Physics 30 Lesson 6

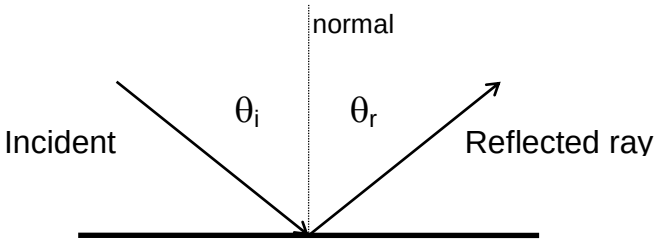
Reflection of Light

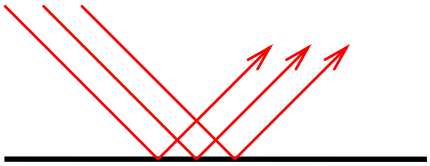
I. Reflection off a surface

Refer to Pearson pages 653 to 656.

When we studied waves in Physics 20, we learned about the law of reflection. In terms of light rays, the Laws of Reflection are:

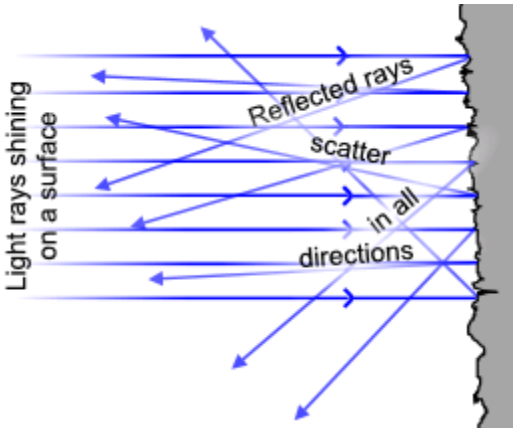
1. The angle of incidence (θ_i) equals the angle of reflection (θ_r). ($\theta_i = \theta_r$) θ_i and θ_r are always measured from the normal to the surface of reflection.
2. The incident ray, normal, and reflected ray all lie in the same plane.





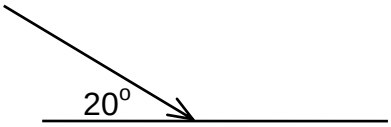
If a bundle of parallel rays strike a smooth surface (plane mirror), they all obey the law of reflection and emerge as reflected parallel rays. This is an example of **specular** reflection.

When parallel light rays strike an irregular or rough surface they will not be reflected as parallel rays. In each case, the ray obeys the law of reflection, but the rays are reflected in a multitude of directions. The surface is said to produce **diffuse** reflection.



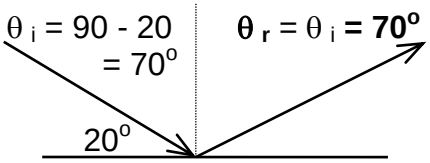
Example 1

What is the angle of reflection for the light ray in the diagram below?



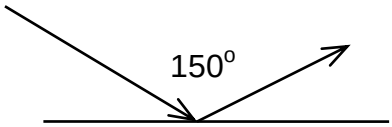
solution

The angle of reflection and the angle of incidence are always measured from the normal.

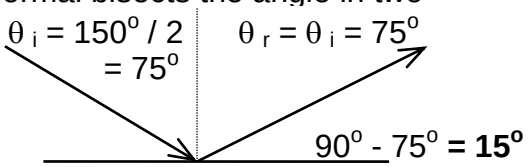


Example 2

What is the angle between the reflected ray and the mirror surface for the diagram below?

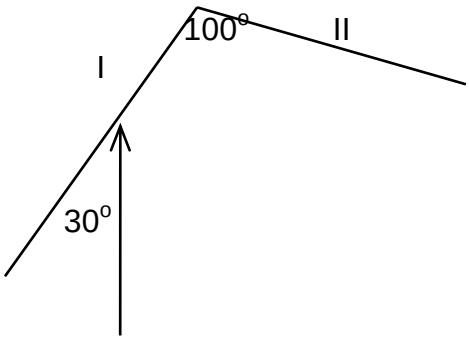


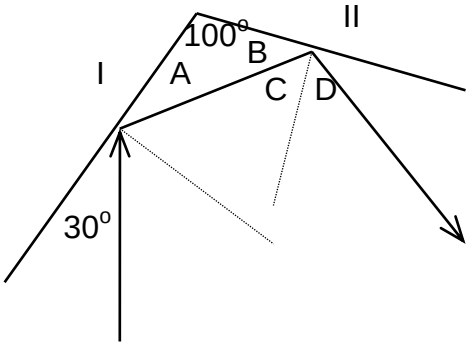
the normal bisects the angle in two



Example 3

What is the angle of reflection for the light ray bouncing off of mirror II in the diagram below?

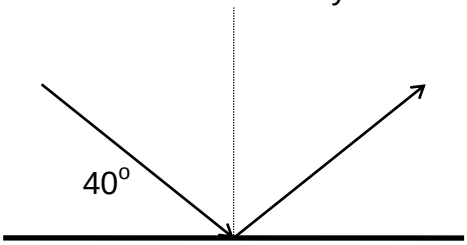




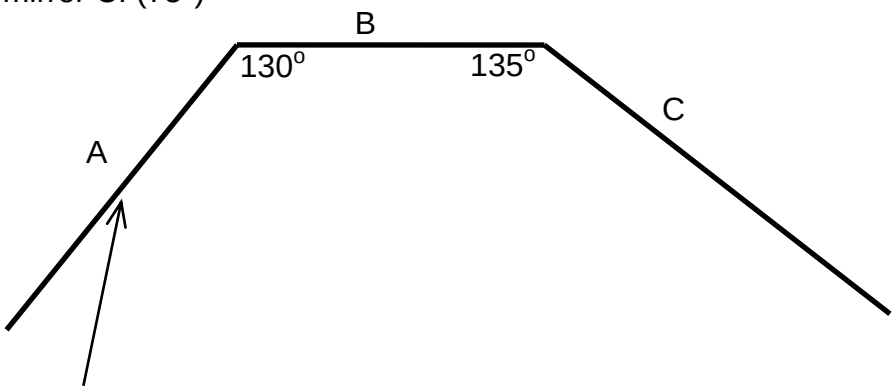
Draw in normal lines.
A = 30°
B = 180° - (100° + 30°) = 50°
C = 90° - 50° = 40°
D = C **= 40°**

II. Practice problems

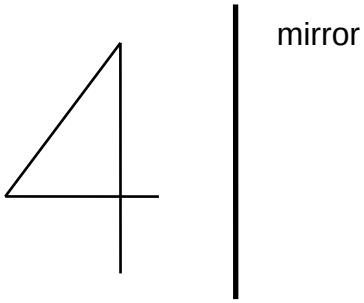
1. What is the angle of reflection for the ray shown below? (50^o)



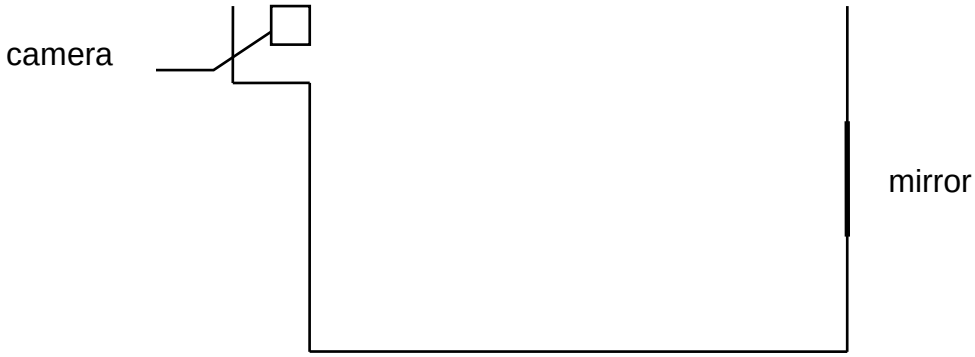
2. Light strikes mirror A at an angle of 20^o to the mirror. Find the angle of reflection from mirror C. (75^o)



3. Draw the image of the following object in the mirror.



4. A hidden surveillance camera is mounted on a wall 2.5 m above the floor. It "sees" by looking into a mirror on the opposite wall which is 3.5 m away. The mirror starts 1.0 m up from the floor and is 1.0 m high. How much floor does the camera actually see? (1.17 m)



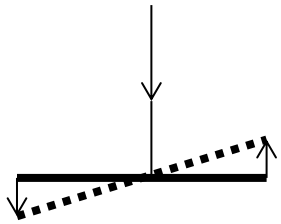
III. Hand-in assignment

1. If the angle of reflection from a mirror is 60.0^o, what is the angle of incidence? (60^o)

2. If the angle between the light ray and the reflecting surface is 41.0^o, what is the angle of the reflection? (49^o)

3. A ray of light makes an angle of 25^o with a mirror. What is the angle between the incident ray and reflected ray? (130^o)

4. An incident ray of light has an angle of 0^o with the normal. If the mirror is turned so that the angle of incidence becomes larger by 10^o, through what angle is the reflected ray rotated? (20^o)



5. A ray of light is reflected from mirrors A and B as shown in the diagram. What is the angle of reflection from mirror B? (48^o)

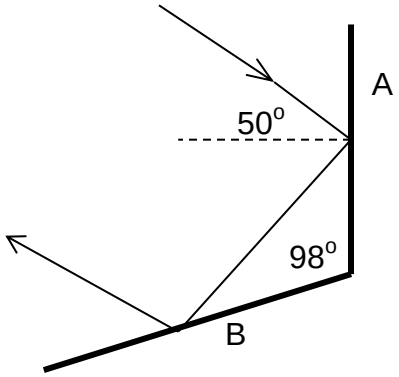


diagram is not drawn to scale

6. A ray of light is reflected from mirrors A and B as shown in the diagram. What is the angle of reflection from mirror B? (3^o)

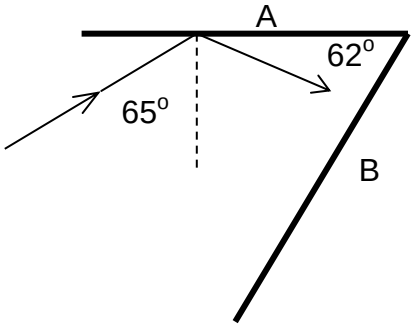


diagram is not drawn to scale

7. A ray of light is reflected in a series of mirrors as shown in the diagram. If the distance xy is 10.0 cm, what is the distance xz? (15.6 cm)

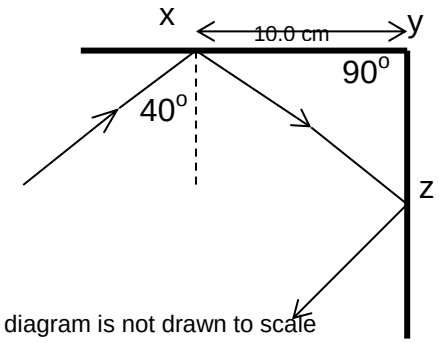


diagram is not drawn to scale

8. A ray of light is reflected in a series of mirrors as shown in the diagram. If the distance xy is 10.0 cm and the distance yz is 7.0 cm, what is the angle of incidence of the light ray to mirror A? (55^o)

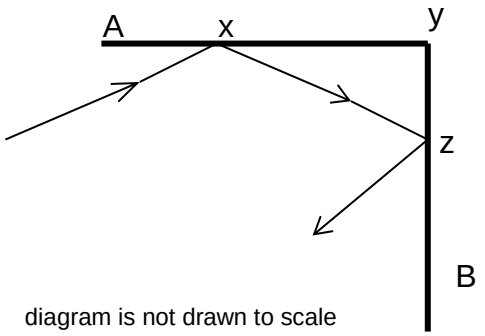
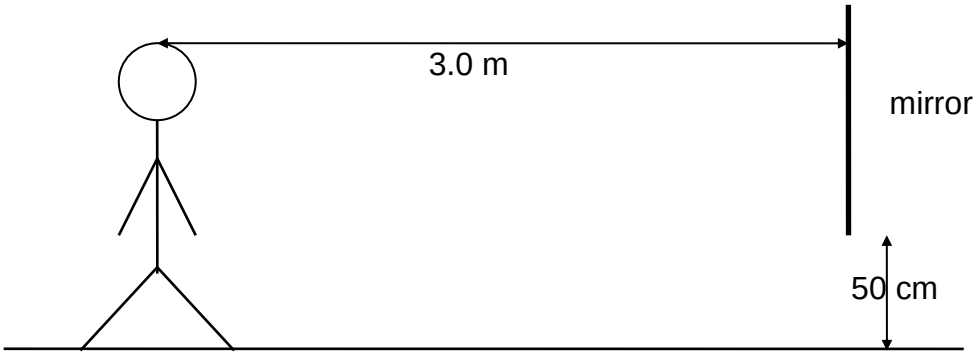


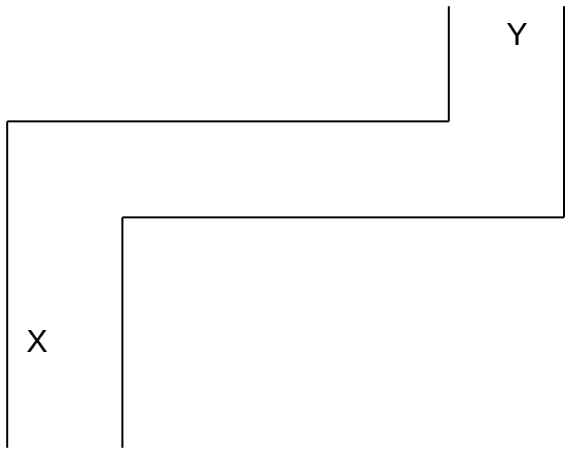
diagram is not drawn to scale

9. Draw the mirror images of the objects shown:

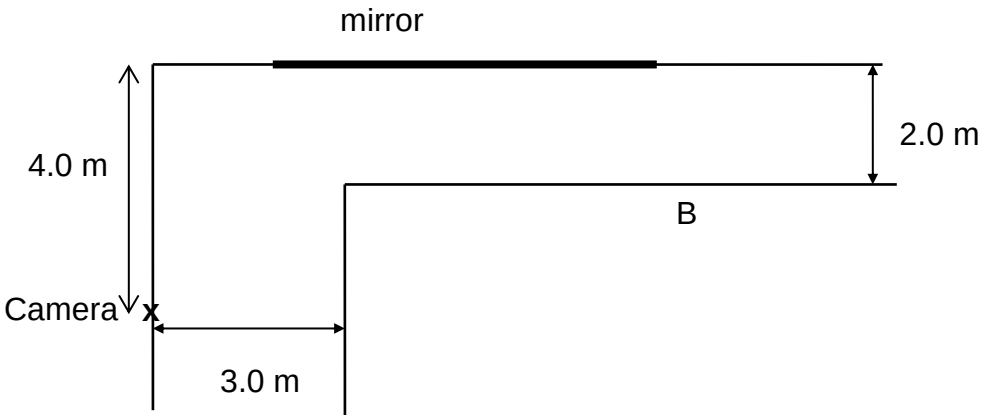
10. A boy stands 3.0 m from a vertical plane mirror and his eyes are 1.50 m above the floor. If the bottom of the mirror is 0.50 m above the floor, what is the point closest to the wall which can be seen in the mirror? (1.50 m)



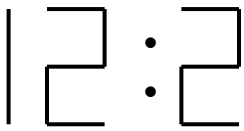
11. A security guard sits in a hallway at the point marked X in the diagram below. If he wishes to clearly see point Y from where he sits, where would two plane mirrors need to be located and what would their orientation have to be? Draw light rays to support your choices.



12. A hidden surveillance camera is mounted 4.0 m from the corner on a wall as shown in the diagram below. How far down the corridor wall marked B could the camera see? (6.0 m)



13. The following time is seen as a reflection in a mirror:



What is the actual time?