CHAPTER 16 REVIEW QUESTIONS

SECTION I: MULTIPLE CHOICE

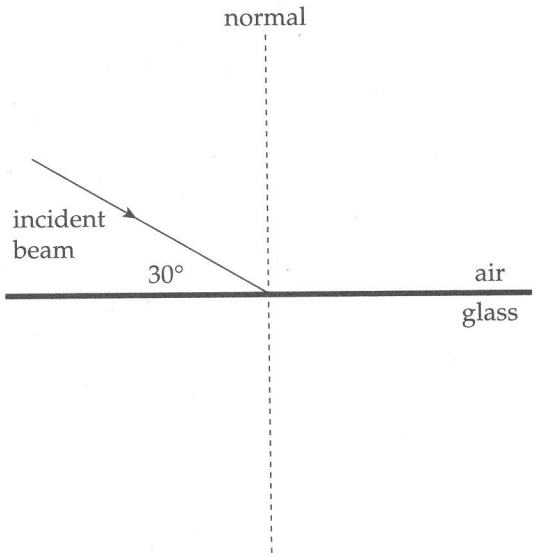
1. What is the wavelength of an X-ray whose frequency is 1.0×10^{18} Hz?

   (A) 3.3×10^{-11} m
   (B) 3.0×10^{-10} m
   (C) 3.3×10^{-9} m
   (D) 3.0×10^{-8} m
   (E) 3.0×10^{26} m

2. In Young's double-slit interference experiment, what is the difference in path length of the light waves from the two slits at the center of the first bright fringe above the central maximum?

   (A) 0
   (B) $\frac{1}{4}\lambda$
   (C) $\frac{1}{2}\lambda$
   (D) λ
   (E) $\frac{3}{2}\lambda$

3. A beam of light in air is incident upon the smooth surface of a piece of flint glass, as shown:



   If the reflected beam and refracted beam are perpendicular to each other, what is the index of refraction of the glass?

   (A) $\frac{1}{2}$
   (B) $\frac{1}{2}\sqrt{3}$
   (C) $\sqrt{3}$
   (D) 2
   (E) $2\sqrt{3}$

4. When green light (wavelength = 500 nm in air) travels through diamond (refractive index = 2.5), what is its wavelength?

   (A) 200 nm
   (B) 300 nm
   (C) 500 nm
   (D) 1000 nm
   (E) 1250 nm

5. A beam of light traveling in Medium 1 strikes the interface to another transparent medium, Medium 2. If the speed of light is less in Medium 2 than in Medium 1, the beam will

   (A) refract toward the normal.
   (B) refract away from the normal.
   (C) undergo total internal reflection.
   (D) have an angle of reflection smaller than the angle of incidence.
   (E) have an angle of reflection greater than the angle of incidence.

6. If a clear liquid has a refractive index of 1.45 and a transparent solid has an index of 2.90 then, for total internal reflection to occur at the interface between these two media, which of the following must be true?

	incident beam originates in	at an angle of incidence greater than
(A)	the solid	30°
(B)	the liquid	30°
(C)	the solid	60°
(D)	the liquid	60°
(E)	Total internal reflection cannot occur.	

7. An object is placed 60 cm in front of a concave spherical mirror whose focal length is 40 cm. Which of the following best describes the image?

	Nature of image	Distance from mirror
(A)	Virtual	24 cm
(B)	Real	24 cm
(C)	Virtual	120 cm
(D)	Real	120 cm
(E)	Real	240 cm

8. An object is placed 60 cm from a spherical convex mirror. If the mirror forms a virtual image 20 cm from the mirror, what's the magnitude of the mirror's radius of curvature?

   (A) 7.5 cm
   (B) 15 cm
   (C) 30 cm
   (D) 60 cm
   (E) 120 cm

9. The image created by a converging lens is projected onto a screen that's 60 cm from the lens. If the height of the image is 1/4 the height of the object, what's the focal length of the lens?

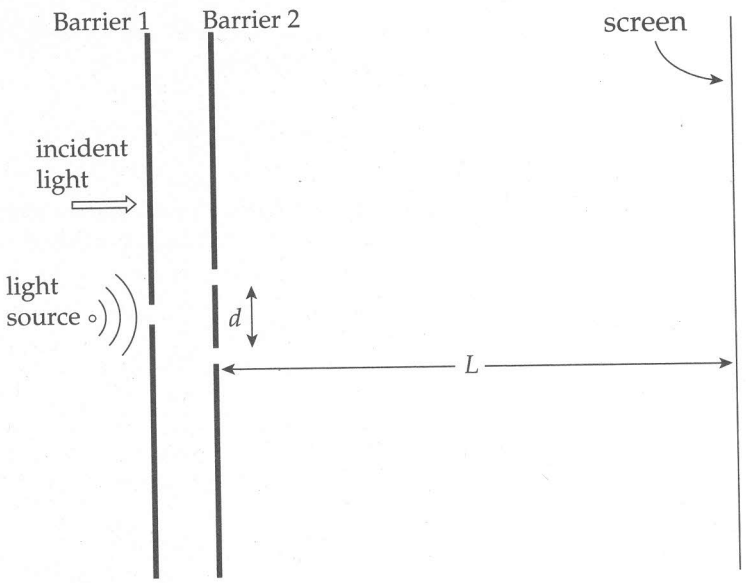
   (A) 36 cm
   (B) 45 cm
   (C) 48 cm
   (D) 72 cm
   (E) 80 cm

10. Which of the following is true concerning a bi-concave lens?

    (A) Its focal length is positive.
    (B) It cannot form real images.
    (C) It cannot form virtual images.
    (D) It can magnify objects.
    (E) None of the above

Section II: Free Response

1. Two trials of a double-slit interference experiment are set up as follows. The slit separation is $d = 0.50$ mm, and the distance to the screen, L, is 4.0 m.



(a) What is the purpose of the first (single-slit) barrier? Why not use two light sources, one at each slit at the second barrier? Explain briefly.

In the first trial, white light is used.

(b) What is the vertical separation on the screen (in mm) between the first-order maxima for red light ($\lambda = 750$ nm) and violet light ($\lambda = 400$ nm)?

(c) Locate the nearest point to the central maximum where an intensity maximum for violet light ($\lambda = 400$ nm) coincides with an intensity maximum for orange-yellow light ($\lambda = 600$ nm).

In the second trial, the entire region between the double-slit barrier and the screen is filled with a large slab of glass of refractive index $n = 1.5$, and monochromatic green light ($\lambda = 500$ nm in air) is used.

(d) What is the separation between adjacent bright fringes on the screen?