PHYSICS 11 OPTICS WORKSHEET 1

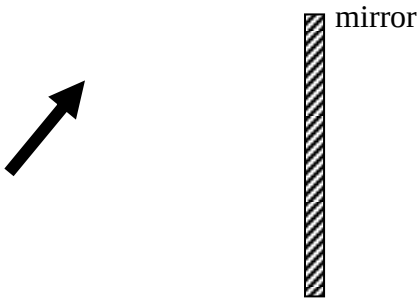
1. A pinhole camera 20.0 cm long is used to photograph a student 175 cm high. If the image is 10.0 cm high, how far from the camera is the student?

2. If that same camera is used to photograph a 10.0 m high building located 30.0 m away, calculate the height of the image on the film.

3. Phreddy Physics wants to take a picture of his image in a plane mirror. If the camera is 1.2 m in front of the mirror, at what distance should the camera lens be focused? Explain why.

4. Use rays to locate the image of the object behind the mirror for each diagram:
   a) object ☆

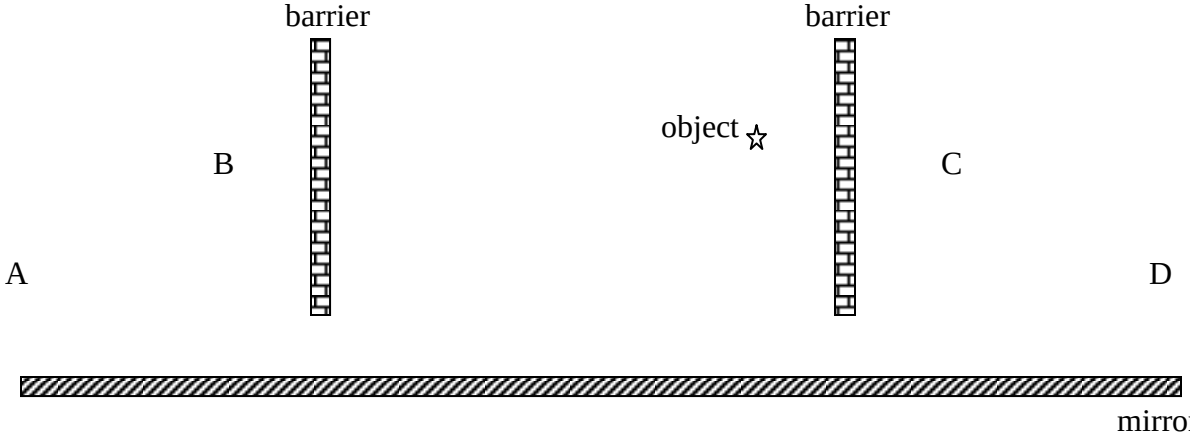
   b)



(Hint: in this case first locate the arrow tip, then the tail, then connect up)

5. A 1.5 m tall girl stands 2.4 m in front of a vertical hanging mirror. The girl is barely able to see her entire body.
   a) How high must the top of the mirror be for her to see her entire face?
   b) What is the size of the mirror? (Hint: how far down the mirror can she see her feet?)

6. (Bonus) Draw accurate rays to show at which locations (A, B, C or D) the point object would not be seen. (hint: draw the range of view for the objectÕs image on either side of each barrier)



1. 350 cm 2. 6.7 cm 3. 2.4 cm; his image is the same distance behind the mirror as he is in front 4. in both cases, image should be same perpendicular distance behind mirror 5. a) 1.5 m b) 0.75 m 6. image can not be seen at B and D

PHYSICS 11 OPTICS WORKSHEET 2

1. A candle is placed 15 cm from the vertex of a concave mirror that has a focal length of 10 cm.
   a) Locate the position of the image by means of (i) a ray diagram
   (ii) the mirror equation.
   b) Find the magnification of the image.
   c) Describe the characteristics of the image.

2. A baby mouse 1.2 cm high is standing 4.0 cm from a converging mirror having a focal length of 300 cm.
   a) Locate the position of the image by means of (i) a ray diagram
   (ii) the mirror equation.
   b) Determine the height of its image.

3. When a butterfly of body length 4.2 cm is 10 cm from a concave mirror, its image is 15 cm behind the mirror. Calculate
   a) the focal length of the mirror.
   b) the magnification.
   c) the length of the image.

4. a) Where must a peanut be placed in order to produce a real image 15 cm from a mirror of focal length 10 cm?
   b) What is the magnification?

5. A 60 cm tall red rose is placed 40 cm from a large convex mirror of focal length 20 cm.
   a) Locate the position of the image by means of (i) a ray diagram
   (ii) the mirror equation.
   b) Find the magnification of the image.
   c) What is the height of the image?
   d) Describe the characteristics of the image.

6. Light from the Sun is collected by a concave mirror. How far from the mirror is the image of the star if the radius of curvature is 150 cm? (no, you donÕt need to know the distance to the Sun; just think about it, and explain your reasoning)

7. A production line inspector wants a mirror that produces an upright image with magnification of 7.5 when it is located 1.40 cm from a machine part.
   a) What kind of mirror would do this job?
   b) What is its radius of curvature?

8. A mirror produces an erect, virtual image of an object. What type of mirror would this be? (hint: there is more than one possible answer here)

1. a) 30 cm b) -2.0 c) real, inverted, larger, beyond 2f 2. a) 12 cm b) 3.6 cm 3. a) 30 cm b) 1.5 c) 6.3 cm
4 a) 30 cm b) -0.50 5. a) -13.3 cm b) 0.33 c) 20 cm d) virtual, erect, smaller, behind mirror 6. 75 cm, located at focus
7. a) concave b) 2.5 cm 8. plane or convex, or concave only if do < f

PHYSICS 11 OPTICS WORKSHEET 3

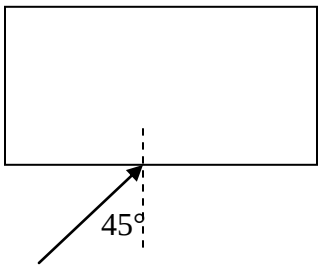
1. Canada balsam, a product of the balsam fir tree, has an index of refraction of 1.53. Calculate the angle of refraction if the angle of incidence in air is 75°.

2. A transparent substance has a refractive index of 1.30. What is the angle of incidence in air when the angle of refraction in the substance is 45°?

3. A block of unknown material is submerged in water. Light in the water is incident on the block at an angle of 31°. The angle of refraction in the block is 27°. What is the index of refraction of the unknown material?

4. Is there a critical angle for light going from crown glass to water? Explain your answer.

5. A light ray enters from air into a rectangle of crown glass, below. Use a ray diagram to trace the path of the ray until it leaves the glass.



6. Determine the critical angle for a light ray travelling from the following substances into air:
   a) crown glass. b) glycerin. (n = 1.47)

7. Explain why:
   a) we can observe the sun even after it has already set.
   b) dry asphalt appears to be wet on a hot, sunny day.

8. An object 1.2 cm high is placed 4.0 cm from a converging lens that has a focal length of 3.0 cm.
   a) Use the lens equations to find: i) the position of the image
   ii) the image size
   b) Locate the image using a ray diagram.

9. A converging lens used as a reading glass is held at less than its focal length from some print. If the focal length of the lens is 15 cm, and the print is 12 cm from the lens, calculate the location and magnification of the image.

10. A diverging lens produces an image 10 cm from the lens when the object is placed 30 cm from the lens. Calculate the focal length and magnification of the lens.

1. 39° 2. 67° 3. 1.51 4. yes; glass is more optically dense 6. a) 41° b) 43° 7. Ask humble instructor
8. a) 12 cm, -3.6 cm 9. -60 cm, 5.0 10. -15 cm, 0.33