CHAPTER 11 FREESTANDING PRACTICE QUESTIONS

1. In optics, spontaneous parametric down conversion is often used to create two photons from one photon. Thus, it is possible for a blue photon with a frequency of 700 THz to be split into two identical red photons when incident on a nonlinear crystal. What is the wavelength of the red photons with respect to the blue photon, λ_B, given that energy is conserved?

A) $2\lambda_B$
B) $4\lambda_B$
C) $1/2\lambda_B$
D) $1/4\lambda_B$

2. If the magnification of a mirror is 2, where are the focal point and the image?

A) The image is on the same side of the mirror as the object and the focal point is twice as far from the mirror as the object.
B) The image is on the same side of the mirror as the object and the focal point is half as far from the mirror as the object.
C) The image is on the opposite side of the mirror as the object and the focal point is twice as far from the mirror as the object.
D) The image is on the opposite side of the mirror as the object and the focal point is half as far from the mirror as the object.

3. Glasses that correct for nearsightedness have a negative power associated with them. Are these lenses diverging or converging, and do they have a focal length that is positive or negative?

A) Diverging lens with positive focal length
B) Converging lens with negative focal length
C) Diverging lens with negative focal length
D) Converging lens with positive focal length

4. A physics student looking into a carnival funhouse mirror sees that his image is upright but his head appears twice as big as normal and his feet look half as big as normal. Let o represent the distance from the student to the mirror, f_{top} represent the focal length of the top of the mirror (where the student's head appears), and f_{bottom} represent the focal length of the bottom of the mirror (where the student's feet appear). What combination of curved mirrors is necessary to create the illusion?

A) The mirror top is concave with $f_{top} = 2o$ and the mirror bottom is convex with $f_{bottom} = -(1/2)o$.
B) The mirror top is concave with $f_{top} = 2o$ and the mirror bottom is convex with $f_{bottom} = -o$.
C) The mirror top is concave with $f_{top} = 3o$ and the mirror bottom is convex with $f_{bottom} = -(1/3)o$.
D) The mirror top is convex with $f_{top} = -o$ and the mirror bottom is concave with $f_{bottom} = (1/2)o$.

5. For a plane mirror, the object distance from the mirror is o, the image distance from the mirror is i, the focal point distance from the mirror is f, and the magnification of the mirror is m. Which of the following is true of the plane mirror?

I. Since f approaches infinity, then $i = -o$.
II. Since $f = 0$, then $i = -o$.
III. Since $i = -o$, then $m = 1$ and the image is the same size as the object.

A) I only
B) II only
C) I and III
D) II and III

6. A photon of wavelength 600 nm is travelling toward earth at a distance 6×10^3 m from the earth's surface. Ionized nitrogen and oxygen at this altitude create a potential difference of approximately 10^4 V. Which of the following forms of energy account for the majority of the photon's energy? (Planck's constant, h, is 6.6×10^{-34} J·s)

A) Kinetic energy
B) Gravitational potential energy
C) Electrical potential energy
D) Photon energy

7. A computer science student has recently gotten engaged, and her physics friends are admiring her diamond ring. One of them suggests that they calculate the critical angle for the light rays hitting the diamond ($n = 2.4$) at an angle of 30°. When would total internal reflection of the light ray occur?

A) 15°
B) 45°
C) 60°
D) Cannot be determined