Physics 1214, Midterm III (11/12)

M1 A beam from an infrared laser with a wavelength of 1064 nm is incident on a lithium niobate crystal which doubles the light frequency. The wavelength of the converted light is

A. 532 nm (green).

B. 2128 nm (infrared).

C. the same as the original beam.

M2 A beam of light is incident on a system of two mirrors at 60° relative to the normal to the first mirror. It undergoes two reflections and comes out parallel to the normal to the first mirror. What is the angle between the two mirrors?

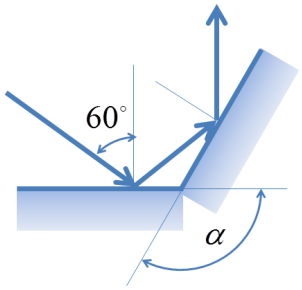
A. 90°

B. 120°

C. 135°

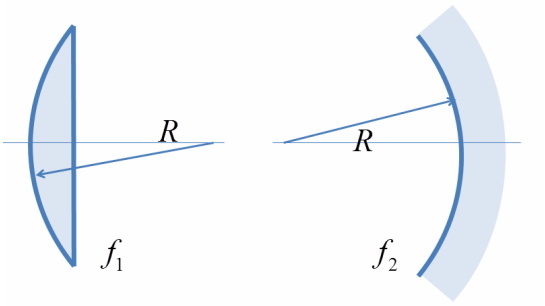
D. 150°

E. 175°



M3 A thin planoconvex lens made of glass with refractive index $n = 2$ and a concave mirror have the same radius R. What is the relation between their focal lengths f_1 and f_2?

A. $f_1 = 4f_2$
B. $f_1 = 2f_2$
C. $f_1 = f_2$
D. $2f_1 = f_2$
E. $4f_1 = f_2$



M4 A beam of light enters the end of an optic fiber as shown below. What is the minimum index of refraction n such that regardless of the incident angle θ_a, the light beam is guaranteed to reflect back into the material at point a (in other words, the total internal reflection at the side surface of the material occurs for all incident angles θ_a)?

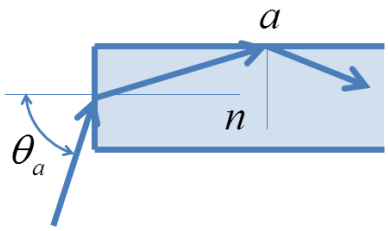
A. 1

B. $\sqrt{2}$

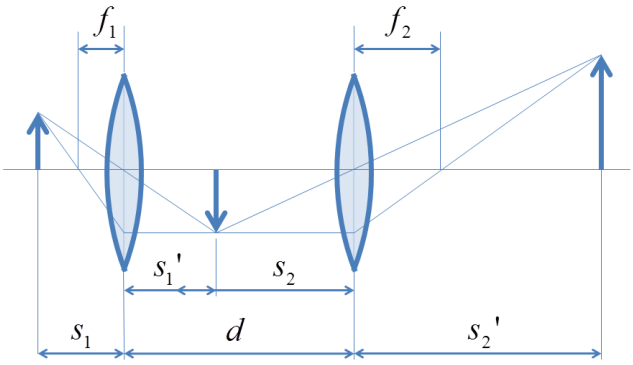
C. $\sqrt{3}$

D. 2

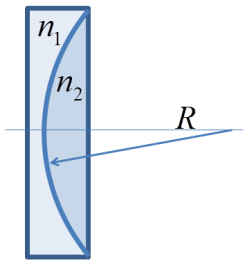
E. There is no value of n that satisfies this condition.



P1 An optical system consists of two converging lenses with focal lengths of 1 cm and 2 cm. For an object placed at 2 cm to the left of the first lens, the overall magnification is 2. Find the distance between the lenses.



P2 Find the focal length of a compound lens shown below.



$n_1 = 1.24$

$n_2 = 1.49$

$R = 5\,\text{cm}$

P3 In a double slit experiment with two slits 0.2 mm apart, it is found that second order maxima for red light ($\lambda = 660$ nm) and blue light ($\lambda = 460$ nm) are separated by 1 mm. How far away is the screen?

P4 If the amplitude of the electric field of an EM wave is 1 V/m, (a) what is the amplitude of the magnetic field? (b) What is the average energy density?