OPAC101-INTRODUCTION TO OPTICS. [Solved Problems (set3)]

[1]. Consider a 6 mW laser pointer $\lambda = 600$ nm. Laser beam delivers a spot of light 5 mm in diameter on the wall across a room 15 m wide.

(a) How many photons/s are generated from a laser pointer?

(b) What is the frequency of the pointer?

(c) What is the luminous flux of the pointer?

(d) What is the irradiance and illumination at the spot on the wall?

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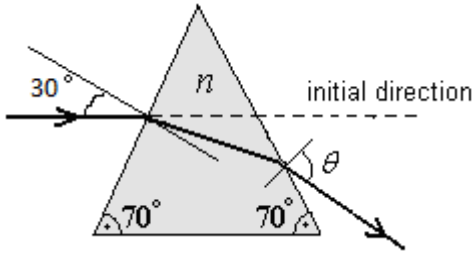
[2]. You are given a plane mirror and a right angle prism (45^o - 45^o - 90^o) to set up an optical system such that an outgoing ray should leave the system parallel to incoming ray as shown in Figure below. Note that the outgoing ray is shifted with respect to the original direction of the incoming ray. Sketch your design in the box provided.

[3]. The prism in air shown in the figure has an index of refraction of $n = 1.5$. A light ray is incident at an angle of 30^o as shown in the figure.

(a) What is the angle θ at which the light emerges?



(b) What is the minimum angle of deviation?

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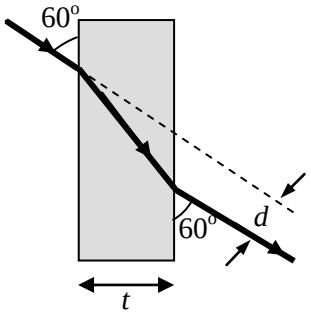
[4]. The atmosphere is a layer of gas whose index of refraction is $n = 1.0003$ and width is $D = 100$ km. The radius of Earth is approximately given by $R = 6400$ km. Calculate the time difference in seconds for the sun rise at the sea level on the equator if the index of refraction was n = 1.0000?

[5]. A light ray enters from air to a parallel-faced slab of glass of thickness t = 5 cm and leaves it as shown in figure. What is the displacement, d, between incident and emerging ray, if refraction index of the glass is n = 1.5?



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[6]. PMMA is a transparent plastics used mainly in illumination sector. Calculate the critical angle (θc) for total internal reflection at PMMA-air interface for the following wavelengths λ_1 = 400 nm, λ_2 = 500 nm, λ_3 = 600 nm and λ_4 = 700 nm.

[7]. Using Fermat's principle derive snell's law of refraction.

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[8]. Problem 60 in the Chapter 35 of the book: If $R = d$ = 2 m, find n.