Multi-choice questions

Multi-choice Quiz Module 1

1. An optical fiber is illuminated by light from an external source. The numerical aperture NA = $\sin(\theta_a)$ of the fiber is 0.3. Knowing that the refractive index of the cladding is 1.46. What is the value of the refractive index of the core?

a. $n_{core} = 1.55$

b. $n_{core} < 1$ so this optical fiber cannot exist

c. $n_{core} = 1.43$

2. Yes/No. Light with an incidence angle of $\theta_1 = 45$ degrees passes through a medium with sunflower oil ($n_1 = 1.46$) to an air medium. Considering that the interface is a planar boundary. Does the phenomenon of total internal reflection occur?

a. Yes

b. No

3. A 2-cm toy object is located 30 cm in front of a concave mirror of a focal length of 20 cm. How is the image of the toy?

a. The image is virtual and smaller

b. The image is virtual and larger

c. The image is real and smaller

d. The image is real and taller

4. Could a converging lens form virtual images?

a. No, never.

b. Yes, if the object to be imaged is placed at an axial position smaller than the (object) focal length, $z_{obj}<f$.

c. Yes, if the object to be imaged is placed at an axial position z_{obj} is $f < z_{obj} < 2f$.

5. The same double-convex thin lens with a refractive index of 1.52 is embedded in two different media: air (n=1) and water (n = 1.33). Which of the following sentences is true?

a. The focal length of the lens is independent of the medium in which it is embedded.

b. The focal length of the lens embedded in water is higher than the one embedded in air.

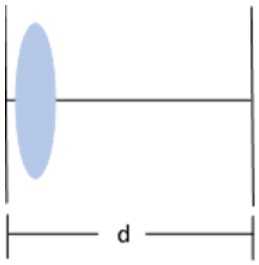
c. The focal length of the lens embedded in water is smaller than the one embedded in air.

6. Yes/No. There is an optical system made of a thin convex lens of focal length *f* and a thin concave lens of focal length *-f* separated by a distance *f*. Do parallel rays remain parallel after emerging from this system?

a. Yes

b. No

7. Which is the ray-transfer matrix of an optical system composed of an ideal lens of focal length *f* followed by a free-space propagator of distance *d*?



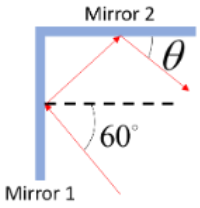
a. $\begin{pmatrix} 1 & d \\ 0 & 1 \end{pmatrix}$

b. $\begin{pmatrix} 1 & 0 \\ 1/f & 1 \end{pmatrix}$

c. $\begin{pmatrix} \frac{f-d}{f} & d \\ -1/f & 1 \end{pmatrix}$

d. $\begin{pmatrix} 1 & d \\ 1/f & \frac{f-d}{f} \end{pmatrix}$

8. Two mirrors are located on a table. Between the two mirrors, there is an angle of 90deg, as the figure shows. Consider that on the Mirror 1 impinges a beam with an angle of 60-deg respect to the normal. What is the angle θ in which the beam reflected on the Mirror 2?



a. 15 deg

b. 30 deg

c. 45 deg

d. 60 deg

9. Light travels through a homogenous medium with a refractive index n = 1.56. What is its speed after transitioning to another homogenous medium with a refractive index of n=1.21?

a. 2.48×10^8 m/s

b. 3.00×10^8 m/s

c. 1.92×10^8 m/s

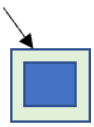
10. A 0.5-m tall object is placed 5 m away from a concave mirror with a focal length of 2 m. How far should a 0.75-m tall object be placed from a second concave mirror with a focal length of 2 m so that its image is the same height as the first's?

a. 47.6 mm

b. 6.5 m

c. 5 m

11. Light (initially in air) travels into a glass box (n=1.46) filled with water(n=1.33), with an initial incidence of 30°. At what angle does the light leave the box?



a. 20.03

b. 22.08

c. 30.00

12. A 10-cm toy boxer (B1) is placed 100 cm from a spherical mirror with a curvature radius of 10 cm. A second toy boxer (B2) of the same size is placed at 90 cm from the mirror. Which boxer's image is bigger/larger through the image and, therefore, wins the heavyweight title? How is the image: real or virtual?

a. B1 is bigger, and the image is real.

b. B1 is bigger, and the image is virtual.

c. B2 is bigger, and the image is real.

d. B2 is bigger, and the image is virtual.

13. Light is measured to travel through a new material at a speed of 1.97×10^8 m/s. This material creates a spherical lens with radii of 15 cm and 25 cm. The spherical lens is submerged in olive oil (refractive index of 1.47). About how far from the lens should we observe a clear image of an object located at infinity?

a. 10.4 m

b. 8.2 m

c. The image will be placed at the infinity.
