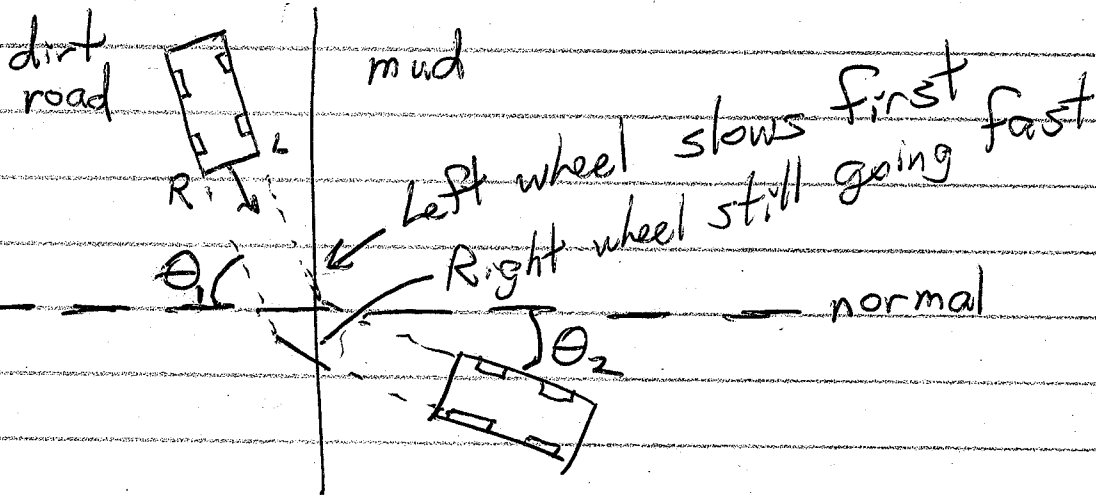
Ex: $n_{\text{water}} = 1.33$

$$v = \frac{3 \times 10^8}{1.33} = 2.25 \times 10^8 \text{ m/s}$$

$n_{\text{air}} = 1.0003$

$$v = 3 \times 10^8 \text{ m/s} \text{ (only } 0.03\% \text{ error)}$$

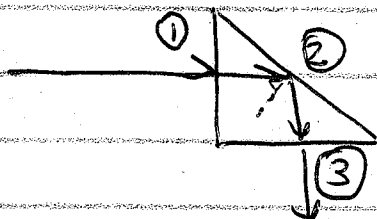
Effect: Bending



Bending is "Away from faster medium"

3

Total Internal Reflection



① Some glare, no bending, light slows.

② Try refraction

$$n_1 = 1.5 \text{ (Glass)} \quad \theta_1 = 45^\circ$$

$$n_2 = 1.0 \text{ (Air)}$$

$$n_1 \sin \theta_1 = 1.5 \sin 45^\circ = 1.06$$

$$1.06 = n_2 \sin \theta_2$$

$$1.06 = \sin \theta_2$$

No valid θ_2 , no refraction

At ② Light is reflected.

③ Some glare, no bending, light speeds up.

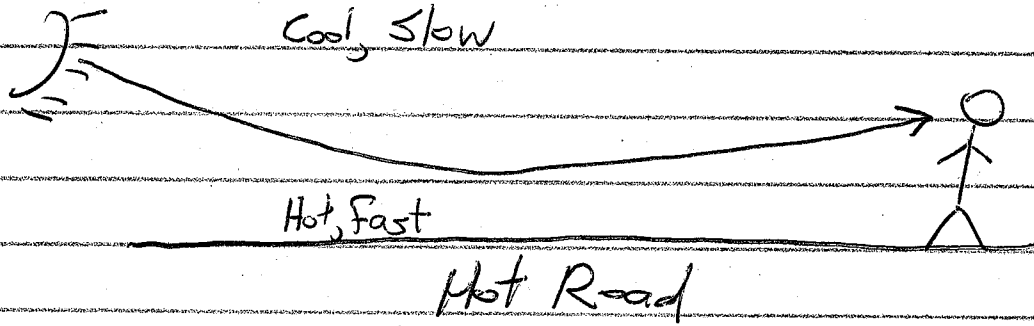
The "critical angle" is the θ_1 that makes $\sin \theta_2 = 1$

$$n_1 \sin \theta_c = n_2$$

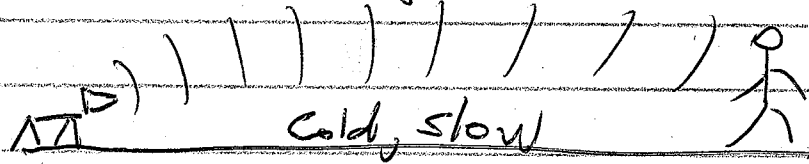
Used in jewelry, fiber optics.

4)

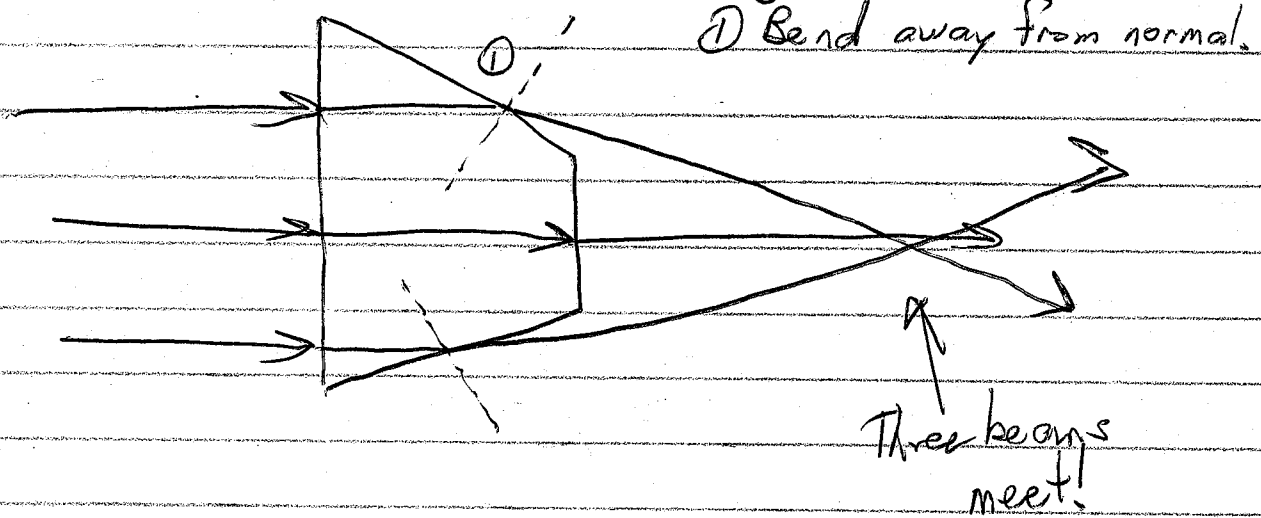
Refraction in Air



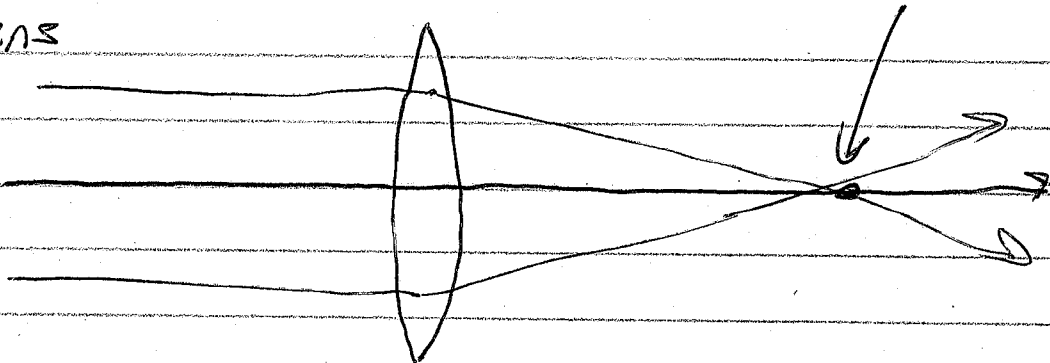
Sound in cooler weather



Consider a trapezoid block of glass:



Lens



⑤

Lens Equation

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

d_o = object-lens distance

d_i = image-lens distance

F = focal length of lens

d_i negative \rightarrow Virtual Image

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