Optical Activity Encyclopedia Article

Optical Activity

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Contents

Optical Activity Encyclopedia Article.....1

Contents.....2

Optical Activity.....3

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Certain molecules differ from one another only in the fact that one is the mirror image of the other. These molecules are known as **enantiomers** (from the Greek word for "opposite"). Although enantiomeric pairs have identical physical and chemical properties, the fact that the two molecules are mirror images of each other causes them to exhibit different optical behavior.

An ordinary light beam consists of a group of electromagnetic waves that vibrate in all directions. When a beam of such light passes through a polarizer, only those waves vibrating in a specific plane are transmitted. Almost all molecules are theoretically capable of producing a slight rotation of the plane of plane-polarized light, with the magnitude and direction of the rotation in part dependent on the molecule's orientation when it is struck by the beam. In an *optically inactive* **solution**, the beam is as likely to encounter a **molecule** in its mirror-image orientation as in its original orientation, with the result that all the rotations produced by individual molecules cancel out.

If a polarized beam is passed through a solution consisting of only one enantiomeric type, however, the beam does not encounter any of the molecule's mirror images and so emerges with its plane of **polarization** rotated. Separate enantiomers rotate the plane of polarized light by the same amount, but in opposite directions. Because these molecules show different behaviors under plane polarized light, they are said to be *optically active*.