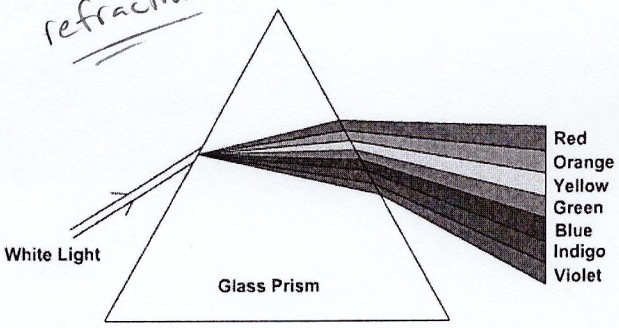
Refraction vs. Diffraction

- Recall that refraction is the bending of light/EMR as it passes from one medium into a new medium
- Newton was able to refract white light through a glass prism, which caused a rainbow spectrum of the individual wavelengths/colours to appear as the refracted EMR
  - Notice how red is refracted/bent the least, and violet gets refracted/bent the most

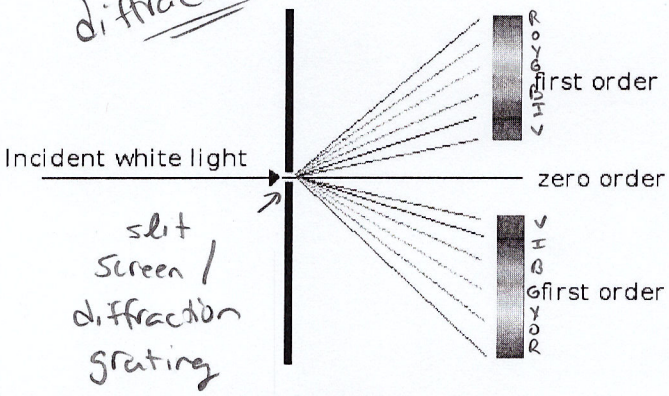
refraction!



- Refraction is the reason why we see a rainbow after it rains because the moister in the air acts like little prisms to *disperse* the white light
  - **Dispersion** is the separation of EMR into individual wavelengths
  - Because white light is made up of a bunch of different wavelengths, each wavelength will have a different angle of refraction. Therefore, each color/wavelength will be bent at different angles, or in other words, separated b/c each wavelenght/color has a different index of refraction
  - Shorter wavelengths (like violet) refract the most and longer wavelengths (like red) refract the least. This is why the rainbow always appears in the color order that it does

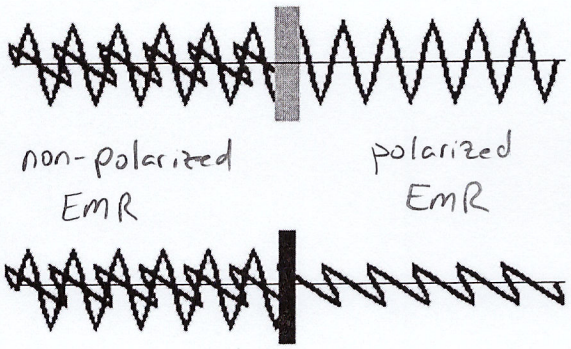
- The spectrum produced by refraction is the exact opposite of the spectrum produced by a diffraction grating/double slit screen
  - Shorter wavelengths (like violet) diffract the least and longer wavelengths (like red) diffract the most.

diffraction!

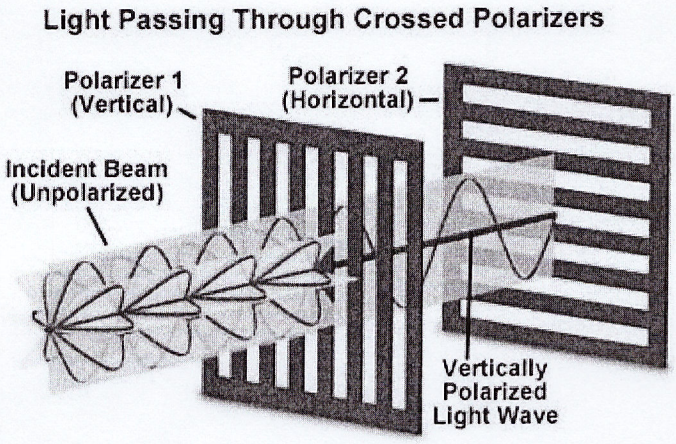


Polarization

- Polarization supports the wave model for EMR and also the idea that EMR is a *transverse* wave
- A polarized wave vibrates in only one plane (ie. either the electric or magnetic component of an EMR wave is eliminated)
    - Non polarized light can vibrate in all planes (ie. the EMR wave has both the electric and magnetic components)



- It is possible to filter out all but one plane of vibration/oscillation of EMR with one polarizing filter and it is possible to filter out all planes of vibration/oscillation of EMR with two polarized filters
    - Every polarizing filter has a polarizing axis/orientation that only allows light to pass through that is vibrating in the same plane as the axis/orientation



- The fact that EMR can be polarized, also shows that EMR is a *transverse* wave
    - Recall transverse means that the wave propagation is *perpendicular* to the wave oscillation. Therefore, placing the polarizing filters perpendicular to the wave propagation and allowing the polarization filters to eliminate a vibration/oscillation in a specific plane proves that EMR is transverse

*****Now try pg. 232 #1-9 & Practice Problem*****

Practice Problem

1. Describe two methods to separate/disperse white light into all of its wavelengths. Compare the spectra that are produced from each method.

Answer:
One method of dispersing light includes shining white light through a prism. Each wavelength will have its own index of refraction according to Snell's Law. This will allow white light to be dispersed. A second method would be to shine white light through a diffraction grating. Different wavelengths will be diffracted differently according to the equations developed from Young's double slit experiment. The rainbow spectrum that is produced from the refraction of light through a prism will result in red light being refracted less and violet light being refracted more. The rainbow spectrum that is produced from a diffraction grating will result in red light being diffracted more and violet light being diffracted less.

Diffraction

$\lambda = \frac{d \sin\theta}{n}$ therefore, $\lambda \alpha \sin\theta$

As wavelength increase, so does the value of sinθ (also means θ increases). Therefore, longer wavelengths get diffracted more