Physics 161
Lecture 26 Summary
Mirrors and Lenses

December 5, 2017

Lecture 26: learning objectives

You will be able to discuss and apply the properties of flat mirrors.

You will be able to define the focal length of spherical mirrors, and state the mirror equation.

You will be able to explain images formed by atmospheric refraction, such as mirages.

You will be able to solve problems with thin lenses, their focal length and state the lens equation.

You will be able to master the sign conventions for: concave and convex mirrors; refracting surfaces; and thin lenses.

Flat mirrors

First law of mirrors:
The image formed by an object in front of a flat mirror is as far behind the mirror as the object is in front.

Magnification, M:
The ratio of the image height to the object height.

$$M = \frac{\text{image height}}{\text{object height}} = \frac{h'}{h}$$

Virtual image:
The image is formed in a place through which the light does not actually pass.

Real image:
The image is formed in a place through which the light does actually pass.

Concave mirrors

Mirror equation:
The inverse of the distance to the object plus the inverse of the distance to the image is equal to two divided by the radius of curvature.

$$\frac{1}{p} + \frac{1}{q} = \frac{2}{R}$$

Focal length:
Half of the radius of curvature.

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

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

Thin lenses

Thin lens equation:
The same as the mirror equation.

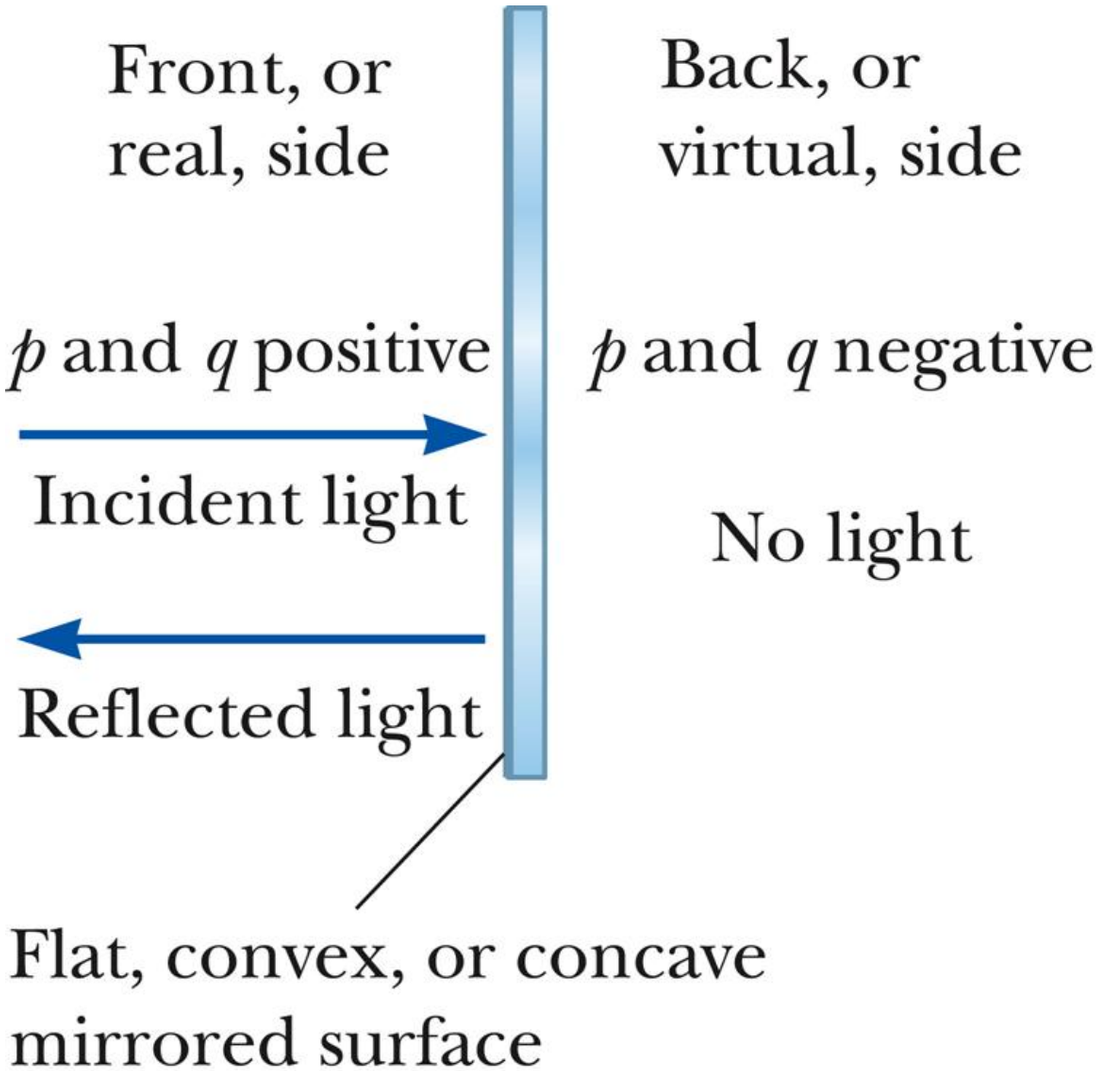
$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

Magnification, M :
The ratio of the image height to the object height.

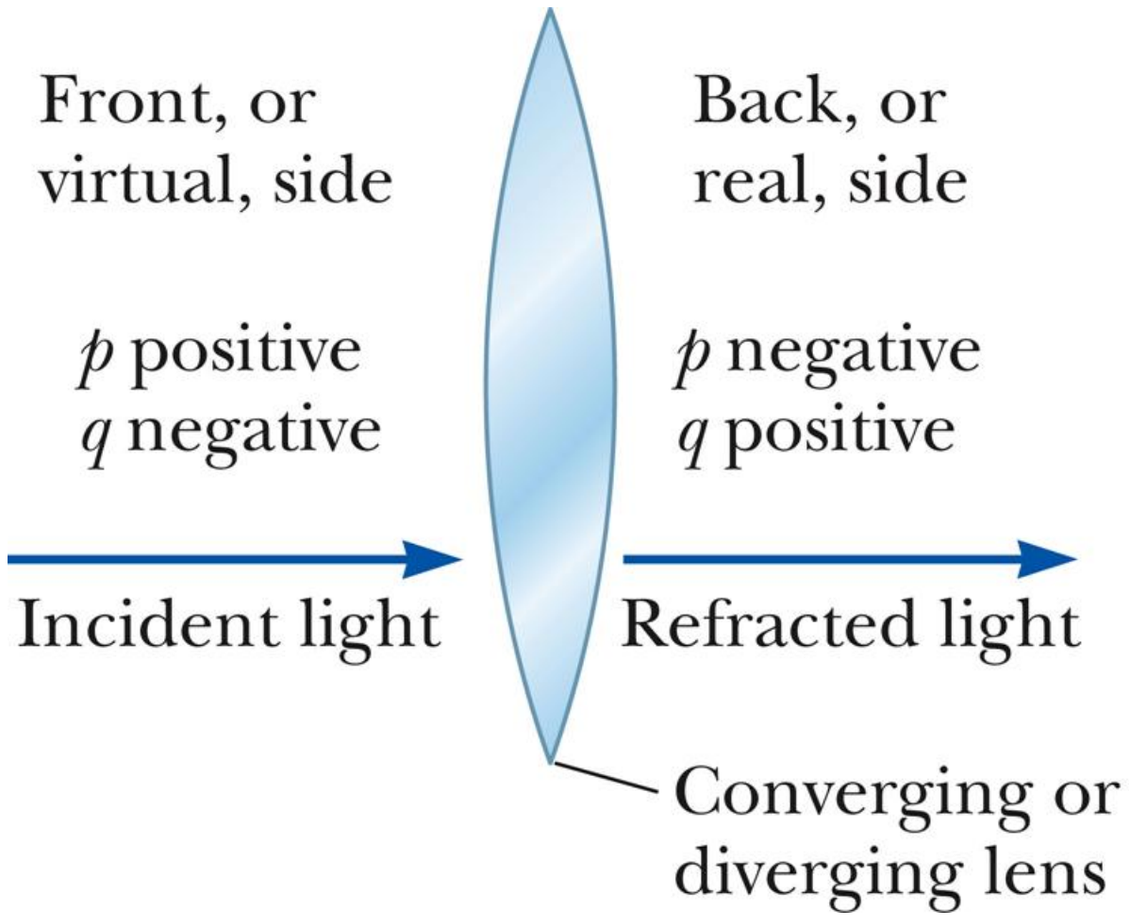
$$M = \frac{h'}{h} = -\frac{q}{p}$$

Sign conventions

Mirrors



Lenses



Mirror summary

Flat mirror: image is unmagnified, virtual and upright.

Concave mirror: object outside the centre of curvature, image is reduced, real and inverted.

Concave mirror: object inside the focal point, image is magnified, virtual and upright.

Convex mirror: image is reduced, virtual and upright.

Lens summary

Converging lens: object outside the focal point and in front of the lens, image is real and inverted on the back side of the lens.

Converging lens: object inside the focal point and in front of the lens, image is magnified, virtual and upright on the front side of the lens.

Diverging lens: image is reduced, virtual and upright on the front side of the lens.