Chapter 34 Tutorial

Optics - II

Geometric Optics

Question 1:

A concave mirror forms an image, on a wall 3.00m in front of the mirror, of a headlamp filament 10.0cm in front of the mirror.
a) What are the radius of curvature and focal length of the mirror.
b) What is the lateral magnification? What is the image height if the object height is 5.00mm.

Question 2:

A candle 4.85cm tall is 39.2cm to the left of a plane mirror. Where is the image formed by the mirror, and what is the height of this image?

Question 3:

An object 0.600 cm tall is placed 16.5 cm to the left of the vertex of a concave spherical mirror having a radius of curvature of 22.0 cm.
  a) Draw a principal-ray diagram showing the formation of the image.
  b) Determine the position, size, orientation, and nature (real or virtual) of the image.

Question 4:

A camera lens has a focal length of 200 mm. How far from the lens should the subject for the photo be if the lens is 20.4 cm from the film?

Question 5:

A person can see clearly up close but cannot focus on objects beyond 75.0 cm. She opts for contact lenses to correct her vision.
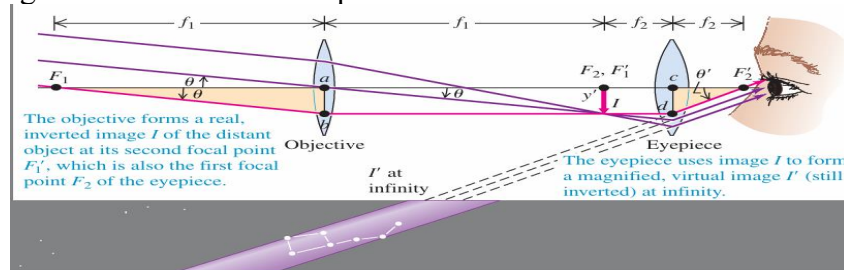 (a) Is she nearsighted or farsighted?
  (b) What type of lens (converging or diverging) is needed to correct her vision?
  (c) What focal length contact lens is needed, and what is its power in diopters?

Question 6:

You want to view an insect 2.00 mm in length through a magnifier. If the insect is to be at the focal point of the magnifier, what focal length will give the image of the insect an angular size of 0.025 radian?

Question 7:

The eyepiece of a refracting telescope has a focal length of 9.00 cm. The distance between objective and eyepiece is 1.80 m, and the final image is at infinity. What is the angular magnification of the telescope?

The objective forms a real, inverted image I of the distant object at its second focal point F_1', which is also the first focal point F_2 of the eyepiece.

Objective

I' at infinity

Eyepiece

The eyepiece uses image I to form a magnified, virtual image I' (still inverted) at infinity.

Question 8:

A common telephoto lens for a 35-mm camera has focal length of 200 mm; its f-stops range from f/2.8 to f/22. (a) What is the corresponding range of aperture diameters? (b) What is the corresponding range of image intensities on the film?

Question 9:

The focal length of the eyepiece of a certain microscope is 18.0 mm. The focal length of the objective is 8.00 mm. The distance between objective and eyepiece is 19.7 cm. The final image formed by the eyepiece is at infinity. Treat all lenses as thin. (a) What is the distance from the objective to the object being viewed? (b) What is the magnitude of the linear magnification produced by the objective? (c) What is the overall angular magnification of the microscope?