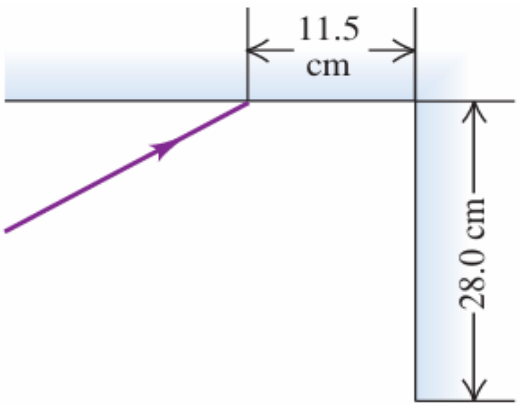
Chapter 33Tutorial

Optics-I

Chapter 33 : The Nature and Propagation of Light

Question 1:

Two plane mirrors intersect at right angles. A laser beam strikes the first of them at a point 11.5 cm from their point of intersection, as shown in figure below. For what angle of incidence at the first mirror will this ray strike the midpoint of the second mirror (which is 28.0 cm long) after reflecting from the first mirror?



Question 2:

A beam of light has a wavelength of 650 nm in vacuum.

(a) What is the speed of this light in a liquid whose index of refraction at this wavelength is 1.47 ?
(b) What is the wavelength of these waves in the liquid?

Question 3:

A flat piece of glass covers the top of a vertical cylinder that is completely filled with water. If a ray of light traveling in the glass is incident on the interface with the water at an angle of $\theta_a = 36.2°$, the ray refracted into the water makes an angle of $49.8°$ with the normal to the interface. What is the smallest value of the incident angle θ_a for which none of the ray refracts into the water (refractive index for water is 1.33)?

Question 4:

A beam of light strikes a sheet of glass at an angle of $57.0°$ with the normal in air. You observe that red light makes an angle of $38.1°$ with the normal in the glass, while violet light makes a $36.7°$ angle.

(a) What are the indexes of refraction of this glass for these colors of light?
(b) What are the speeds of red and violet light in the glass?

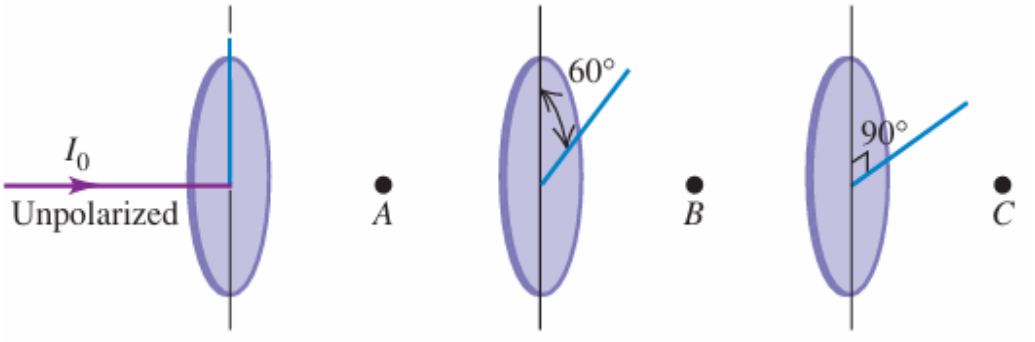
Question 5:

Unpolarized light with intensity I_0 is incident on two polarizing filters. The axis of the first filter makes an angle of $60.0°$ with the vertical, and the axis of the second filter is horizontal. What is the intensity of the light after it has passed through the second filter?

Question 6:

A beam of unpolarized light of intensity I_0 passes through a series of ideal polarizing filters with their polarizing directions turned to various angles as shown in figure below.

(a) What is the light intensity (in terms of I_0) at points A, B, and C?
(b) If we remove the middle filter, what will be the light intensity at point C?



Question 7:

A light beam is directed parallel to the axis of a hollow cylindrical tube. When the tube contains only air, it takes the light 8.72 ns to travel the length of the tube, but when the tube is filled with a transparent jelly, it takes the light 2.04 ns longer to travel its length. What is the refractive index of this jelly?

Question 8:

You sight along the rim of a glass with vertical sides so that the top rim is lined up with the opposite edge of the bottom (fig (a)). The glass is a thin-walled, hollow cylinder 16.0 cm high. The diameter of the top and bottom of the glass is 8.0 cm. While you keep your eye in the same position, a friend fills the glass with a transparent liquid, and you then see a dime that is lying at the center of the bottom of the glass (Fig (b)). What is the index of refraction of the liquid?