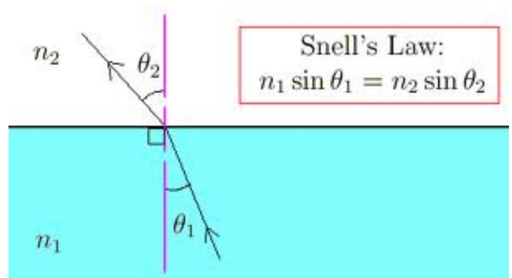
Chapter 26/27 Review

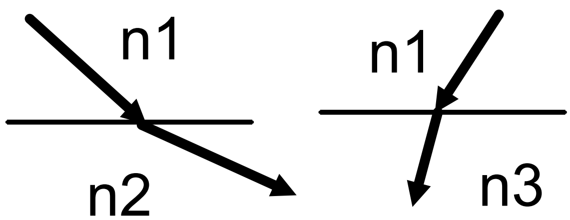
Refraction

- $n_1 \sin\theta_1 = n_2 \sin\theta_2$ = Snell's Law
- due to diff n's = diff speeds
- f remains constant
- $\lambda_{med} = \lambda_{vac}/n$, $v_{med} = c/n$
- BIG n = slower



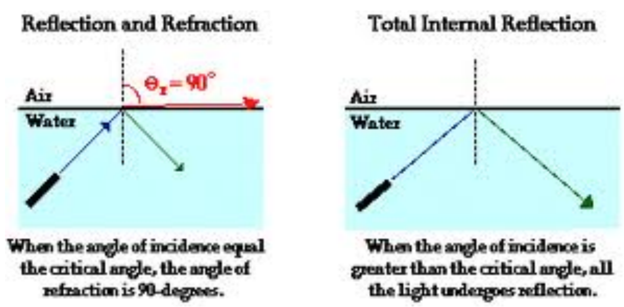
- if n → **n** = towards normal
- if **n** → n = away from normal

bigger difference in n = more bending

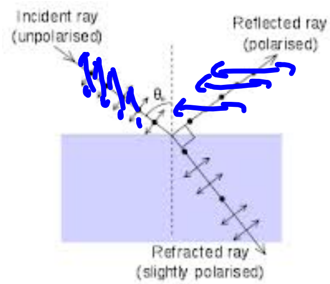


Critical Angle

- > must be BIG n to small n
- > $\theta_c = \sin^{-1}(n_2/n_1)$
- > $\theta_2 = 90^o$
- > Causes total internal reflection



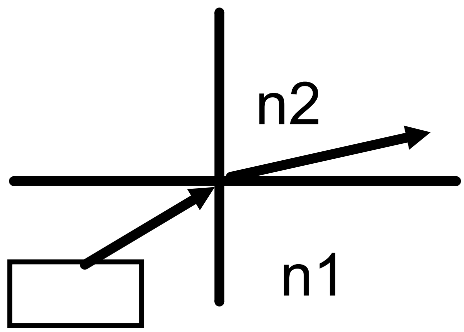
Brewster's Angle



- $\tan\theta_B = (n_2/n_1)$
- causes light to be polarized parallel to surface
- reflected and refracted rays at 90^{o}

Apparent Depth

> $d' = d(n_2/n_1)$



Lenses

Rules:

1) $f_1 \rightarrow \parallel$

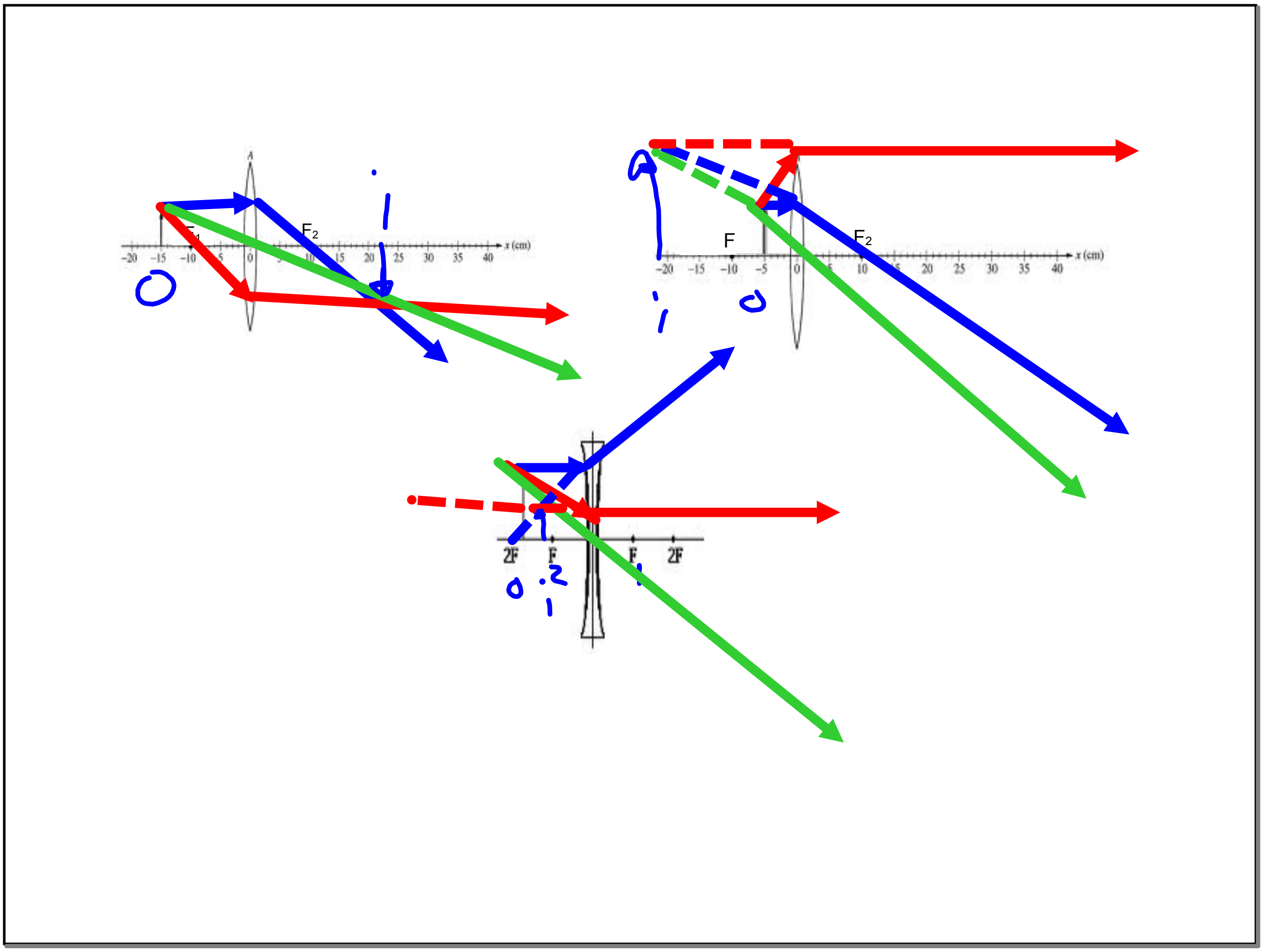
2) $\parallel \rightarrow f_2$

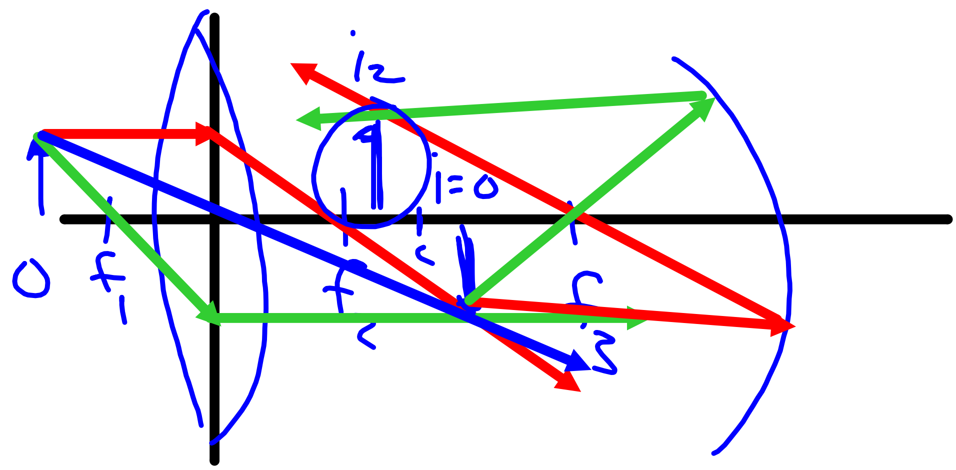
3) center → straight

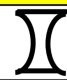
Equations:

1/di + 1/do = 1/f

m = -di/do = hi/ho


F
F2
x (cm)
-20
-15
-10
-5
0
10
15
20
25
30
35
40
2F
F
F
2F


i2
I=O
O
f1
f2
C
i3

convex lens	concave lens
	
+ f	- f
real or virt	virt only
any size	demag only
mag virtual	

Eyes

- Nearsighted
  - > long eye
  - > concave lens
  - > image in front of retina

- Farsighted
  - > short eye
  - > convex lens
  - > image behind retina

dispersion - separation of colors due to different n's (prisms, rainbows)

Problems with lenses

1. spherical aberration = separation of rays due to edges thinner
2. chromatic aberration = colors not coming together after passing through due to differen't n's

Diffraction

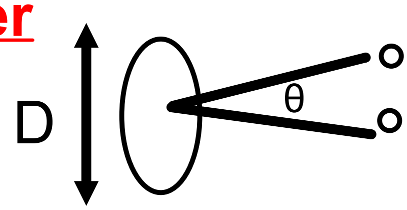
- Bending due to barrier
- λ ≤ barrier
- for same barrier, ↑λ = more diffraction
- for same λ, smallest barrier = more diffraction

Interference

<table>
<tr><th>double slit</th><th>single slit</th><th>DG</th><th>Thin Film</th></tr>
<tr><td>$d\sin\theta = m\lambda$ (max)</td><td>$W\sin\theta = m\lambda$ (min)</td><td>$d\sin\theta = m\lambda$ (max)</td><td>reflection
n → N
= 1/2λ shift</td></tr>
<tr><td>$d\sin\theta = (m+1/2)\lambda$ (min)</td><td>$W\sin\theta = (m +1/2)\lambda$ (~~min~~) (max)</td><td>$d\sin\theta = (m+1/2)\lambda$ (min)</td><td>reflection
N → n
= no shift</td></tr>
<tr><td colspan="3" rowspan="2">Max = bright = "see" light = 1λ = 2π = 360°

Min = dark = "don't see" light = λ/2 = π = 180°</td><td>n → N → n
no order = no 1/4 for min
$2tn = m\lambda$ (min)
$2tn = (m+1/2)\lambda$ (max)</td></tr>
<tr><td>n → N → N
$2tn = m\lambda$ (max)
$2tn = (m+1/2)\lambda$ (min)</td></tr>
</table>

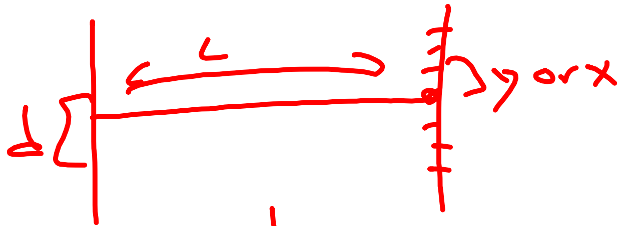
Resolving Power



$\theta_{min} = 1.22\lambda/D$

- θ in radians
- smaller λ = BETTER resolving power
- BIGGER D = BETTER resolving power

Diffraction



$\tan\theta = y/L$, $m\lambda = d\sin\theta$

$\sin\theta = \frac{m\lambda}{d}$

$y/L = \frac{m\lambda}{d}$

eq sheet $x \approx \frac{m\lambda L}{d}$

n → n → n

2tn = mλ (max)

2tn = (m+1/2)λ (min)