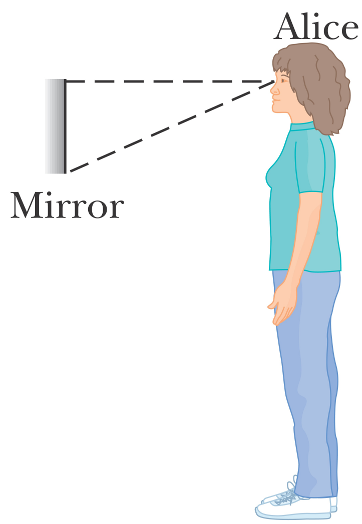
Learning Goals:

F.15b Apply the law of reflection for flat mirrors to draw a diagram showing how light rays travel from an object to the eye to allow you to see an image in a plane mirror.
F.15c Apply the law of reflection for flat mirrors to draw a diagram showing how light rays travel from an object to the eye to allow you to see an image in a plane mirror.
F.15d Apply the law of reflection for flat mirrors to draw a diagram showing how light rays travel from an object to the eye to allow you to see an image in a plane mirror.
A.15a Use Snell's Law to find the angle of refraction or the critical angle for total internal reflection (TIR) for light traveling from one transparent material to another.
A.15b Apply the thin lens equation and definition of magnification to a thin lens to find the object distance, image distance, and/or focal length.

1) What would be the appearance of the Moon if it had (a) a rough surface; (b) a polished mirror-like surface?

2) Alice faces a looking glass (mirror) and is standing at a level so that her eyes appear to her to be right at the top of the mirror as shown in the figure below. At the position she is standing, she can just see her hands at the bottom of the mirror. If she steps back far enough,



(a) she will eventually be able to see all of herself in the mirror at the same time.
(b) there will be no change in how much of herself she can see.
(c) she will see less of herself as she steps back.
(d) Some other result (explain).

Choose the letter of the choice that completes the sentence correctly and explain why you think so with a few sentences and some rays on the diagram.

3) A photographer moves closer to her subject and then refocuses. Does the camera lens move farther or nearer to the film? Explain.

4) An 80-mm-focal-length lens is used to focus an image on the film of a camera. The maximum distance allowed between the lens and the film plane is 120 mm.

(a) How far ahead of the film should the lens be if the object to be photographed is 10.0 m away?

(b) 3.0 m away?

(c) 1.0 m away?

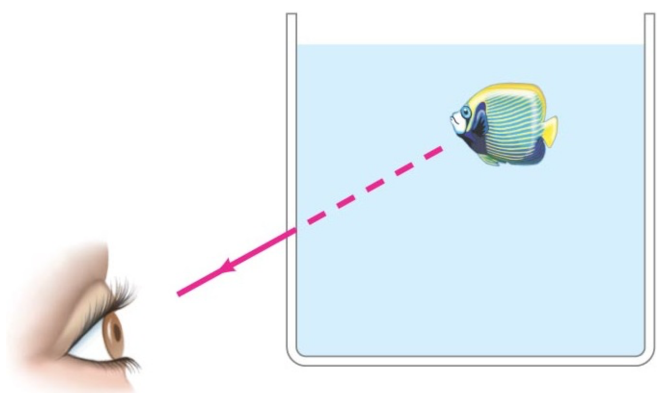
(d) What is the closest object this lens could photograph sharply?

5) A bright object and a viewing screen are separated by a distance of 66.0 cm. At what location(s) between the object and the screen should a lens of focal length 12.5 cm be placed in order to produce a sharp image on the screen? [Hint: First draw a diagram.]

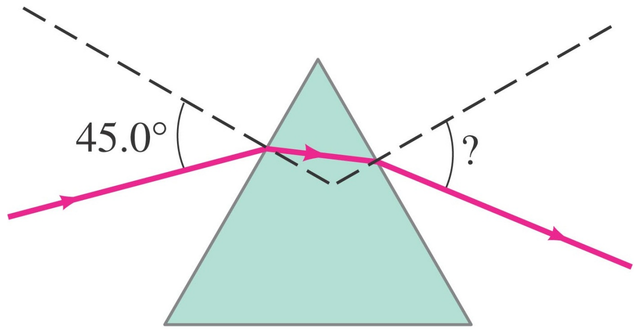
6) Draw a ray diagram to show why a straw looks bent when part of it is under water (as shown in the picture below).

7) How can you "see" a round drop of water on a table even though the water is transparent and colorless?

8) Your eye looks into an aquarium and views a fish inside. One ray of light that emerges from the tank from the fish is shown in the figure below. Also shown is the apparent position of the fish as seen by the eyeball. In the drawing, indicate the approximate position of the actual fish. Briefly justify your answer.



9) Light in air is incident on an equilateral glass prism at a 45.0° angle to one face, as shown in the figure below. Calculate the angle at which light emerges from the opposite face. Assume that *n* = 1.58 for the glass prism.



10) What is the critical angle for the interface between water and crown glass? To be totally internally reflected, the light must start in which material?

11) A beam of light is emitted in a pool of water from a depth of 62.0 cm. Where must it strike the air-water interface, relative to the spot directly above it, in order that the light does not exit the water?