Ch35 (Homework)
Current Score : – / 15 **Due :** Monday, August 27 2018 02:32 PM CDT

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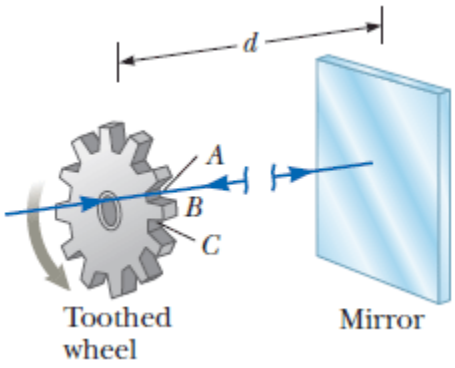
1. –/1 pointsSerPSE9 35.P.003.MI.

In an experiment to measure the speed of light using the apparatus of Armand H. L. Fizeau (see figure below), the distance between light source and mirror was 11.50 km and the wheel had 720 notches. The experimentally determined value of c was 2.995×10^8 m/s when the outgoing light passed through one notch and then returned through the next notch. Calculate the minimum angular speed of the wheel for this experiment. (Enter your answer to four significant figures.)

[ ] rad/s



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2. –/1 pointsSerPSE9 35.P.004.

As a result of his observations, Ole Roemer concluded that eclipses of Io by Jupiter were delayed by 22 min during a six–month period as the Earth moved from the point in its orbit where it is closest to Jupiter to the diametrically opposite point where it is farthest from Jupiter. Using the value 1.50×10^8 km as the average radius of the Earth's orbit around the Sun, calculate the speed of light from these data.

[ ] m/s

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3. –/3 pointsSerPSE9 35.P.005.WI.

The wavelength of red helium–neon laser light in air is 632.8 nm.

(a) What is its frequency?

[ ] Hz

(b) What is its wavelength in glass that has an index of refraction of 1.64?

[ ] nm

(c) What is its speed in the glass?

[ ] Mm/s

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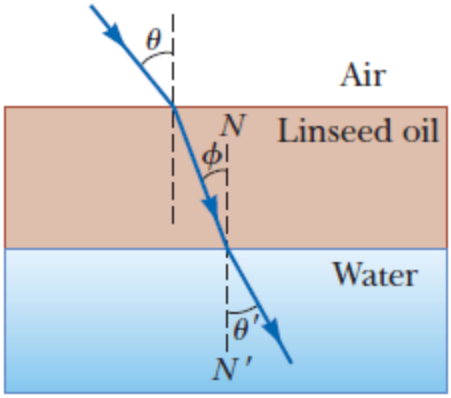
4. –/2 pointsSerPSE9 35.P.008.MI.FB.

The figure shows a refracted light beam in linseed oil making an angle of ϕ = 25.6° with the normal line *NN′*. The index of refraction of linseed oil is 1.48.



(a) Determine the angle θ.

[ ]

(b) Determine the angle θ'.

[ ]

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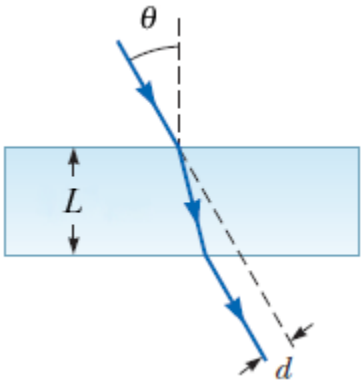
5. –/2 pointsSerPSE9 35.P.022.WI.

When the light ray illustrated in the figure below passes through the glass block of index of refraction n = 1.50, it is shifted laterally by the distance d. (Let L = 1.27 cm and θ = 33.0°.)



(a) Find the value of d.

[ ] cm

(b) Find the time interval required for the light to pass through the glass block.

[ ] ps

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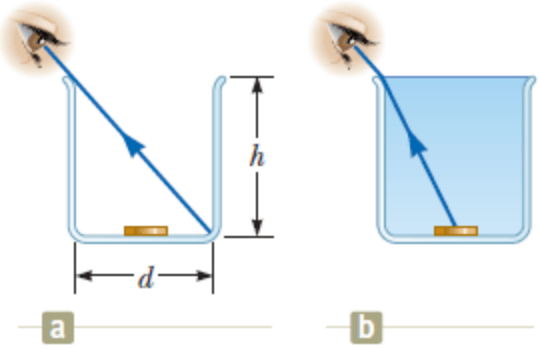
6. –/2 pointsSerPSE9 35.P.032.

A person looking into an empty container is able to see the far edge of the container's bottom as shown in Figure (a). The height of the container is h, and its width is d. When the container is completely filled with a fluid of index of refraction n and viewed from the same angle, the person can see the center of a coin at the middle of the container's bottom as shown in the Figure (b).



(a) Show that the ratio h/d is given by

$$\frac{h}{d} = \sqrt{\frac{n^2 - 1}{4 - n^2}}$$

(Do this on paper. Your instructor may ask you to turn in this work.)

(b) Assuming the container has a width of 5.51 cm and is filled with water, use the expression above to find the height of the container.

[ ] cm

(c) For what range of values of n will the center of the coin not be visible for any values of h and d?

$n >$ [ ]

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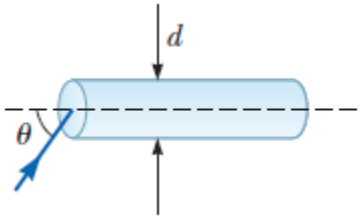
7. –/1 pointsSerPSE9 35.P.045.

Assume a transparent rod of diameter d = 6.81 μm has an index of refraction of 1.34. Determine the maximum angle θ for which the light rays incident on the end of the rod in the figure below are subject to total internal reflection along the walls of the rod. Your answer defines the size of the *cone of acceptance* for the rod.

[ ] °



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8. –/1 pointsSerPSE9 35.P.051.MI.FB.

A beam of light is incident from air on the surface of a liquid. If the angle of incidence is 45.0° and the angle of refraction is 25.5°, find the critical angle for total internal reflection for the liquid when surrounded by air.

[ ] °

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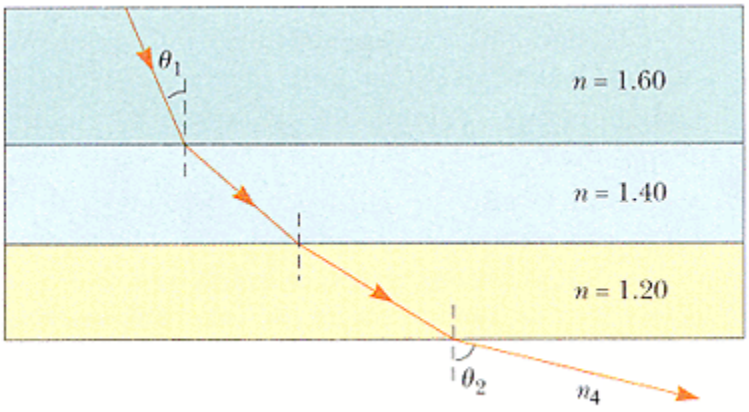
9. –/2 pointsSerPSE9 35.P.075.soln.

The figure below shows the path of a light beam through several slabs with different indices of refraction. (n_4 = 1.10)



(a) If θ_1 = 34.0°, what is the angle θ_2 of the emerging beam?

[ ] °

(b) What must the incident angle θ_1 be to have total internal reflection at the surface between the medium with n = 1.20 and the medium with n_4 = 1.10?

[ ] °

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