Physics 123 - March 6, 2013

- Exam 1 graded - stay tuned
- regrade requests
- Solutions posted
- last problem
- No problem set due next week ☹

Enjoy your Break!

Hey Dude - I'm saying the pressure is intense!

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} \rightarrow v = \frac{1}{\sqrt{\epsilon \mu}}$$

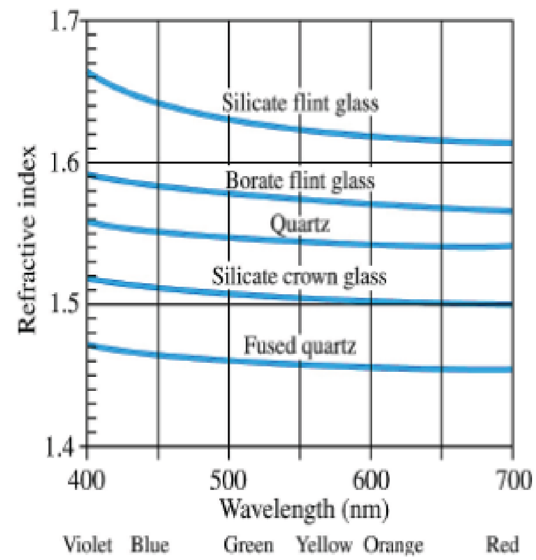
$v < c$

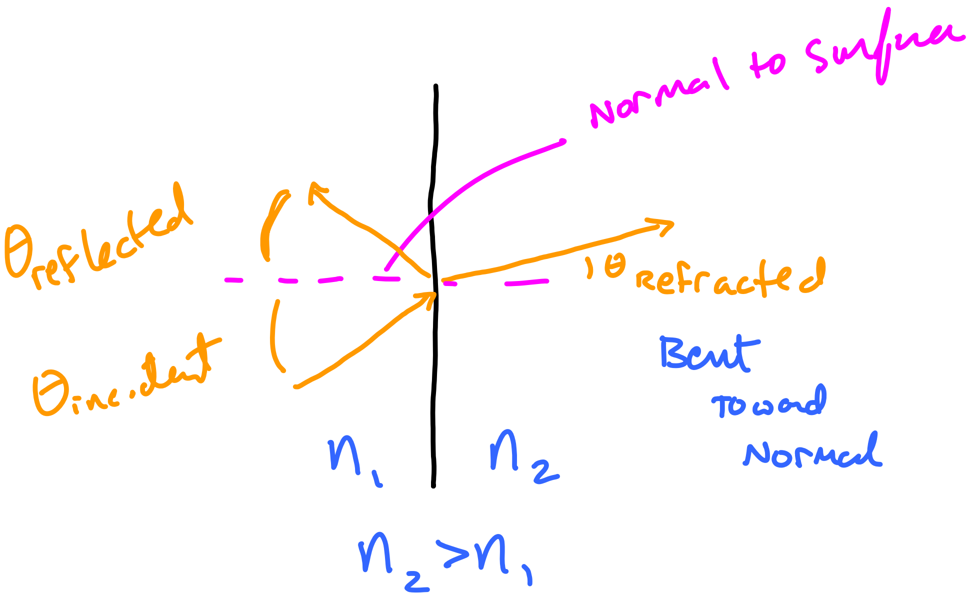
$$\frac{c}{v} \equiv n \equiv \text{index of refraction}$$

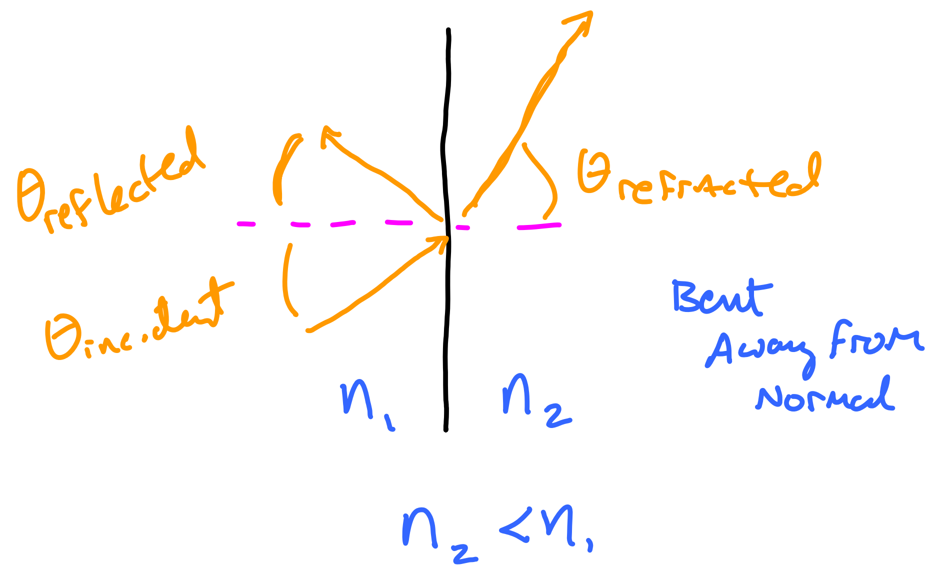
$n \geq 1$

$$\lambda n = \lambda_0$$

λ: in material; λ_0: in vacuum





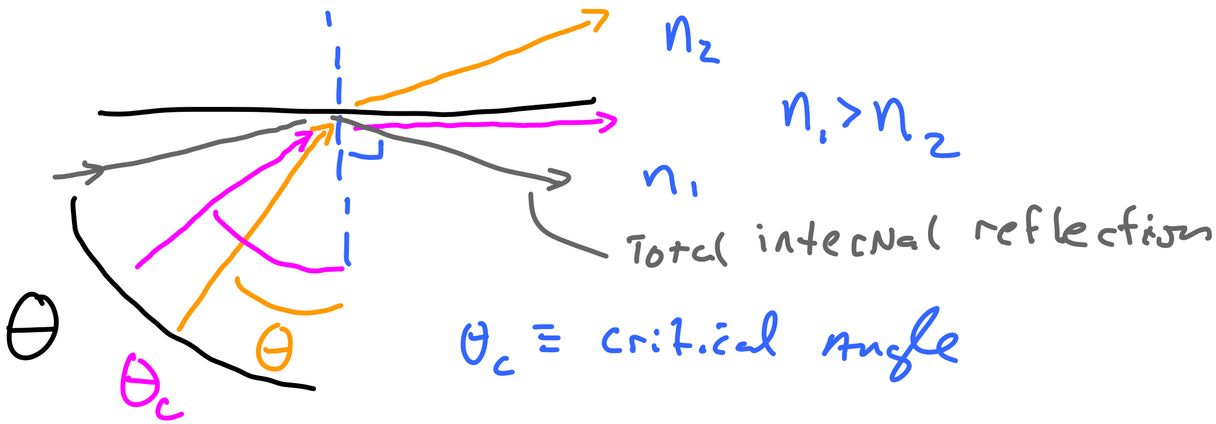


$$\theta_{reflected} = \theta_{incident}$$

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

$(1 \equiv \text{incident},\ 2 \equiv \text{refracted})$

Critical Angle

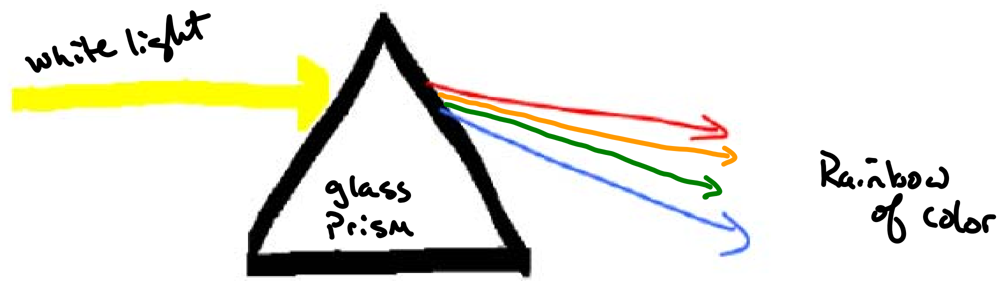


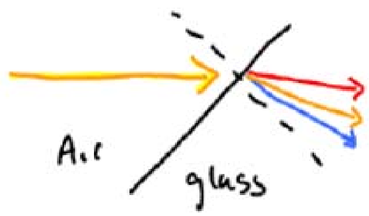
$\theta_c \equiv$ critical angle

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

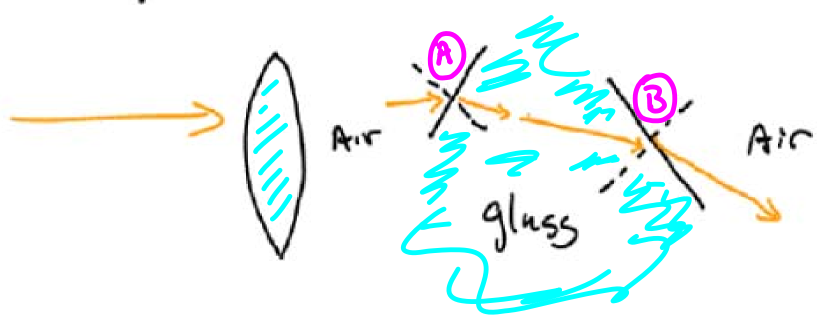
$$n_1 \sin\theta_c = n_2 \cdot 1$$

$$\sin\theta_c = \frac{n_2}{n_1}$$

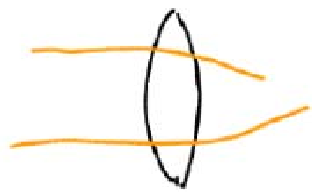




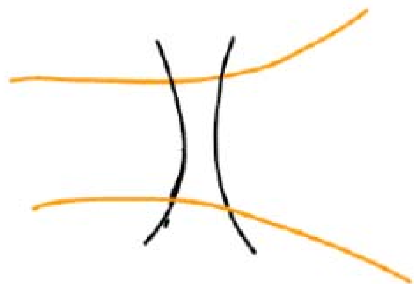
because $n_{red} < n_{blue}$
red bent less



operation of a thin convex lens

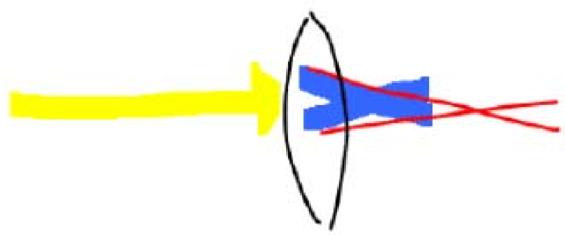


converging lens



diverging lense

abberation

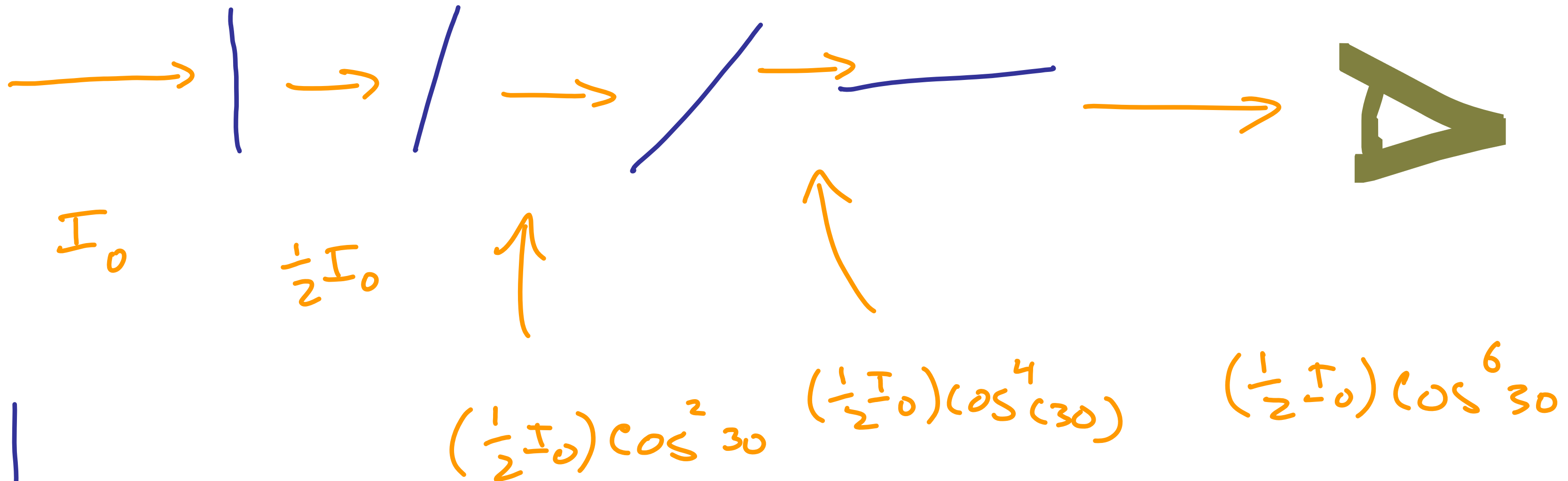


Chromatic
dispersion

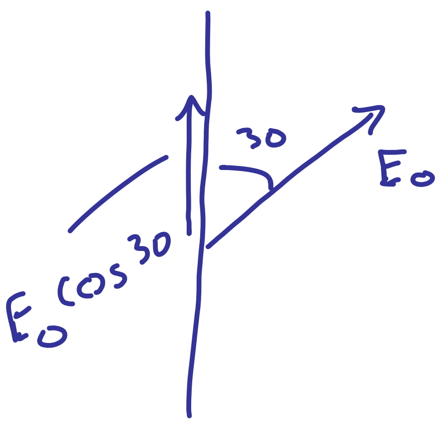
pulse broadening

Four perfectly (linear) polarizing plates are stacked So that the optical axis of each is turned 30° counterclockwise with respect to the plate above it. The percentage of incident unpolarized light that is transmitted is Approximately

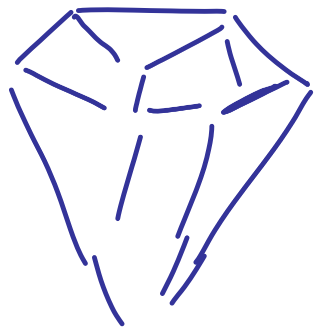
1) zero
2) 0.78%
3) 6.3%
4) 21%
5) 42%
6) 100%



I_0
$\frac{1}{2}I_0$
$(\frac{1}{2}I_0)\cos^2 30$
$(\frac{1}{2}I_0)(\cos^4(30))$
$(\frac{1}{2}I_0)\cos^6 30$



30
E_0
$E_0 \cos 30$



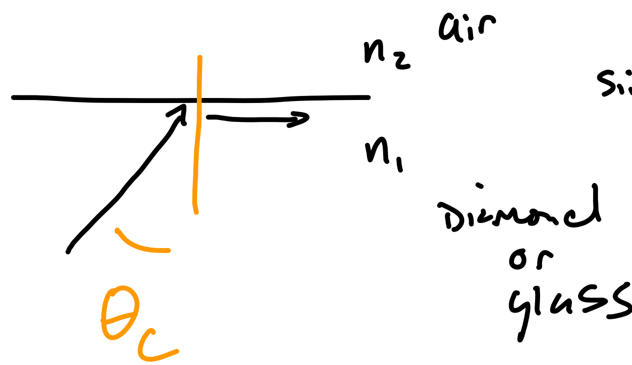
Why do Diamonds "Sparkle"

More than glass of

the same shape?

$n_{glass} \sim 1.5$

$n_{diamond} \sim 2.54$



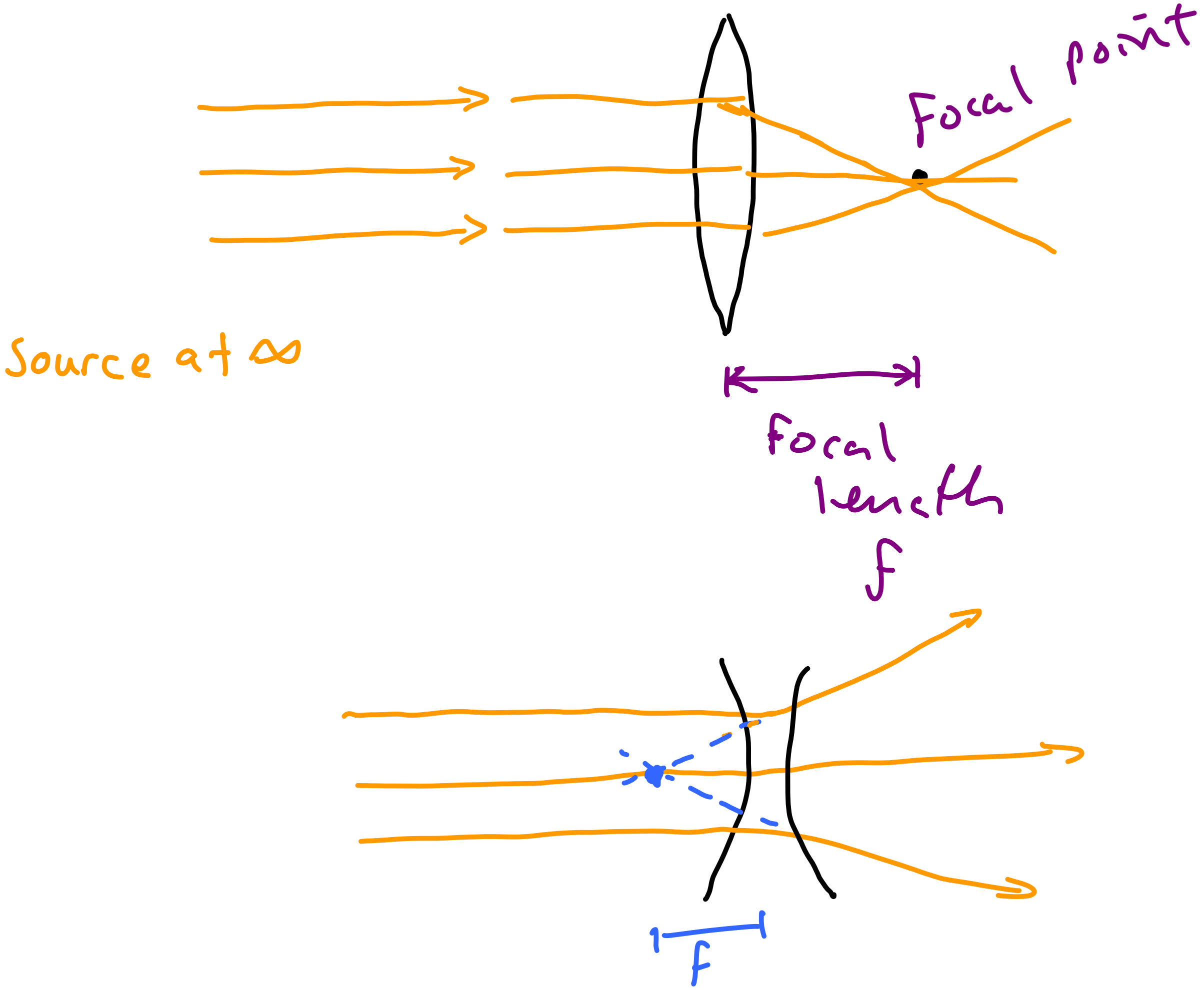
$$\sin\theta_c = \frac{n_2}{n_1}$$

Diamond

$\theta_c = 23^\circ$

glass

$\theta_c = 41^\circ$


Focal point
Source at ∞
Focal length
f
f

Thin lenses and optical instruments

SM, Phy 123, Spring 2013

References and photo sources:

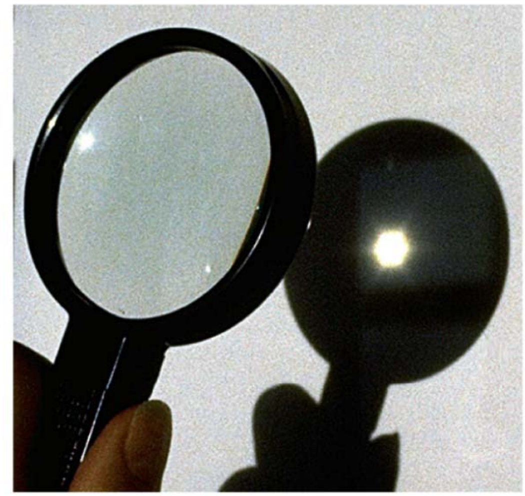
D. Giancoli, Physics for Scientists and Engineers, 3rd ed., 2000, Prentice-Hall

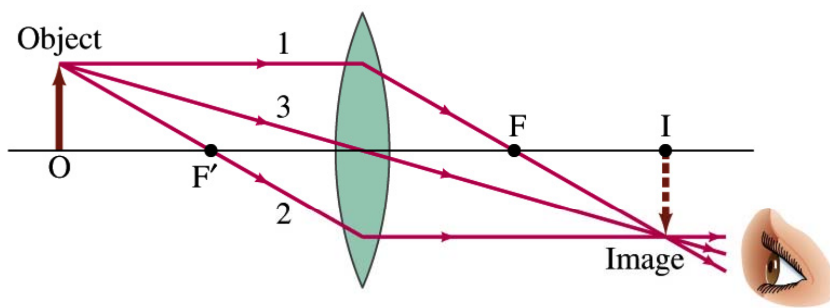
http://cvs.anu.edu.au (D. Denning and M. Kirk)

http://www.ebiomedia.com

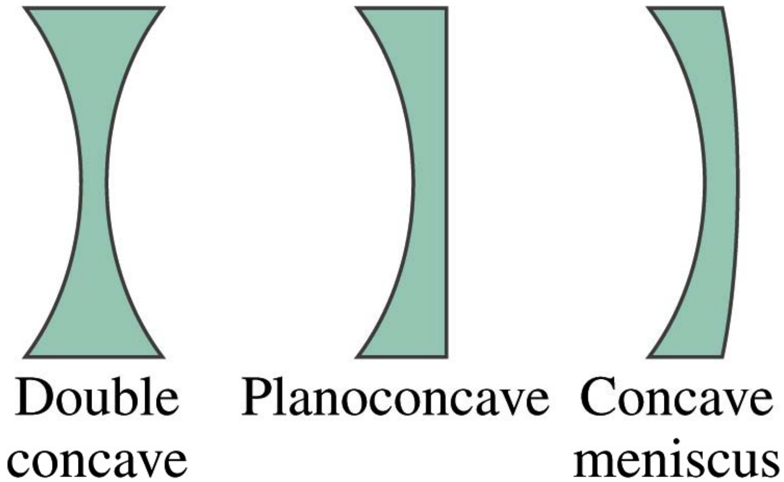
NASA

(a) Converging lenses

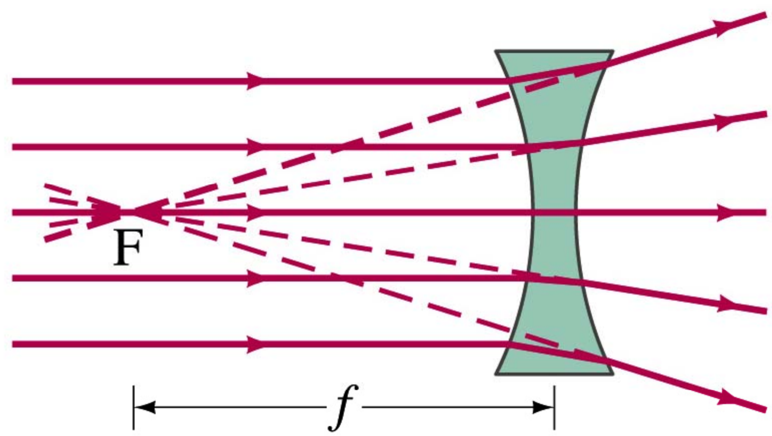


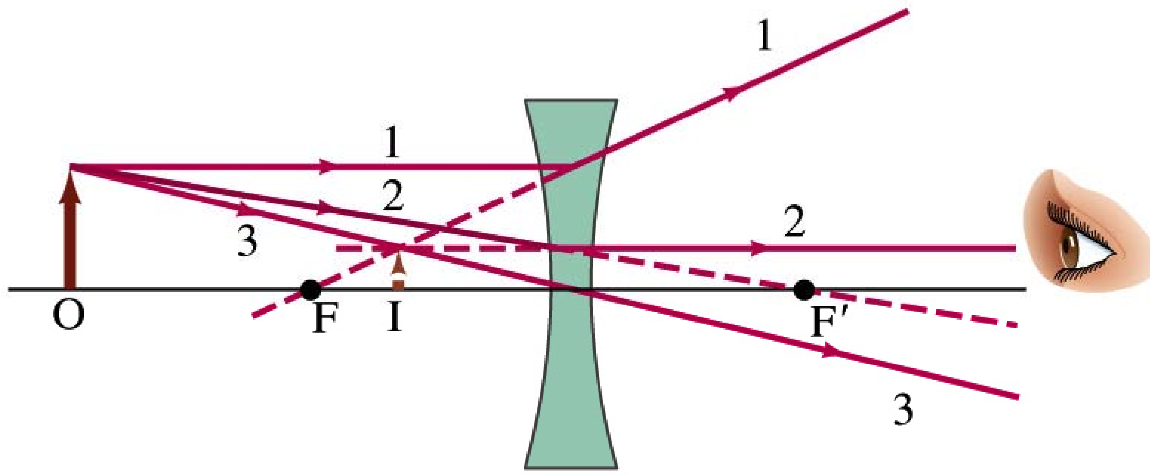


(c) Ray 3 passes straight through the center of the lens (assumed very thin).



(b) Diverging lenses

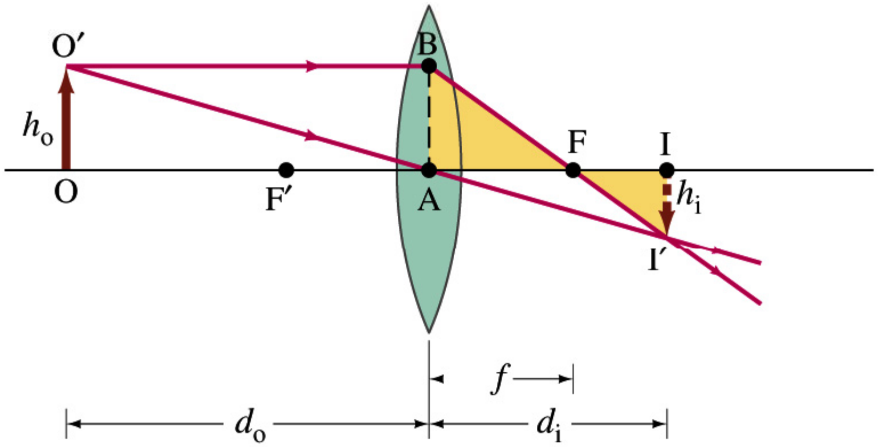



1
1
2
2
3
3
O
F
I
F′

Power of lens measured in diopters

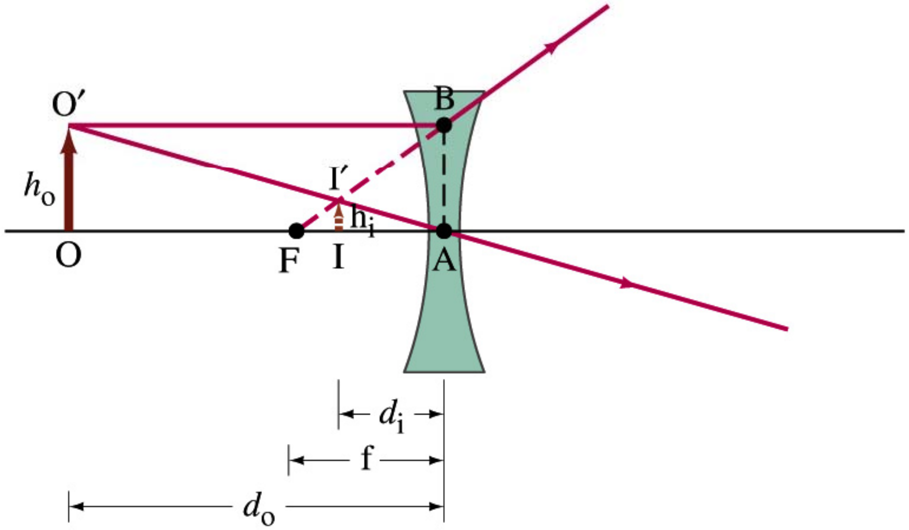
$$P = \frac{1}{f}$$ where f is focal length in meters

Power is positive for converging lenses
and negative for diverging lenses



Magnification:

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



Lens equation:

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

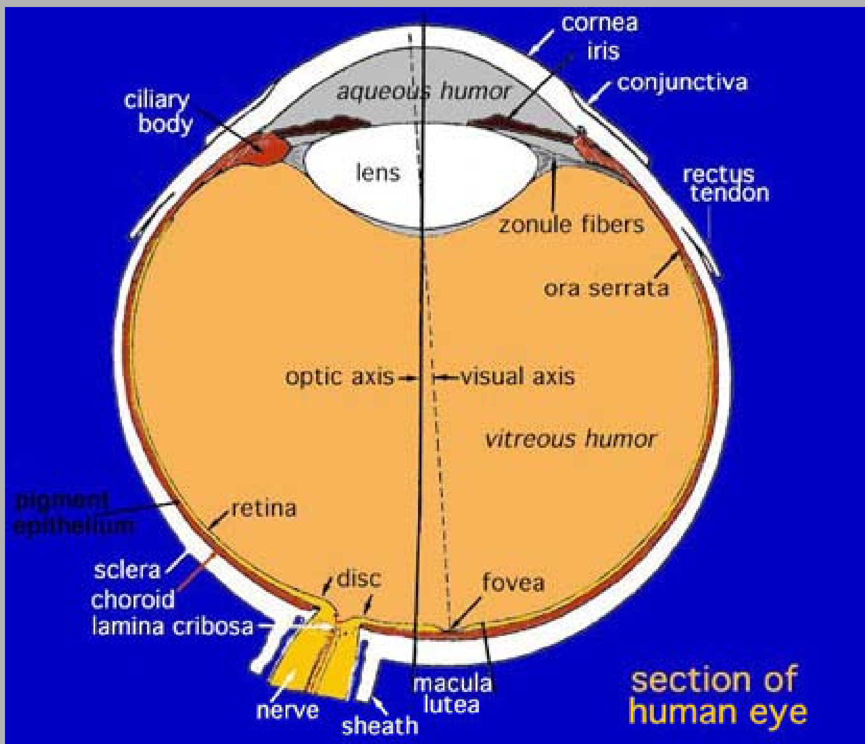
Real image: rays actually pass thru image

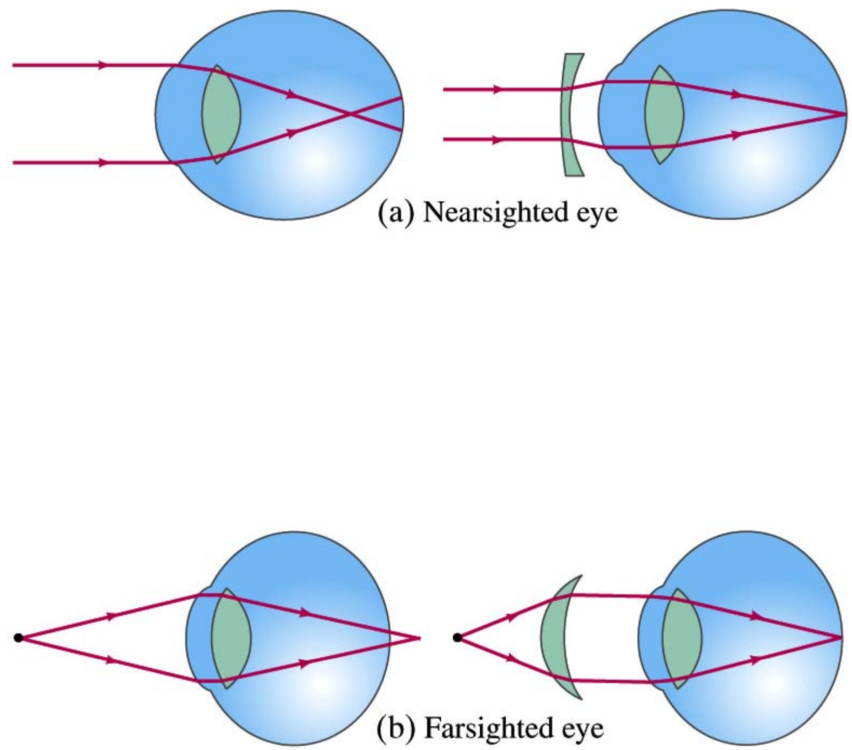
Virtual image: rays do not actually pass thru image

Sign convention is the tricky part, especially in multiple lens systems

Convention from Giancoli p. 841:

- **Focal length is + for converging lens and - for diverging lens**
- **Object distance is + if on the side of the lens from which the light is coming (usual, unless in multi-lens system)**
- **Image distance is + if on the opposite side of the lens from where the light is coming, if on same side, image distance is –**
- **Image distance is + for real images and – for virtual images**
- **Height of image is + if image is upright and – if image is inverted. Height of object is always taken to be +.**

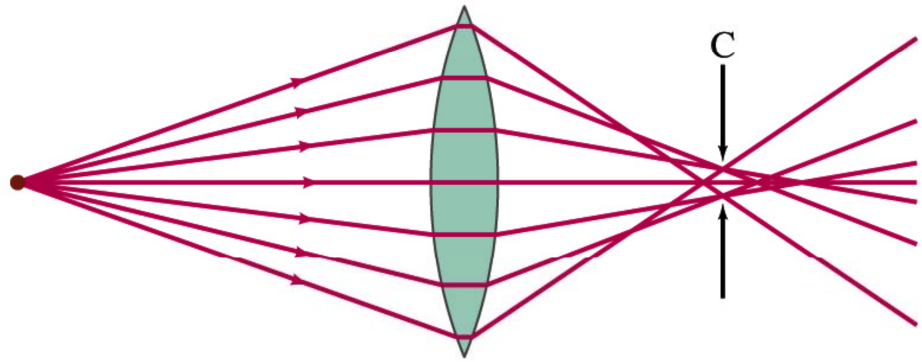




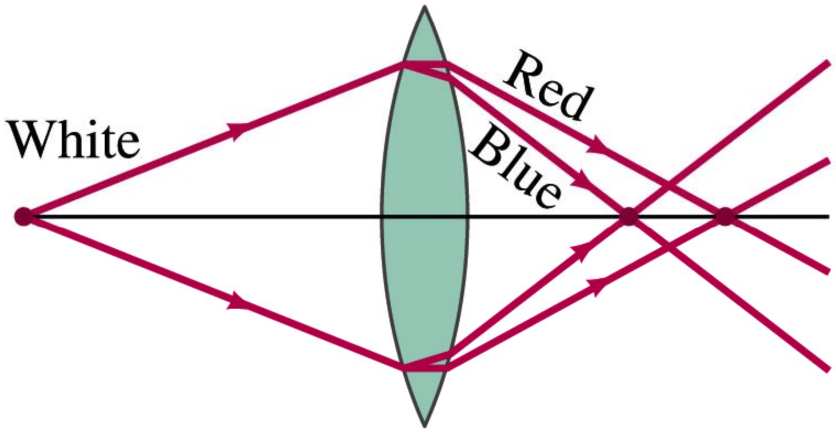
(a) Nearsighted eye

(b) Farsighted eye

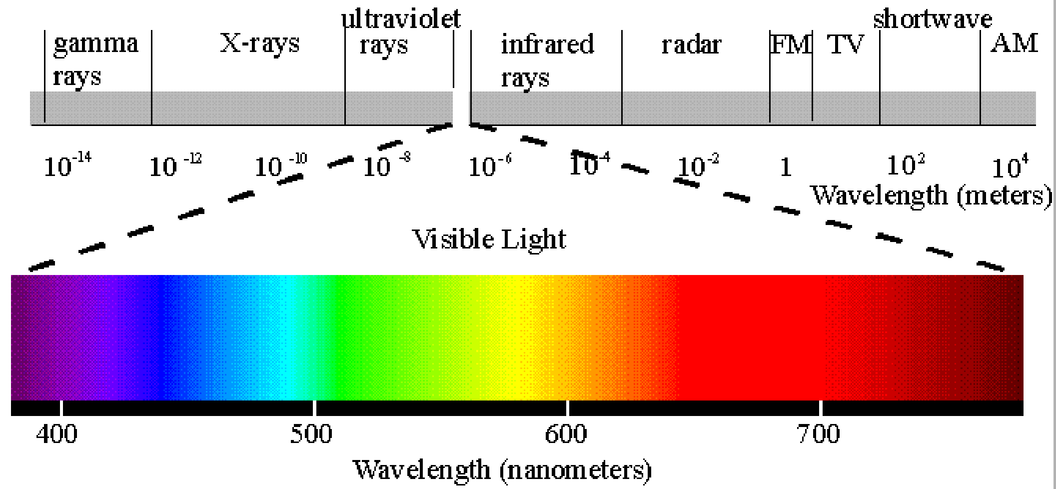
Aberrations



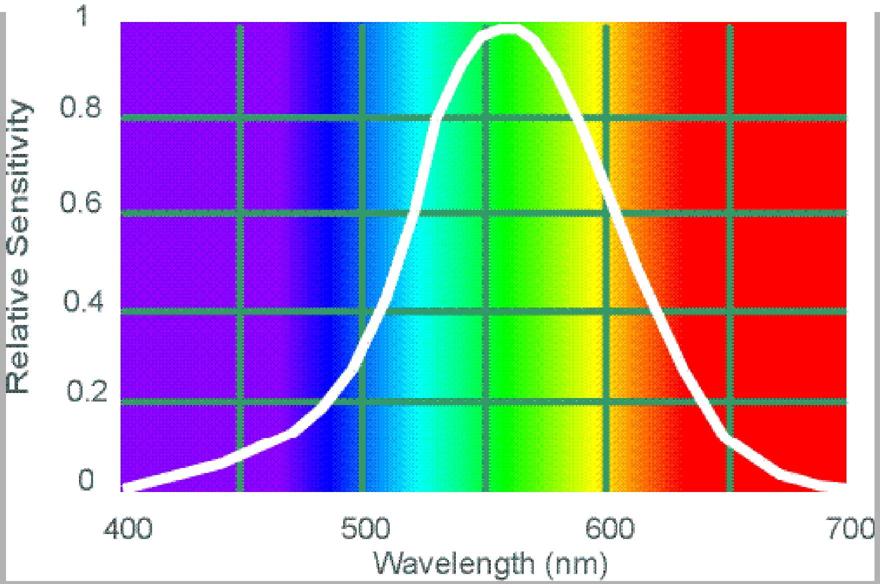
Spherical aberration

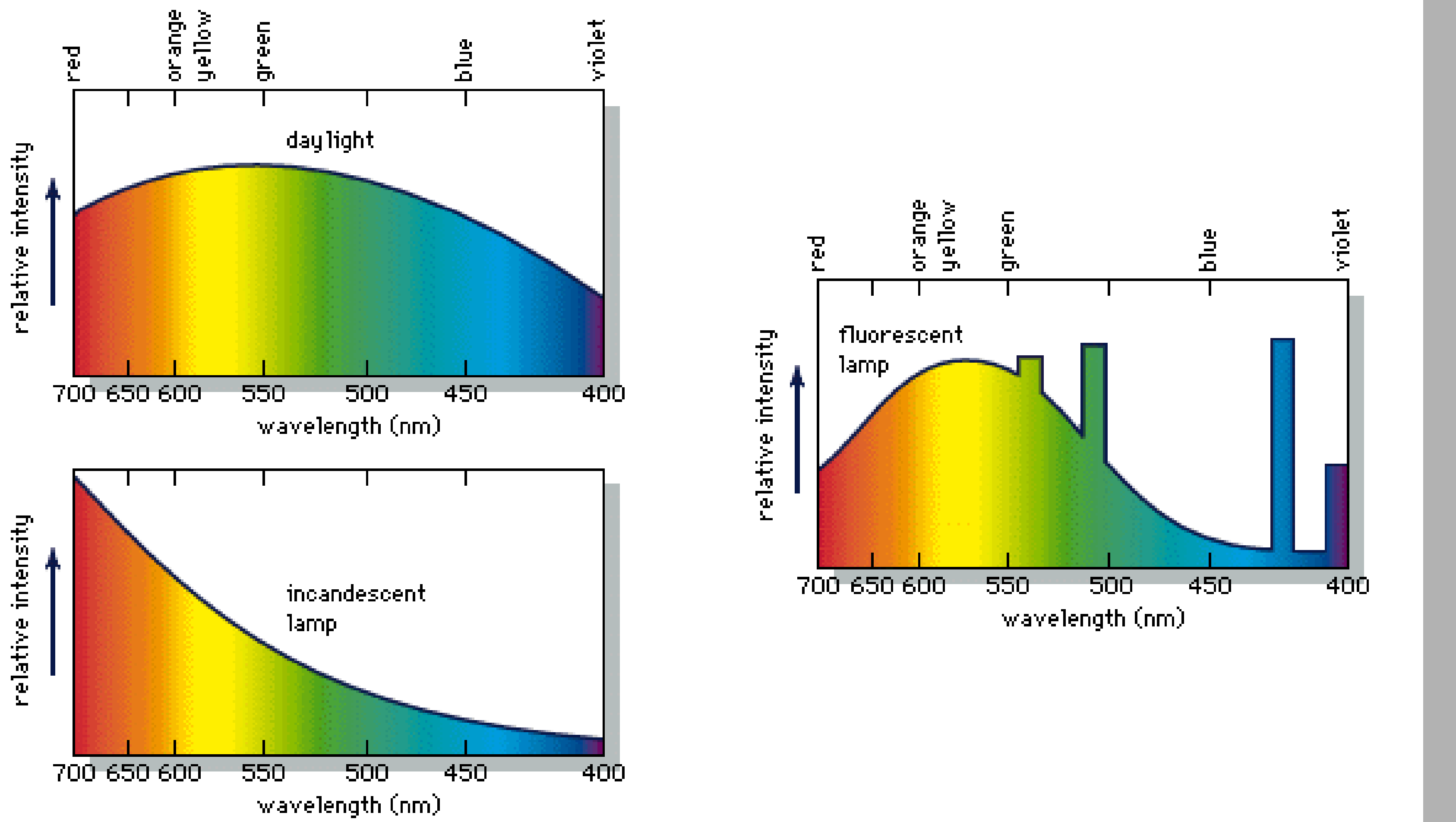


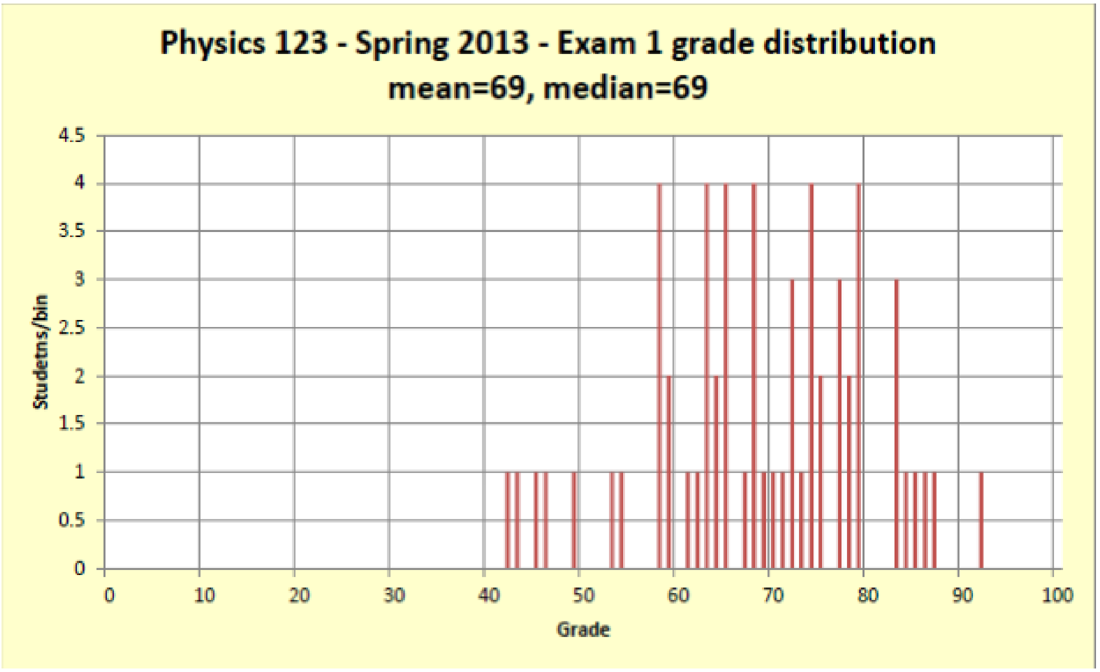
Chromatic aberration



The electromagnetic spectrum
from "The Joy of Visual Perception: A Web Book"
http://www.yorku.ca/eye/




red
orange
yellow
green
blue
violet
daylight
relative intensity
700 650 600 550 500 450 400
wavelength (nm)
incandescent
lamp
relative intensity
700 650 600 550 500 450 400
wavelength (nm)
red
orange
yellow
green
blue
violet
fluorescent
lamp
relative intensity
700 650 600 550 500 450 400
wavelength (nm)



Physics 123 - Spring 2013 - Exam 1 grade distribution
mean=69, median=69
Studetns/bin
Grade
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0
10
20
30
40
50
60
70
80
90
100