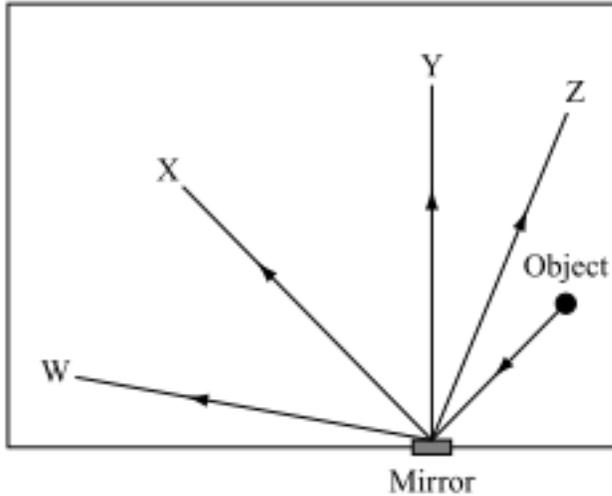


*Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.*

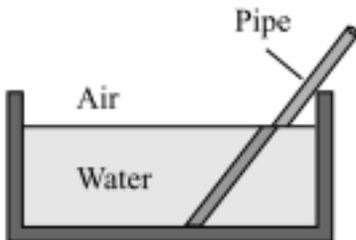
1. A small object is placed in a room with a narrow mirror on the wall. Four positions in the room are labeled W, X, Y, and Z, as shown below.



At which position should a person stand to see the reflection of the object in the mirror?

- A. position W
- B. position X
- C. position Y
- D. position Z

2. The picture below shows what a straight pipe looks like in a container of water when viewed from the side.



What is happening in this example as light travels from the water into the air?

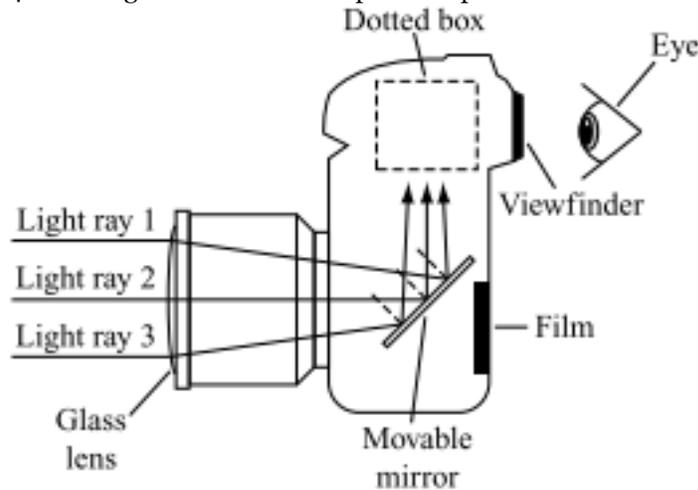
- A. absorption
- B. diffraction
- C. reflection
- D. refraction

Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.

3. Which of the following always occurs when a light ray reflects off a mirror?

- A. The speed of the light ray increases.
- B. The direction of the light ray stays the same.
- C. The frequency of the light ray decreases as it reflects and loses energy to the mirror.
- D. The angle at which the light ray strikes the mirror equals the angle at which it reflects.

4. The diagram below is a simplified representation of the inside of a certain type of camera.



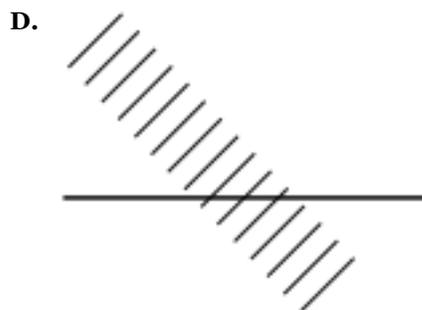
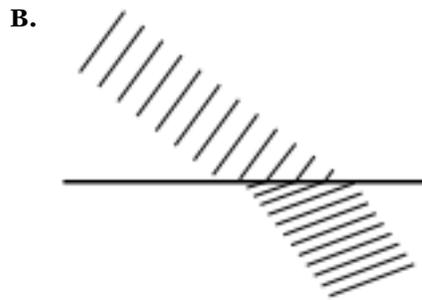
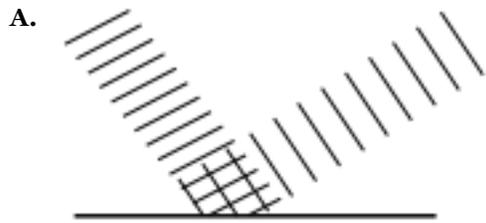
- a. Identify **and** describe the wave behavior as the light rays pass through the glass lens.
- b. Identify **and** describe the wave behavior as the light rays strike the mirror.
- c. Copy the dotted box from the camera diagram into your Student Answer Booklet. Draw what must happen inside the box for light ray 2 to strike the viewfinder. Be sure to include the following:
  - either a lens **or** a mirror that is labeled
  - the path of light ray 2
  - a line normal to the surface where light ray 2 strikes

5. Which of the following statements explains why light is refracted as it moves from air into glass?

- A. The speed of light decreases in glass.
- B. The energy of light increases in glass.
- C. The frequency of light decreases in glass.
- D. The wavelength of light increases in glass.

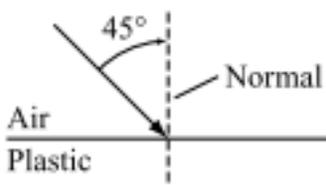
Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.

6. Which of the following diagrams represents the refraction of waves?

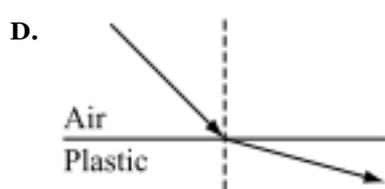
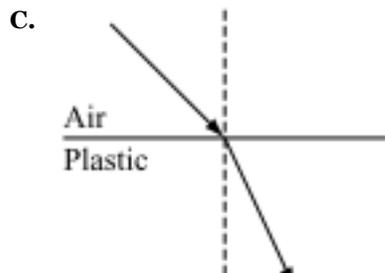
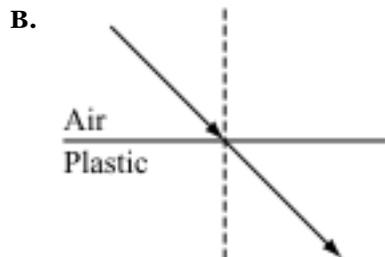
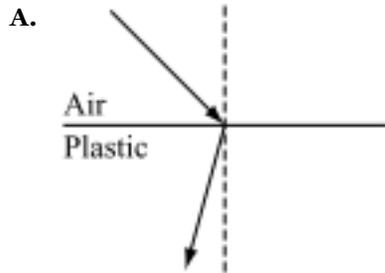


Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.

7. The diagram below shows a light ray striking the flat surface of a piece of clear hard plastic at an angle of  $45^\circ$ . Light travels faster in air than through plastic.

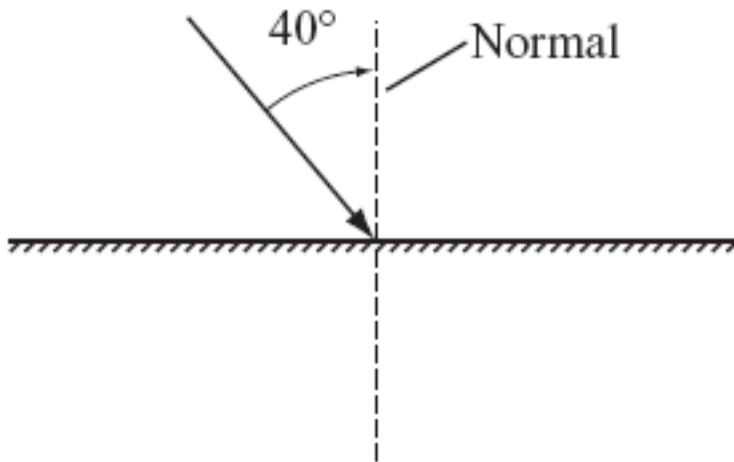


Which of the following diagrams shows how the ray is refracted after it travels through the plastic?



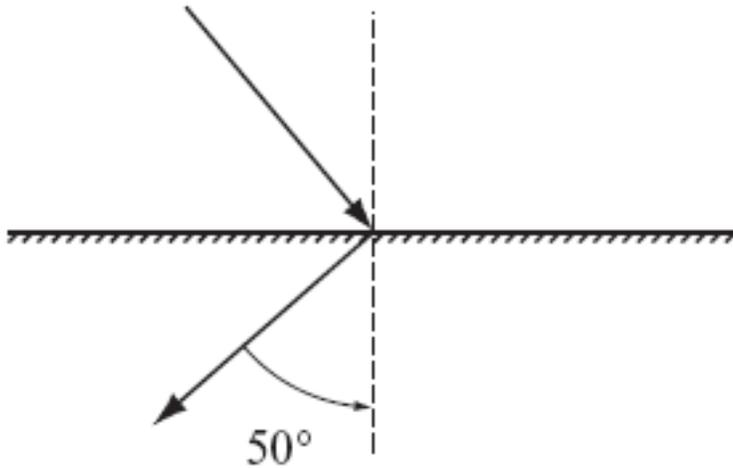
Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.

8. The diagram below shows a light ray striking a plane mirror surface at an angle of  $40^\circ$  to the normal.

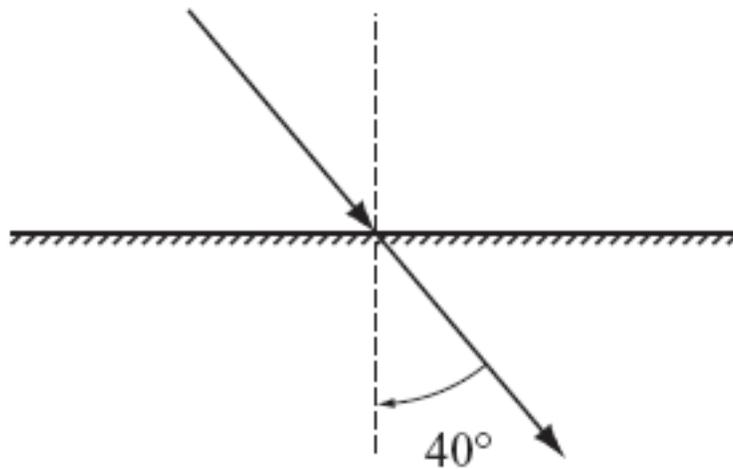


Which of the following diagrams shows the ray that is reflected from the plane mirror surface?

A.

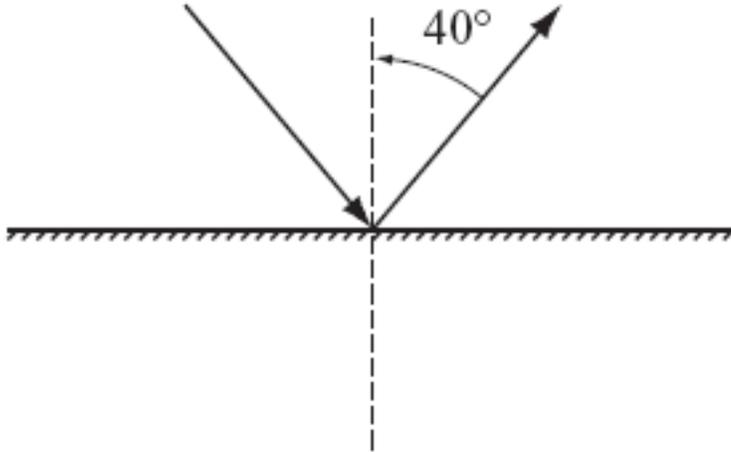


B.

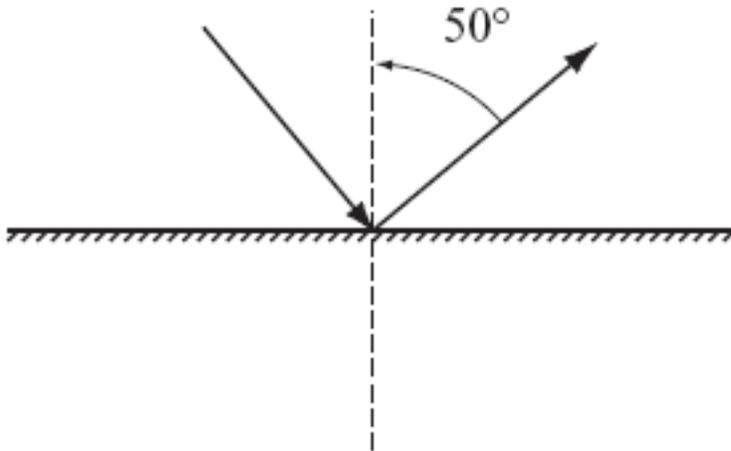


Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.

C.



D.



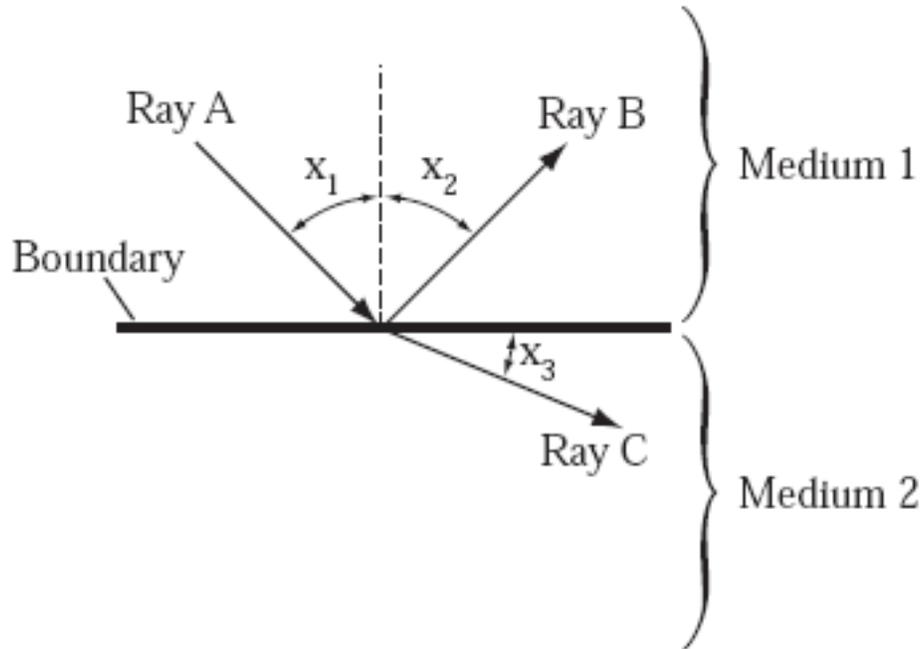
9. A student standing on the edge of a swimming pool sees a painted mark on the bottom of the pool. The mark appears to be at a shallower depth than the actual depth of the pool.

Which of the following descriptions of light waves **best** explains this observation?

- A. Light from the mark travels through the water in a curved path.
- B. Light from the mark is refracted as it travels from the water to the air.
- C. Light from the mark is reflected as it travels from the water to the air.
- D. Light from the mark bounces off the boundary between the water and the air.

Standard: 4.4 - Describe qualitatively the basic principles of reflection and refraction of waves.

10. The diagram below shows what happens when a particular light wave strikes a boundary.



- Identify each light ray, A, B, and C, as an incident, a refracted, or a reflected ray.
- Describe the relationship between angles  $x_1$  and  $x_2$ .
- Describe how this setup could be changed so that the size of angle  $x_3$  is different.