# PreAP Light and Optics 1

*From "Light" notes*:

1. Give examples for why we know light is a wave.

2. The notes say that light is a particle because it can go thru a vacuum. Why can't sound go thru a vacuum? (Think about the Slinky.)

3. What is a packet or single particle of light called?

4. What is the speed of sound in air?

5. What is the speed of light (pretty close to the same in air as in a vacuum)?

6. Lightening strikes 1 mile away (which is very close to 1600 m).
   A. * How long does it take the light to reach you?

   B. How long does it take the sound (the thunder) to reach you?

   *This is why we see the lightening before we hear the thunder*.

7. Where does light come from?
8. When does an atom emit (give off) light?
9. What happens when an atom absorbs (take in) light (energy)?
10. Why do we know that stars are made up of different elements (be complete in this explanation)?

11. The process by which a prism creates a rainbow of colors from white light is known as:
12. Which bends more as it passes thru a prism: blue or red light?
13. Give the expression to help you remember the pattern of colors in the rainbow (starts with an "R"):

14. Which color in the rainbow has the highest amount of energy?
15. All of light, both visible and invisible is known as the:
16. Give the EM spectrum from highest to lowest energy:

17. Which has a longer wavelength: blue or red light?
18. Which has a higher frequency: x-rays or radio waves?
19. Which has more energy: microwaves or visible light?
20. Which has a faster speed: red light or radio waves?
21. Which kind of EM Spectrum is responsible for the following:
    A. Used to communicate with cell phones.
    B. Created in nuclear reactions.
    C. We feel as heat.
    D. Very long, low power waves.
    E. Damage human skin with sufficient exposure.
    F. Used to pass thru materials for industrial purposes.

*Let's be sure we remember some prefixes:*
*"Kilo" means* $\times 10^3$ *(1000g = 1 kg); Mega means* $\times 10^6$ *(1,000,000 m = 1 Mm); 1 nanometer =* $\times 10^{-9}$ *m. (1 m = 1,000,000,000 nm)*

*Interestingly 10,000 nm = width of a human hair (approximately)*

*So 3.4 MHz = 3,400,000 Hz (that's a lot of times per second);* $350\text{ nm} = 350\times10^{-9}\text{ m} = 3.5\times10^{2}\times10^{-9}\text{ m} = 3.5\times10^{-7}\text{ m}$

22. A person tunes their radio to 101.1 FM.
    A. * What is the speed of the radio wave?
    B. How far do the radio signals travel in 0.25 seconds?

    C. Turns out 101.1 on the dial is actually 101.1 MHz. What is the wavelength of the radio signals?

    D. * What is the period of vibration of the radio waves?

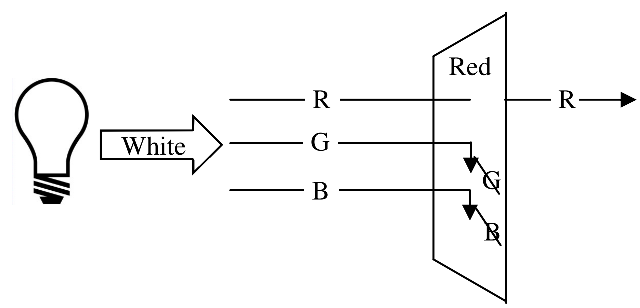
*Read the "Color Notes". I will show you this in class tomorrow. It will help if you familiarize with the terms and, especially the color chart. Read the instructions on the right side of the color chart to learn how to use it.*

23. Given three lights: red (R), green (G), and blue (B).

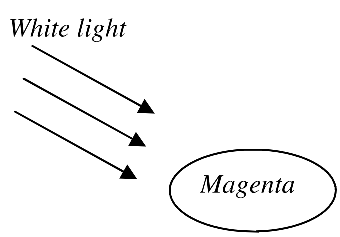
| | | | | | |
|---|---|---|---|---|---|
| A. | ______ | What color is the background (*before you turn the lights on*)? | D. | ______ | How do you make yellow? |
| | | | E. | ______ | If you make red, what colors are off? |
| B. | ______ | How do you make blue? | F. | ______ | To make magenta, what color is off? |
| C. | ______ | How do you make magenta? | G. | ______ | What color is off when you see cyan? |

*Help with subtractive color: Our eyes can only see lights. When looking at a red stop sign, we can only see the red light reflected OFF of the stop sign.*

*In the example at the right, notice that a red filter only allows red light to go thru. Therefore a red filter would block (absorb) green and blue light. If I put a blue light behind a red filter, you would see black, because blue cannot get thru a red filter.*




*The other big help for light reflecting off of objects can be found on the "color" notes, especially the banana example.*




24. A. What colors make up white light? (*Label them on the diagram.)*

    B. * What color lights must be reflected for us to see Magenta (*label them as arrows coming off of Magenta*)?

    C. So, what color does Magenta absorb?

6) Use S = D/T. Work in meters.
22) A. Same as all light. C. You have speed and frequency. The equations we used last D. how do period and freq. relate?