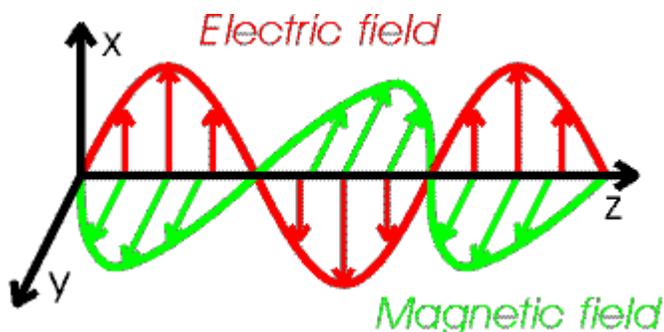


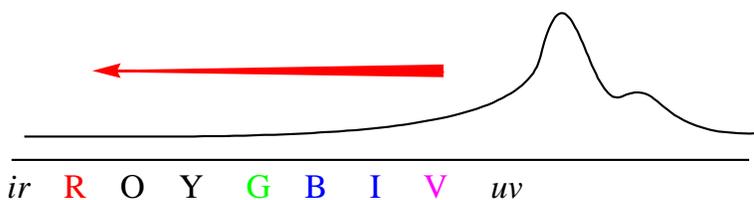
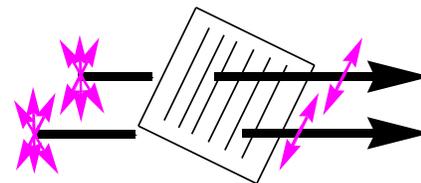
This handout is not a stand-alone piece. It was used in conjunction with a Visual Basic 6.0 simulation (<http://www.stolaf.edu/people/hanson/origami/WIN/optics.exe>) and a demonstration of optical rotation using corn syrup. Answers are given at the end of this document.



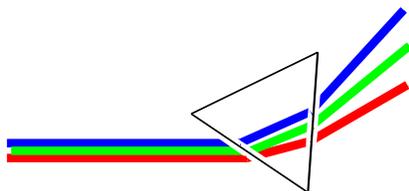
A. Light can be thought of either in terms of an oscillating magnetic field or an oscillating electric field. Light oscillating like this in a single plane (in terms of the electric field) is called _____.

B. The time-dependent oscillation can be seen as the sum of two _____.

C. Normally light is composed of a randomly polarized fields, but certain _____ materials are selective in which polarizations are allowed to pass through.

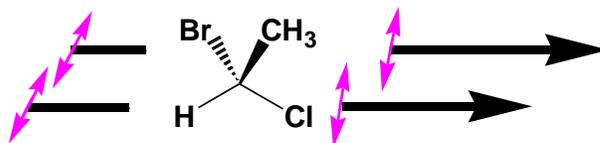


D. All chemical compounds absorb _____ light, because all compounds contain _____ bonds. This absorption is primarily electronic in nature, but also involves _____ and _____. The broad UV absorptions tail off into the _____ region, which is at _____ energy.



E. The absorption of light results in its being slowed down. As a result, the light _____. Higher energy light refracts _____ than lower energy light. (This is why the sky is blue and sunsets are red.)

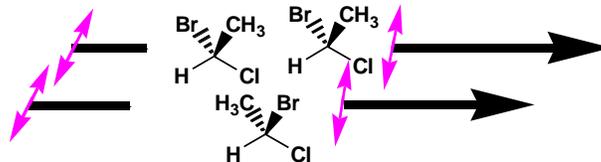
F. _____ molecules selectively absorb one of the counter-rotating components of light more than the other. If you think about it, they *have* to. How could they not? This “retardation” of one component more than the other results in a rotation of the plane of polarization.



G. The extent to which the plane of polarization is rotated is called the _____ (alpha), which depends upon several factors, including the intrinsic structure of the molecule and arrangement of bonds (the _____) at a specific wavelength of light, the _____ of the sample, and the _____ according to the following formula:

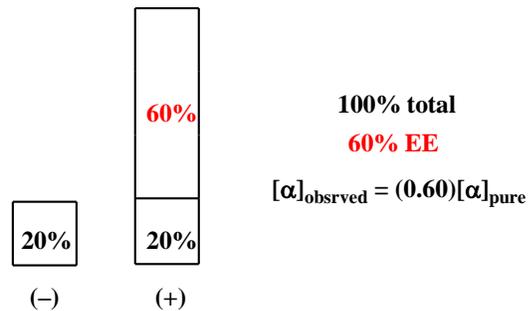
H. Note that the concentration is given in the units of grams per mL and the path length is given in the odd units of decimeters. This is for historical reasons. Our cells are 20 cm, or ___ dm, long. They hold about 25 mL of solution.

I. The specific rotation of a sample also depends upon its purity. Each _____ of a compound rotates the plane in the opposite direction, so if both are present, the _____ specific rotation is lower than the specific rotation for the _____ enantiomer.



J. “optical _____” is defined as the ratio _____ / _____. (This is often expressed in percent.) If a sample is “100% optically pure” then it is a single enantiomer.

K. Optical purity is sometimes called “_____” because it represents the amount of one enantiomer that is in excess of the other enantiomer. If we have, for example, “60% EE,” then ___% of the mixture is one enantiomer and ___% is the other, for a DIFFERENCE (an *excess*) of 60%. Effectively, if the EE is 60%, then $(100 - 60) = 40\%$ of the mixture is racemic (20% is one enantiomer, and 20% is the other) and contributes nothing to the overall rotation. Thus, $(100 - EE) / 2$ gives the percent of the _____ enantiomer in a mixture.



L. If both enantiomers are present in exactly the same amounts, then optical purity, or enantiomeric excess, is ___% and we have what is called a “_____.”

- A. polarized
- B. counter-rotating components
- C. translucent
- D. ultraviolet, single, vibration, rotation, visible, lower
- E. refracts, more
- F. chiral
- G. optical rotation, specific rotation, concentration, path length,
$$\alpha = [\alpha]_{\lambda} \times \text{CONC (g/mL)} \times \text{PATHLENGTH (dm)}$$
- H. 2.0
- I. enantiomer, observed, pure
- J. purity, $[\alpha](\text{observed}) / [\alpha](\text{pure enantiomer})$
- K. enantiomeric excess, 80, 20, minor
- L. 0, racemic mixture