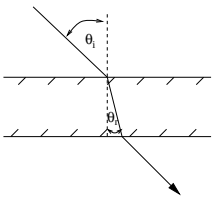
Pratt, Scott **Section 999**

–Introductory Physics II - EXAM 3 - Apr. 8, 1998

CAPA ID is **4880**

1. [3pt] Ten polarizers are arranged consecutively with polarization angles of : $0°, 10°, 20°, 30°, \cdots, 90°$ respectively. Unpolarized light with intensity $S_0 = 9.70 \times 10^2$ W/m^2 is incident on the array. What is the intensity (in W/m^2) of the light leaving the last polarizer?

A) 1.57×10^2 B) 1.77×10^2 C) 2.00×10^2 D) 2.26×10^2
E) 2.55×10^2 F) 2.88×10^2 G) 3.26×10^2 H) 3.68×10^2

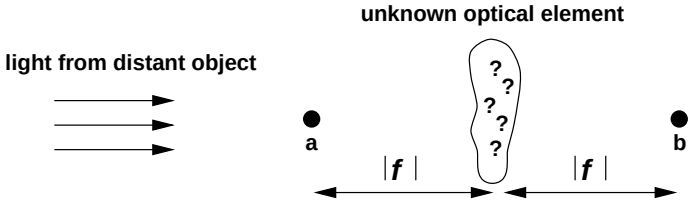


2. [3pt] A laser beam enters a 10.5 cm thick glass window at an incident angle of θ_i =59°. The index of refraction of the glass is 1.50. What is the angle of refraction θ_r? (in degrees)

A) 2.73×10^1 B) 3.08×10^1 C) 3.49×10^1 D) 3.94×10^1
E) 4.45×10^1 F) 5.03×10^1 G) 5.68×10^1 H) 6.42×10^1

3. [3pt] How long does it take the beam to pass through the plate (in *nanoseconds*)?

A) 2.10×10^{-1} B) 2.62×10^{-1} C) 3.28×10^{-1} D) 4.09×10^{-1}
E) 5.12×10^{-1} F) 6.40×10^{-1} G) 8.00×10^{-1} H) 1.00



4. [3pt] Light from a distant object is incident on an unknown optical element, as shown above. (For each statement select T True or F False).

A) If there is a VIRTUAL IMAGE at b the optical element is a CONVERGING LENS.

B) If there is a REAL IMAGE at a the optical element is a CONCAVE MIRROR.

C) If there is a REAL IMAGE at b the optical element is a CONVERGING LENS.

5. [3pt] Grandma has a farpoint of 2.91 m. Assuming her eyes are 2.0 cm from her glasses, what is the refractive power (in diopters) she needs in her lenses to see objects far away.

A) 2.77×10^{-1} B) 3.46×10^{-1} C) 4.33×10^{-1} D) 5.41×10^{-1}
E) 6.76×10^{-1} F) 8.45×10^{-1} G) 1.06 H) 1.32

6. [3pt] An object that is 6 cm high is placed 30 cm from the lens. The image is inverted and is 5.0 cm high. The magnitude of the focal length of the lens (in cm) is

A) 9.40 B) 1.36×10^1 C) 1.98×10^1 D) 2.87×10^1
E) 4.16×10^1 F) 6.03×10^1 G) 8.74×10^1 H) 1.27×10^2

7. [3pt] Light of wavelength 640 nm is incident on a single slit of width 9.0 μm. An interference pattern is observed on a screen 2.7 m away from the slit. How far (in cm) is the first minimum separated from the central maximum?

A) 6.41 B) 7.50 C) 8.78 D) 1.03×10^1
E) 1.20×10^1 F) 1.41×10^1 G) 1.65×10^1 H) 1.92×10^1

8. [3pt] (For each statement select T True or F False).

A) If a clock goes on a long space voyage at relativistic speeds, it will read the same time as a clock that stayed on earth if the time is read after the clock has come to rest again on earth.

B) An astronaut moving at relativistic speeds would perceive that our galaxy is smaller than what we would perceive.

C) Since a photon has no mass it can have energy but no momentum.

9. [3pt] A supernova explosion releases 3.5×10^{46} J. How much mass (in earth masses) has the star converted to energy? DATA: $M_e = 5.98 \times 10^{24}$ kg.

A) 3.09×10^4 B) 4.48×10^4 C) 6.50×10^4 D) 9.43×10^4
E) 1.37×10^5 F) 1.98×10^5 G) 2.87×10^5 H) 4.17×10^5

10. [3pt] A powerful laser can emit 775 joules in one pulse of light. The wavelength of the light is 675 nm. How many photons are in one pulse?

A) 2.63×10^{21} B) 3.50×10^{21} C) 4.65×10^{21} D) 6.19×10^{21}
E) 8.23×10^{21} F) 1.09×10^{22} G) 1.46×10^{22} H) 1.94×10^{22}