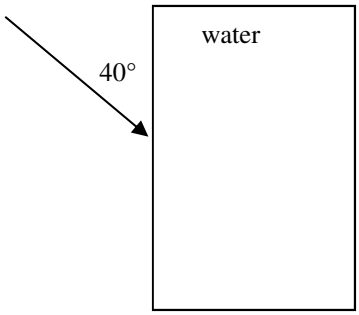
PreAP Light and Optics 5

1. A substance has an index of refraction of 2.
   A. * Calculate the speed of light in that substance.

   B. How does the speed of light in the substance compare with that of the speed of light in a vacuum?

2. So, (quickly, now), light travels 1×10^8 m/s in a substance. What is its index of refraction?

3. 450 nm light traveling in air then passes into a tray of water, as shown. This time, I will walk you thru this.



   A. What part of the light wave is the same as it passes into water?

   B. *Calculate the frequency of the light in air.

   C. * Calculate the speed of light in the water (*find n for water on the "Refraction" notes*).

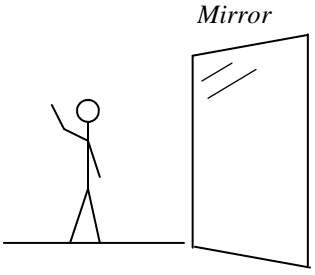
   D. * Calculate the frequency of the light in the water.

   E. Calculate the wavelength of the light in the water.

   F. Sketch the path of the light as it enters and exits the water tray.

   G. Calculate the angle that the light refracts in the water.

   H. At what angle will the light reflect off the surface?



4. Slim Jim is waving hello to you. (He's a good guy!) Just so happens that he is standing next to a mirror. Draw the image of Jim you see in the mirror. (*Think about what you see in your mirror at home.)*

Let's start using a new equation…

5. * A light wave has a frequency of 4×10^{15} Hz. How much energy does each photon have?

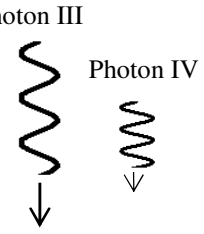
6. * Photon I has a wavelength of 350nm. Use $v = f\lambda$, solve for frequency, substitute into the formula and solve for energy of the photon.

Energy of one Photon

Energy per photon (in J/ photon) → $E = hf$ ← Photon's Frequency (*in Hz*)

Planck's Constant (6.63×10^{-34} *J•s*) →

7. Photon II has a wavelength of 700 nm. How much energy is Photon II?



8. Photon I or Photon II had more energy?
9. Which of the following photons would have more energy?
   A. Long wavelength or short wavelength?
   B. High frequency or low frequency?
   C. Blue or red light? (See "Light" notes)
   D. Photon III or Photon IV at the right?