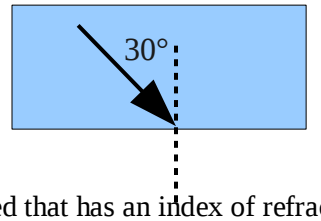
Name: 02/20/13

Quiz - Week 3: Optics

1. A specific type of plastic has an index of refraction of 1.5. This means -
   a) Light travels 1.5 times faster in this plastic than in a vacuum.
   b) Light travels 1.5 times faster in a vacuum than in this plastic.
   c) Light is 1.5 times brighter in a vacuum than in this plastic.
   d) The wavelength of the light is 1.5 times longer in this plastic than in a vacuum.
   e) The frequency of the light is 1.5 times higher in this plastic than the frequency of light in a vacuum.



2. A new type of glass is designed that has an index of refraction of $n=\sqrt{2}\approx 1.414$. Light travels from the glass into the air, $n\approx 1$, with an incident angle of 30°, as shown above. What is the angle of refraction?
   a) 15° b) 30° c) 45° d) 60° e) 90°

3. A ray of light has a wavelength of 460 nm while traveling in a vacuum. The light then enters a material with a refractive index of 2. The wavelength of the light in the material is -
   a) 920 nm
   b) 690 nm
   c) 460 nm
   d) 230 nm
   e) It cannot be determined without knowing the frequency of the light.

4. A long cylinder is made of a transparent, flexible material with an index of refraction of n=2. The material is surrounded by air. If light is traveling in the cylinder, what is the minimum angle light can strike the surface of the cylinder (from the inside) and still remain confined inside the cylinder?
   a) 0.5° b) 15° c) 30° d) 45° e) 60°

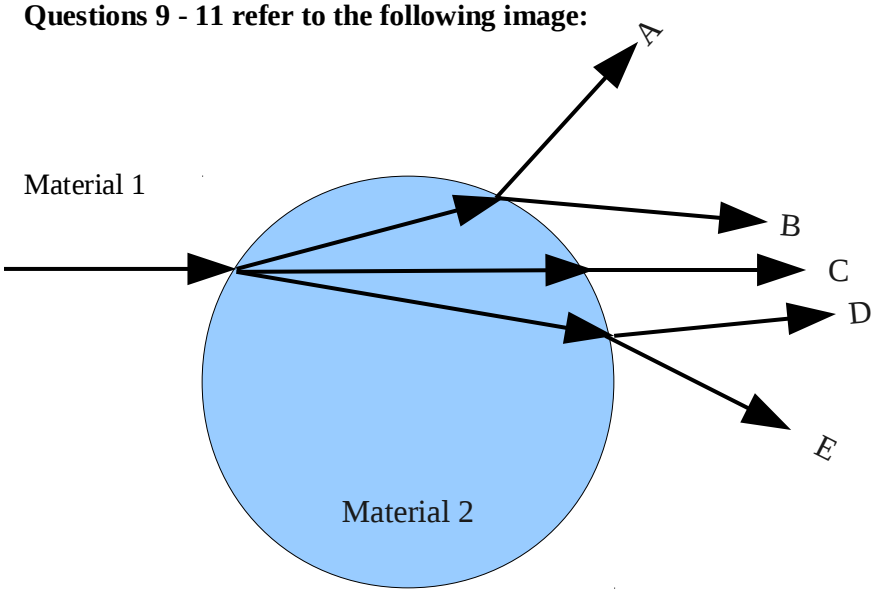
5. The glass windows (n=1.7) of a building are to be coated in a thin layer of plastic (n=1.5) that is designed to make the building to appear red (λ = 660 nm). What should the thickness of this layer of plastic be?
   a) 660 nm b) 440 nm c) 330 nm d) 220 nm e) 110 nm

6. A laser of $\lambda = 5 \times 10^{-7}$ m is incident on a vinyl record. The light is allowed to reflect, and characteristic bright and dark spots appear on a wall 4 meters away. The distance from the central bright spot to the first-order maximum is 2 cm. What is the separation between the grooves on the vinyl disc?
   a) 1×10^{-4} m
   b) 1×10^{-5} m
   c) 1.2×10^{-5} m
   d) 2×10^{-5} m
   e) 4×10^{-5} m

7. A concave mirror is capable of creating an image that is -
   I. Real
   II. Virtual
   III. Inverted
   a) I and III only
   b) I and II only
   c) II only
   d) II and III only
   e) I, II, and III

8. A concave lens has a focal length of -3 cm. An object is placed 6 cm to the left of the lens. The image that forms is -
   a) 0.5 cm to the left of the lens, inverted, and larger.
   b) 2 cm to the left of the lens, upright, and smaller.
   c) 2 cm to the right of the lens, inverted, and smaller.
   d) 6 cm to the left of the lens, upright, and larger.
   e) 6 cm to the right of the lens, inverted, and larger.

Questions 9 - 11 refer to the following image:



9. A light ray travels from air (material 1) through a glass sphere (material 2). Which is the only possible path for light to follow?
   a) A b) B c) C d) D e) E

10. The diagram now shows an air bubble (material 2) surrounded by glass (material 1). What is the only possible path that a light ray could take?
   a) A b) B c) C d) D e) E

11. Material 1 is plastic and material 2 is glass. Both materials have the same index of refraction. What is the only path that light could take through these materials?
   a) A b) B c) C d) D e) E