1. . Which of the following has the shortest wavelength? (A) Red light (B) Blue light (C) Gamma rays (D) X rays (E) Radio waves

2. . Orange light has a wavelength of 6 x 10-7 m. What is its frequency? The speed of light is 3 x 108 m/s. (A) 2 x 1015 Hz (B) 2 x 10-15 Hz (C) 5 x 1014 Hz (D) 5 x 10-14 Hz (E) 2 x 1014 Hz

3. . When the orange light passes from air (n = 1) into glass (n = 1.5), what is its new wavelength? (A) 4 x 10-7 m (B) 4 x 10-6 m (C) 2.5 x 10-7 m (D) 6 x 10-7 m (E) 9 x 10-7 m

4. . When a ray of light is refracted, the refracted ray does not have the same wavelength as the incident ray. Which of the following explain this phenomenon? I. Some of the energy of the incident ray is carried away by the reflected ray II. The boundary surface absorbs some of the energy of the incident ray III. The incident and refracted rays do not travel with the same velocity (A) I only (B) II only (C) III only (D) I and II only (E) I, II, and III

5. . A beam of light that passes through a sheet of plastic and out into the air. The angle the beam of light makes with the normal as it passes through the plastic is , and the angle the beam of light makes with the normal as it passes into the air is . The index of refraction for air is 1 and the index of refraction for plastic is 2. What is the value of , in terms of ? (A) (B) (C) (D) (E)

6. . What is the minimum incident angle for which the light will undergo total internal reflection in the plastic? (A) (B) (C) (D) 0Âº (E) 90Âº

7. . A person’s image appears on the far side of an optical instrument, upside down. What is the optical instrument?  (A) Concave mirror (B) Convex mirror (C) Plane mirror (D) Concave lens (E) Convex lens

8. . A physicist shines coherent light through an object, A, which produces a pattern of concentric rings on a screen, B. A is most likely:  (A) A polarization filter (B) A single-slit (C) A multiple-slit diffraction grating (D) A prism (E) A sheet with a pinhole

9. . Sound waves do not exhibit polarization because, unlike light waves, they are not (A) Longitudinal (B) Coherent (C) Dispersive (D) Transverse (E) Refractive

10. . The solar glare of sunlight bouncing off water or snow can be a real problem for drivers. The reflecting sunlight is horizontally polarized, meaning that the light waves oscillate at an angle of 90Âº to a normal line drawn perpendicular to the Earth. At what angle relative to this normal line should sunglasses be polarized if they are to be effective against solar glare? (A) 0Âº (B) 30Âº (C) 45Âº (D) 60Âº (E) 90Âº