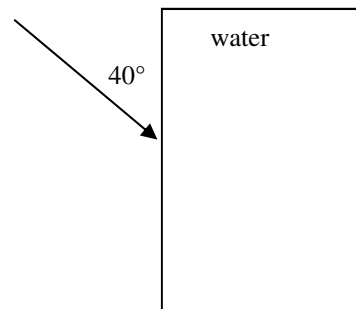# 2011-12 PreAP Light and Optics 5

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?
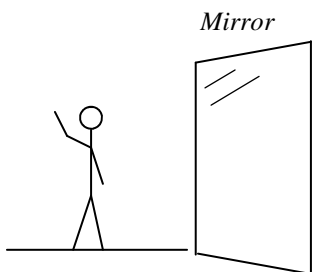
Mirror

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?

Energy of one Photon

Energy per photon (in J/ photon) $\longrightarrow$ Planck's Constant *(6.63×10^{-34} J•s)*

$$E = hf$$

Photon's Frequency *(in Hz)*

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.

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

Photon III

Photon IV

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?
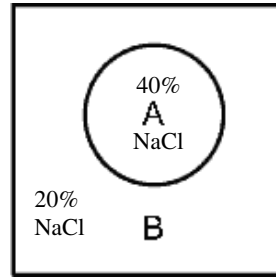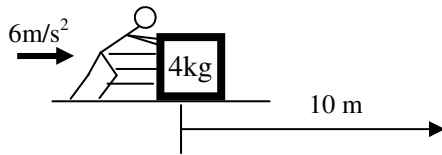   B. High frequency or low frequency?
   C. Blue or red light? (See "Light" notes)
   D. Photon III or Photon IV at the right?
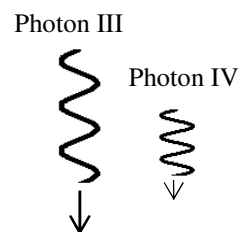
More of Using your TAKS notes (all 5 objectives)….

10. (*Let's try this one again, but with the diagram, this time*.) (Day 7B) If the diagram shows a round membrane that is permeable to water, which way will the water flow?

6m/s² → 4kg — 10 m →

40% A NaCl

20% NaCl B

11. Slim Jim pushes on a box for 10 meters.
    A. How much work does he do on the box? (*And, yes, there is enough information.*)

    B. If there is no friction, how much kinetic energy does it gain?

12. (Day 10) What part of a plant pulls water up to the leaves?

13. What part of a plant moves g_____ down to the roots?

14. What is the name of the process by which plants produce plant sugar in the leaves?

15. Because plants produce their own food, they are known as a_____.

16. (Day 11) When a bear eats berries it is a h_____. When it eats insects it is a c_____. This makes bears o_____.

17. Given these organisms: fresh water snail; fox; algae; bird.
    A. At the right draw a food chain for the above four organisms.

    B. The biomass pyramid at the right is not drawn to scale (use the ones on the notes). Label the four organisms on the pyramid.

    C. If the were mass of birds in an ecosystem had a mass of 10^6 kg, label the relative masses of the other levels of the pyramid.
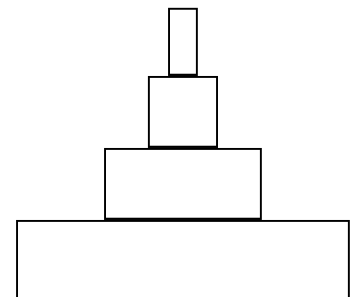
1A) n = c/v, so v = c/n = 3e8/2 = 1.5E8 m/s
3B) 6.67E14Hz   3C) v = 3E8/1.33 = 2.26E8 m/s   3D) same as in air
5) 2.65E−18 J/photon   6) 5.68E−19J