Like ligands in an organic molecule that are not equivalent (see equivalent ligands) under any condition are classified into two classes.

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**Diastereotopic Ligands**

When the replacement test is applied to two like ligands in a molecule, if the resultant molecules are diastereomers, the two ligands are said to be diastereotopic.

**eg:**

Apply the replacement test to find if the two bromine atoms in 1 are diastereotopic.

![Diagram of diastereotopic ligands]

Molecules 2 and 3 are diastereomers. Thus, the two bromine atoms in 1 are diastereotopic. Diastereomers have different chemical properties under all conditions. Since the replacement of Br (a) and of Br (b) in 1 leads to molecules that have different chemical properties under all conditions, Br (a) and Br (b) have different chemical properties under all conditions.

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**Constitutionally Heterotopic Ligands**

When the replacement test is applied to two like ligands in a molecule, if the resultant molecules are constitutional isomers, the two ligands are said to be constitutionally heterotopic.

**eg:**

![Diagram of constitutionally heterotopic ligands]
Apply the replacement test to find if the two methyl groups in 1 are constitutionally heterotopic.

Molecules 2 and 3 are constitutional isomers. Thus, the two methyl groups in 1 are constitutionally heterotopic. Constitutional isomers have different chemical properties under all conditions. Since the replacement of CH\(_3\) (a) and of CH\(_3\) (b) in 1 leads to molecules that have different chemical properties under all conditions, CH\(_3\) (a) and CH\(_3\) (b) have different chemical properties under all conditions.

see also homotopic, enantiotopic

Contributors

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