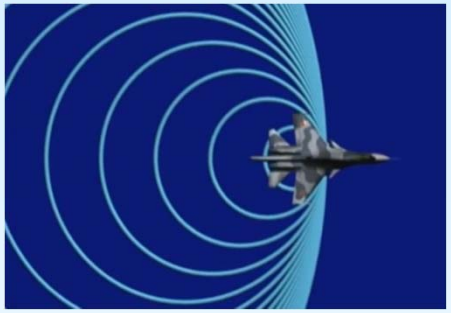
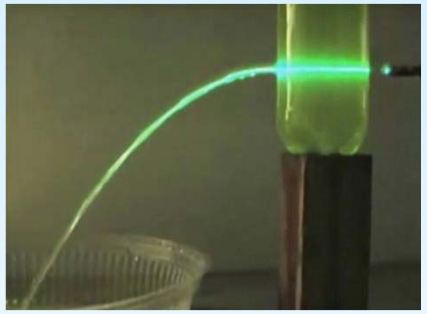
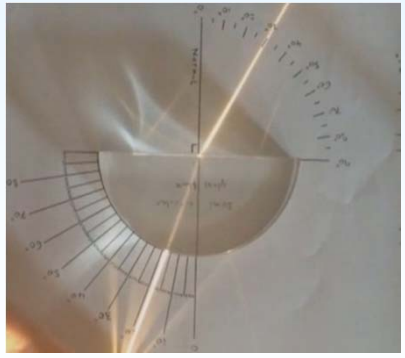
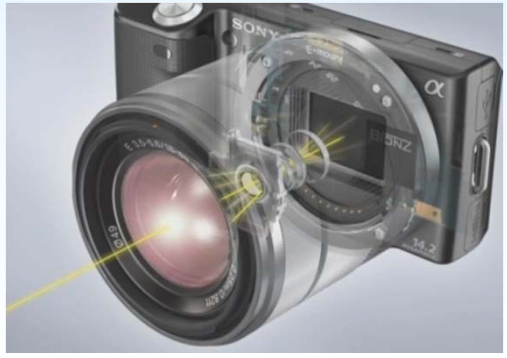
Geometrical optics

SUMMARY OF ALL SUMMARIES

SUMMARY

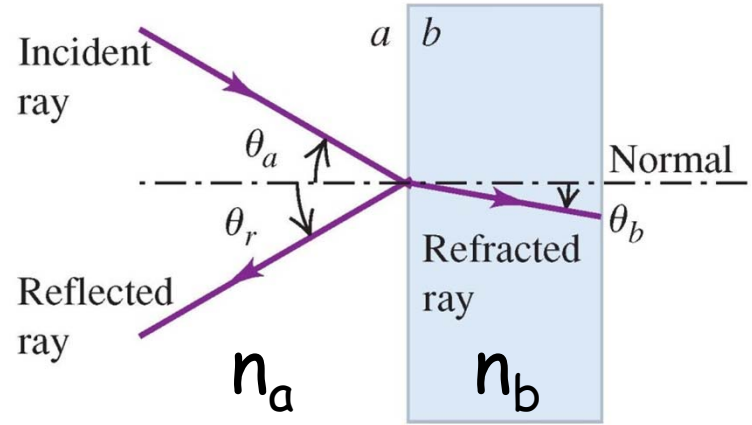
Chapter 33
The nature of light

The nature of light: Summary

Index of refraction: $n = \frac{c}{v}$

Light frequency: $f_a = f_b$

The law of reflection: $\theta_r = \theta_a$



The law of refraction: $n_a \sin\theta_a = n_b \sin\theta_b$

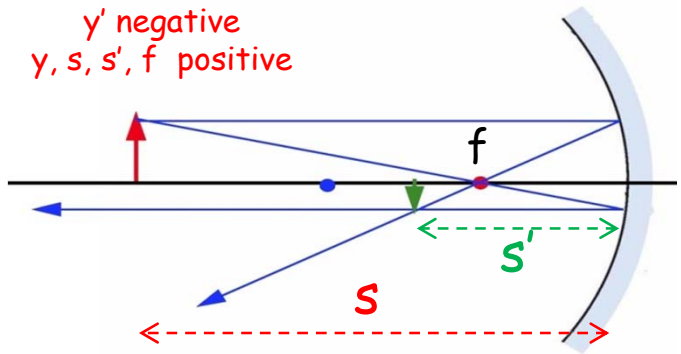
The critical angle: $\sin\theta_{crit} = \frac{n_b}{n_a}$

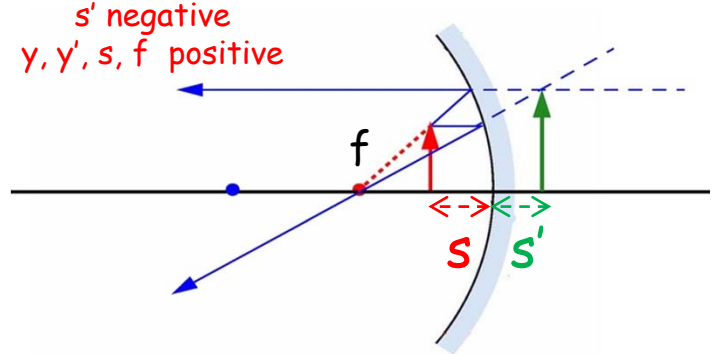
SUMMARY

Chapter 34
Geometrical optics

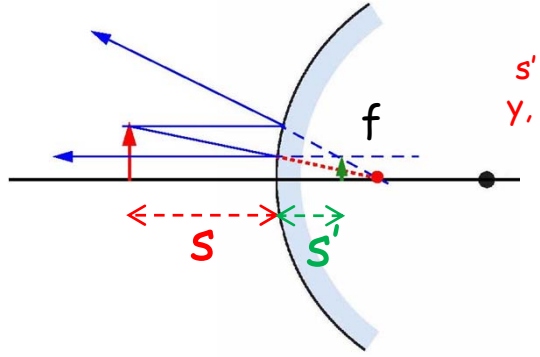
Mirrors: Ray diagrams

Concave mirror





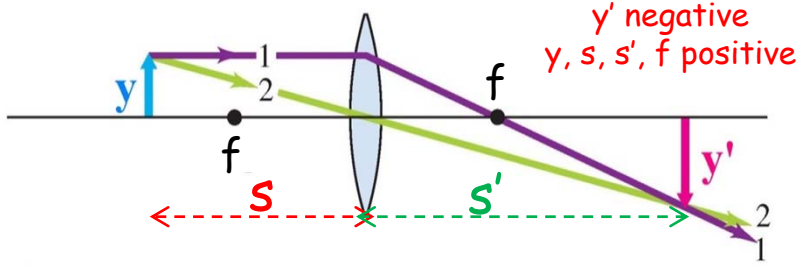
Convex mirror

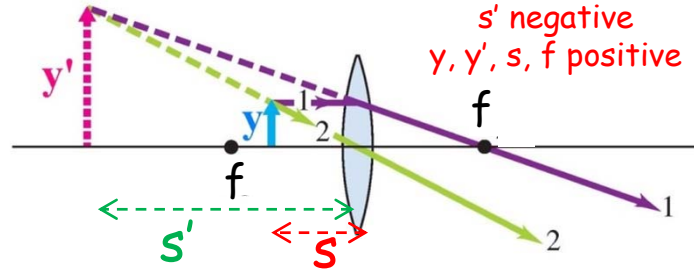


s' , f negative
y, y', s positive

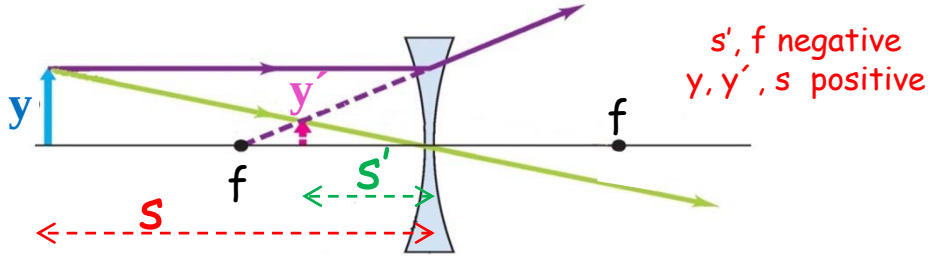
Lenses: Ray diagrams

Convex lens





Concave lens



Geometrical optics: Formulas

Concave mirror

Convex mirror

$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$$

$$m=\frac{y'}{y}=-\frac{s'}{s}$$

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

Spherical surface

$$\frac{n_a}{s}+\frac{n_b}{s'}=\frac{n_b-n_a}{R}$$

$$m=\frac{y'}{y}=-\frac{n_a s'}{n_b s}$$

Convex lens

Concave lens

$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$$

$$m=\frac{y'}{y}=-\frac{s'}{s}$$

$$\frac{1}{s}+\frac{1}{s'}=(n-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

Geometrical optics: Sign rules

Sign rules for mirrors:

Positive object distance (s) =
Object is on the side of the incoming light.

Positive image distance (s') =
Image and outgoing light on the same side.

Positive radius (R) =
Center is on the side of outgoing light.

Positive magnification (m) =
Direction of object and image is the same.

Sign rules for lenses:

Positive object distance (s)
Object and incoming light is on the same side.

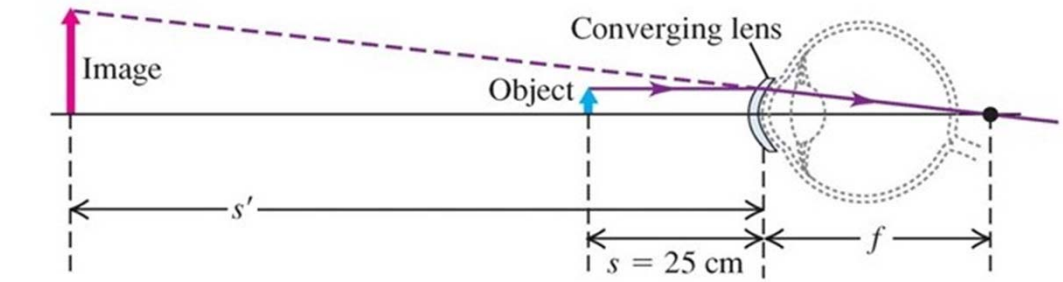
Positive image distance (s')
Image and outgoing light is on the same side.

Positive focal length (f)
Converging (convex) lenses.

Positive magnification (m)
Same direction of object and image.

Summary: The eye

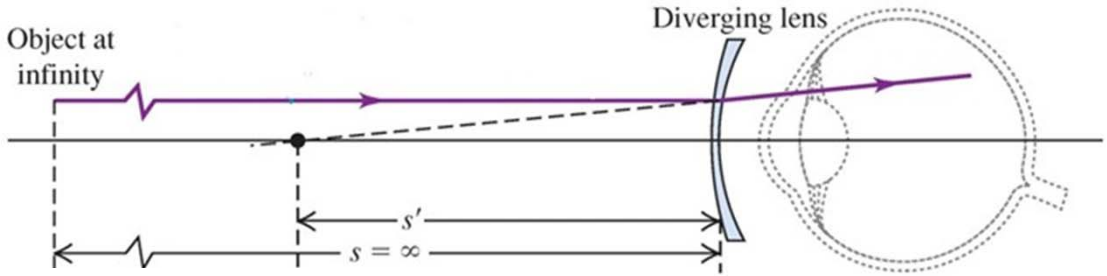
Farsighted



Near point without lens

Near point with lens

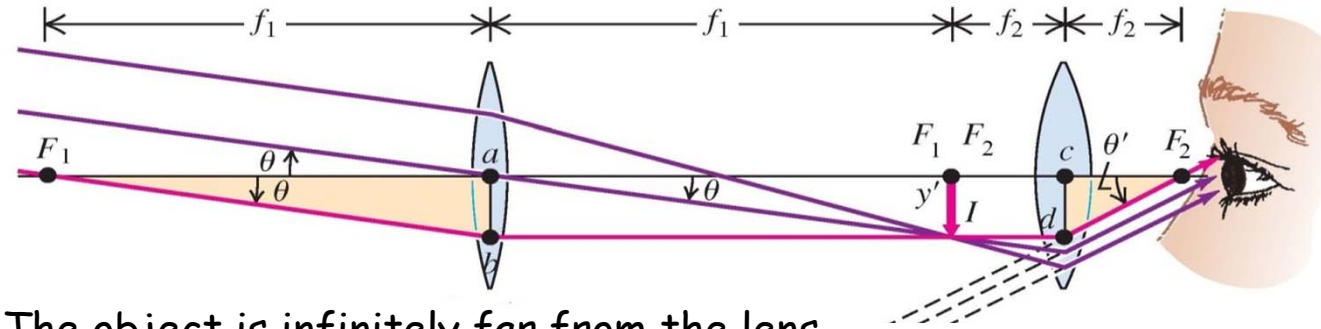
Nearsighted



Far point with lens

Far point without lens

Summary: Microscope & Telescope

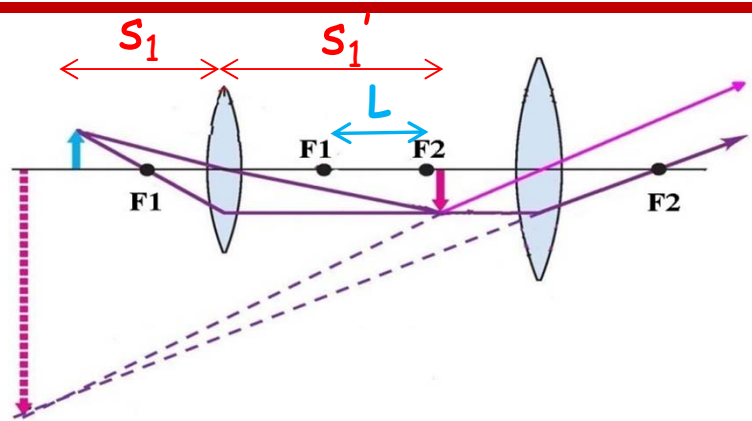


The object is infinitely far from the lens

Telescope

$$M = -\frac{f_1}{f_2}$$

Large f_1 & Small f_2



The object is close to the lens

Microscope

$$M = m_1 M_2 = -\frac{s'_1}{s_1}\frac{\sigma}{f_2} = -\frac{L\sigma}{f_1 f_2}$$

σ is the near point (typically 25 cm)

Small f_1 & Small f_2