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General Physics II (PHYS 112)
Fall 2024

Reading Quiz 3, due Sunday, November 24, 2024, at 11:59 pm. **This is a firm deadline.**

Read Chapters 28 - 30 and answer the following questions.

1. B (1 point) A light ray incident on a smooth surface makes an angle of 30° with the surface. What is the angle of reflection?
   (A) 15°
   (B) 30°
   (C) 60°
   (D) 70°
   (E) 80°

2. B (1 point) When light moves from a medium where its speed is higher to a different medium where its speed is slower, the refracted ray is bent
   (A) away from the normal.
   (B) toward the normal.
   (C) along the normal.
   (D) along the surface.
   (E) perpendicular to the normal.

   $n_1 \sin\theta_1 = n_2 \sin\theta_2$
   $1 \sin 30 = 1.5 \sin\theta_2$
   $\sin^{-1}\left(\frac{\sin 30}{1.5}\right) = \theta_2$
   $\theta_2 \approx 20°$

3. C (1 point) The passenger-side rear view mirror on a car says, "Objects in the mirror may be closer than they appear". Assuming the images are not inverted, this mirror must be:
   (A) concave
   (B) plane
   (C) convex
   (D) mounted on the wrong side of the car
   (E) confused, as objects cannot be closer than they appear

4. B (1 point) Which of the following best describes the image for a thin convex lens that forms whenever the object is at a distance less than one focal length from the lens?
   (A) inverted, enlarged and real
   (B) upright, enlarged and virtual
   (C) upright, diminished and virtual
   (D) inverted, diminished and real.

5. C (2 points) Estimate the distance (in cm) between the central bright region and the third dark fringe on a screen 5.00 m from two double slits 0.500 mm apart illuminated by 500-nm light.
   (A) 3.47
   (B) 2.15
   (C) 1.75
   (D) 1.50
   (E) 1.25

   $L = 5m \quad d = 0.5mm \quad \lambda = 500nm$
   $m = 3^{rd}$ dark
   $\frac{dy}{L} = m\lambda \quad y = \frac{m\lambda L}{d}$
   $y = \frac{3.5 \cdot 500nm \cdot 5m}{0.5mm}$
   $y = 1.75$

6. A (1 point) If a wave from one slit of a Young's double-slit set-up arrives at a point on the screen one-half wavelength behind the wave from the other slit, what is observed at that point?
   (A) dark fringe
   (B) bright fringe
   (C) multi-colored fringe
   (D) gray fringe, neither dark nor bright
   (E) none of the above

7. (3 points) A doctor examines a mole with a 15.0 cm focal length magnifying glass held 11 cm from the mole. (a) Where is the image? (b) What is its magnification? (c) How big is the image of a 7.2 mm diameter mole?

8. (2 points) A Young's double slit has a slit separation of 2.50×10^{-5} m on which a monochromatic light beam is directed. The resultant bright fringes on a screen 1.00 m from the double slit are separated by 2.30×10^{-2} m. What is the wavelength of this beam? (1 nm = 10^{-9} m)

9. (2 points) Light of wavelength 625 nm shines through a single slit of width 0.320 mm and forms a diffraction pattern on a flat screen located 8.00 m away. Determine the distance between the middle of the central bright fringe and the first dark fringe.

10. (3 points) A diffraction grating is 1.5 cm wide and contains 2100 lines. When used with light of a certain wavelength, a third-order maximum is formed at an angle of 15.0^0. What is the wavelength (in nm)?

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7) $f = 15\text{cm}$ $p = 11\text{cm}$

a) $\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$ $\frac{1}{q} = \frac{1}{f} - \frac{1}{p} = \frac{1}{15\text{cm}} - \frac{1}{11\text{cm}} = -2.42^{-1} = -41.25\text{cm}$

b) $m = \frac{q}{p} = \frac{41.25\text{cm}}{11\text{cm}} = -3.75$

c) $h = 7.2\text{cm}$ $\frac{h'}{h} = m$ $\frac{h'}{7.2\text{cm}} = -3.75$ $h' = -27\text{cm}$

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8) $d = 2.5 \times 10^{-5}\text{m}$ $L = 1\text{m}$ $y = 2.3\text{cm}$

$\frac{dy}{L} = \lambda = \frac{25\mu\text{m} \cdot 2.3\text{cm}}{1\text{m}} = 575\text{nm}$

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9) $\lambda = 625\text{nm}$ $w = 0.32\text{mm}$ $L = 8\text{m}$ $m = 1$

$y = \frac{\lambda L}{w} = \frac{625\text{nm} \cdot 8\text{m}}{0.32\text{mm}} = 1.56\text{cm}$

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10) $L = 1.5\text{cm}$ $N = 2100$ $m = 3$ $\theta = 15^\circ$ $d = \frac{w}{N} = \frac{1.5\text{cm}}{2100} = 7.14\mu\text{m}$

$d\sin\theta = m\lambda$

$\lambda = \frac{d\sin\theta}{m} = \frac{7.14\mu\text{m} \cdot \sin 15}{3} = 616.2\text{nm}$