Physics 1C **Midterm 2**
Summer Session II, 2011

1. Light of wavelength 550 nm in vacuum enters a substance with an index of refraction of 1.47. What is the wavelength in nm in the medium?

   (a) 293
   (b) 357
   (c) 374
   (d) 388
   (e) 401

2. Two mirrors are at right angles to one another. A light ray is incident on the first at an angle of 30° with respect to the normal to the surface. What is the angle of reflection from the second surface?

   (a) 30°
   (b) 60°
   (c) 45°
   (d) 53°
   (e) 75°

3. A person in a boat sees a fish in the water (n=1.33) at an angle of 40° relative to the waters surface. What is the true angle in degrees relative to the waters surface?

   (a) 40
   (b) 35
   (c) 50
   (d) 55
   (e) 61

4. A plano-convex lens is made of glass (n=1.5) with one surface flat and the other having a radius of 20 cm. What is the focal length in cm of the lens?

   (a) 20
   (b) 30
   (c) 40
   (d) 10

(e) 50

5. What is the focal length in cm of a convex mirror in which a virtual image is located 10.0 cm from the mirror and the object is 30.0 cm from the mirror. Both object and image are located on the principle axis of the mirror.

   (a) -5
   (b) -10
   (c) -15
   (d) -20
   (e) -25

6. The image distance, q_A, of object A is twice as far from a converging lens as the image distance, q_B, of object B. Both images are real images. Which statement regarding the object distances is correct?

   (a) $p_B < p_A$
   (b) $p_B = p_A$
   (c) $p_B > p_A$
   (d) $p_B < -p_A$
   (e) $p_B = -p_A$

7. A convex lens and a concave mirror each have focal length f. The lens is placed a distance $4f$ in front of the mirror. Then an object is placed a distance $2f$ in front of the lens. The image produced by the lens-mirror system will be

   (a) $2f$ in front of the mirror and inverted.
   (b) $2f$ behind the mirror and upright.
   (c) $2f$ in front of the lens and inverted.
   (d) $2f$ in front of the lens and upright.
   (e) $2f$ behind the mirror and inverted.

8. Estimate the distance in cm between the central bright region and the third dark fringe on a screen 5.00 m from two slits 0.500 mm apart, when the slits are illuminated by 500 nm light.

   (a) 3.47
   (b) 2.15
   (c) 1.75
   (d) 1.50

(e) 1.25

9. An optical coating ($n = 1.4$) on a glass lens ($n = 1.5$) is designed to minimize reflection of light of 500 nm wavelength. How thick (in nm) should the coating be?

   (a) 84

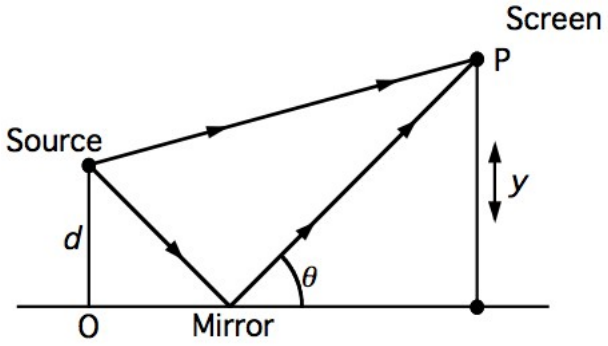
   (b) 94

   (c) 89

   (d) 99

   (e) 179

10. An interference pattern is produced at point P on a screen as a result of direct rays and rays reflected off a mirror shown in the figure. If the source is 100 m to the left of the screen, 1 cm above the mirror, and the source is monochromatic ($\lambda = 500nm$), find the distance y in mm to the first dark band above the screen.



   (a) 1.0

   (b) 2.0

   (c) 1.5

   (d) 2.5

   (e) 5.0

11. A diffraction grating with 4000 lines/cm is illuminated by light from the sun. The solar spectrum is spread out on a white wall across the room. At what angle from the located center line is blue light (400 nm)?

   (a) 9.8°

   (b) 9.2°

(c) $10.1°$

(d) $9.4°$

(e) $9.6°$

12. A stopping potential of 3.2 V is needed for radiation whose wavelength is 200 nm. The work function in eV of the material is ($h = 6.626 \times 10^{-34}\ J \cdot s$; $c = 3.00 \times 10^{8}\ m/s$; $e = 1.60 \times 10^{-19}$ C; $1eV = 1.602 \times 10^{-19} J$)

    (a) 4

    (b) 3

    (c) 5

    (d) 6

    (e) 2

13. The maximum kinetic energy of photoelectrons depends on

    (a) the frequency of the light.

    (b) the intensity of the light.

    (c) the number of photons that reach the surface per second.

    (d) the number of quanta.

    (e) the speed of light.

14. A photon whose energy is $8 \times 10^{-15}\ J$ is scattered off an electron at an angle of $90°$. What is the wavelength of the scattered wave in m? ($m_e = 9.11 \times 10^{-31}$ kg; $h = 6.626 \times 10^{-34}\ J \cdot s$; $c = 3.00 \times 10^{8}\ m/s$; $e = 1.60 \times 10^{-19}$ C)

    (a) 2.73×10^{-11}

    (b) 2.25×10^{-11}

    (c) 2.50×10^{-11}

    (d) 2.40×10^{-11}

    (e) 2.48×10^{-11}