A chiral molecule is a molecule that is not superimposable on its mirror image.

eg. 1:

eg. 2:

Molecule 1 is not superimposable on its mirror image and, therefore, is chiral.

Molecule 2 is not superimposable on its mirror image and, therefore, is chiral.

An achiral molecule is a molecule that is superimposable on its mirror image.

eg. 1:

eg. 2:

Molecule 3 is superimposable on its mirror image and, therefore, is achiral.

Molecule 4 is superimposable on its mirror image and, therefore, is achiral.

Alternatively, an achiral molecule is a molecule that has at least one plane of symmetry.
eg. 1:

The vertical plane that bisects the bromine atom and the methyl group, which is the plane of the screen, is a plane of symmetry. Thus, 3 is achiral.

eg. 2:

The vertical plane that bisects the molecule perpendicular to the plane of the screen is a plane of symmetry. Thus, 4 is achiral.

A chiral molecule has no plane of symmetry.

eg. 1

1 is chiral and has no plane of symmetry.

eg. 2:
2 is chiral and has no plane of symmetry.

Although relatively rare, molecules do exist that have no plane of symmetry but is achiral.

eg:

Thus, presence of a plane of symmetry is not a foolproof method to determine whether a molecule is chiral or achiral.

Contributors

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