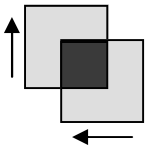
B-day: Due Fri., May 7
A-day: Due Mon., May 10

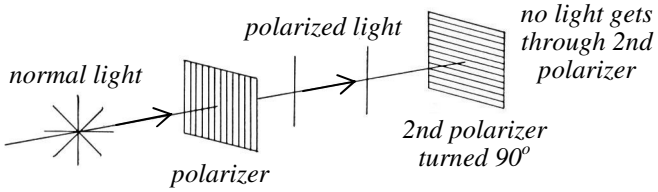
2009-10 PreAP Light and Optics 7

Polarization

Normal light is chaotic, with transverse waves moving in all directions. A ***polarizer*** allows only light going one direction to go through (like a comb).



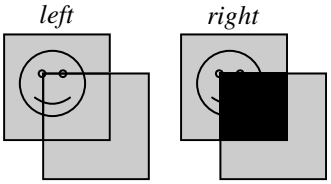
Each polarizer allows light through. Two perpendicular polarizers cancel out all light.



Only light in one direction can get through a polarizer. Two polarizers turned 90° can cancel out all light.

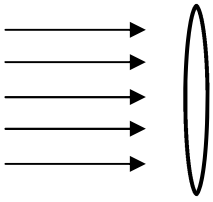
Polarization is used in some sunglasses to reduce glare.

Polarization is how some computers and most calculators screens work..

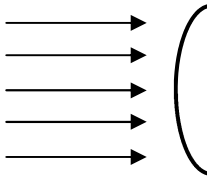


1. Two polarizers are placed over a happy face at the right. In which situation is one of the polarizers turned 90°?
2. What is the speed of radio waves?
3. What is the speed of x-rays?
4. How far can radio waves go in 2 minutes?

5. For a sound wave, increasing the amplitude increases the sounds:
6. In the wave theory of light, how do you change light to increase its amplitude?



7. A. Convergent or divergent?
   B. Concave or convex
   C. Mirror or lens?
   D. Draw what happens to the rays.



8. A. Convergent or divergent?
   B. Concave or convex
   C. Mirror or lens?
   D. Draw what happens to the rays.

Remember that 2 km means 2000m and 3kΩ = 3000Ω. Also, remember that the work function is the minimum energy (the threshold frequency) to get an electron out of the atom. If there is more energy than the work function, the extra energy is KE. A photon is also called a "quantum" or a "quantum of energy".

I'm going to show two examples, then you work the next problems yourself.

9. (*Example*) The electrons of an atom require 4.5 eV to be liberated from a metal surface
   A. What quantum of energy is necessary to give the electrons 0 eV of kinetic energy?
   B. How much KE does each electron have if 6.5eV is incident on the surface.
   (*Answer on bottom of next page.)*

10. If $1eV = 1.6\times10^{-19}$ J, what frequency of light has an energy of 2keV?

(*Answer on bottom of next page.*)

11. An atom needs 140 J to escape the atom. 200J of energy is given the atom.
    A. What is the work function?
    B. How much energy is necessary for an electron to have 0 joules of KE when it gets out?
    C. When the 200 joules is put into the atom, how much KE does the electron have?

12. If 1eV = 1.6×10^{-19} J, what frequency and wavelength of light has a 3.5keV of energy?

13. A quantum of 9eV is shining onto a metal photovoltaic cell. The work function of the metal is 4.8eV.
    A. How much KE does each electron have?
    B. To increase the KE of each electron would you increase or decrease the frequency of the light?
    C. To increase the KE of each electron would you increase or decrease the wavelength of the light?

This is obviously NOT everything on the test. You need to read the notes, come in and fix your quizzes, and redo homework. I've given you everything. It is up to you to learn it. I will also link up last year's review.

Answer Q9: A: 4.5eV;
Answer B: 2eV)
Answer Q10:

$2keV = 2000eV$

convert to joules: $\left(\frac{2000eV}{1}\right)\left(\frac{1.6\times10^{-19}\,J}{1eV}\right) = 3.2\times10^{-16}\,J$

$E = hf$

$3.2\times10^{-16}\,J = (6.63\times10^{-34})f$

$f = \frac{3.2\times10^{-16}}{6.63\times10^{-34}} = 4.83\times10^{17}\,Hz$