OPTICAL ACTIVITY

Optical activity is an effect of an optical isomer's interaction with plane-polarized light.

INTRODUCTION

OPTICAL ISOMERS:

Optical isomers, or enantiomers, have the same sequence of atoms and bonds but are different in their 3D shape. Two enantiomers are non superimposable mirror images of one another (i.e chiral). Optical isomers have no axis of symmetry, which means that there is no line that bisects the compound such that the left half is a mirror image of the right half.

Optical isomers have basically the same properties (melting points, boiling points etc) but there are a few exceptions (uses in biological mechanisms and optical activity)

A BRIEF HISTORY

Optical activity was first observed by the French physicist Jean-Baptiste Biot. He concluded that the change in direction of plane-polarized light when it passed through certain substances

was actually a rotation of light, and that it had a molecular basis. His work was supported by the experimentation of Louis Pasteur. Pasteur observed the existence of two crystals that were mirror images in tartaric acid, an acid found in wine. Through experimentation, he found that one set of molecules rotated polarized light clockwise while the other rotated light counterclockwise to the same extent. He also observed that a mixture of both, a racemic mixture did not rotate light bc2 the optical activity of one molecule cancelled the effects of the other molecule. Pasteur was the first to show the existence of chiral molecules.

ROTATION OF LIGHT

DEXTROROTATORY

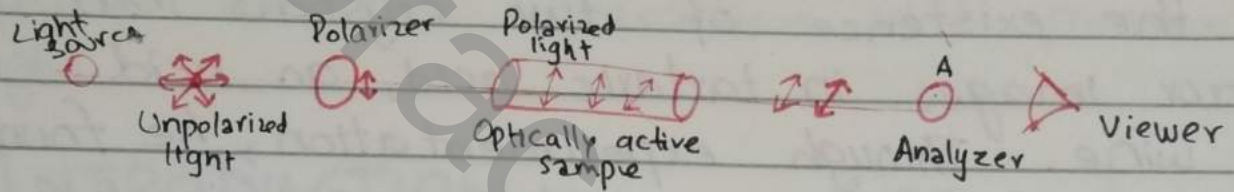
An enantiomer that rotates plane-polarized light in the positive direction, or clockwise is called dextrorotatory [(+) or d-]

LEVOROTATORY

The enantiomer that rotates plane-polarized light in the negative direction, or counterclockwise, is called levorotatory [(-) or l-]

RACEMIC MIXTURE

When both d- and l- isomers are present in equal amounts, the mixture is called a racemic mixture



In the figure, unpolarized light passes through a filter so that only waves that oscillate in a certain direction can pass through. When these waves interact with an optically active material, they are rotated either clockwise or anticlockwise, depending on the enantiomer. In the case of the image above, the light is rotated clockwise so the substance is dextrorotatory enantiomer.