Chemistry I (Organic): Stereochemistry

Diastereoisomers

Dr Alan Spivey; Office: 834 C1; e-mail: a.c.spivey@imperial.ac.uk; Tel.: 45841

Diastereoisomers:

Diastereoisomers (sometimes called diastereomers) are *stereoisomers that are not enantiomers*. A common way of generating ***diastereoisomers*** is to put two (or more) stereogenic centres in the same molecule.

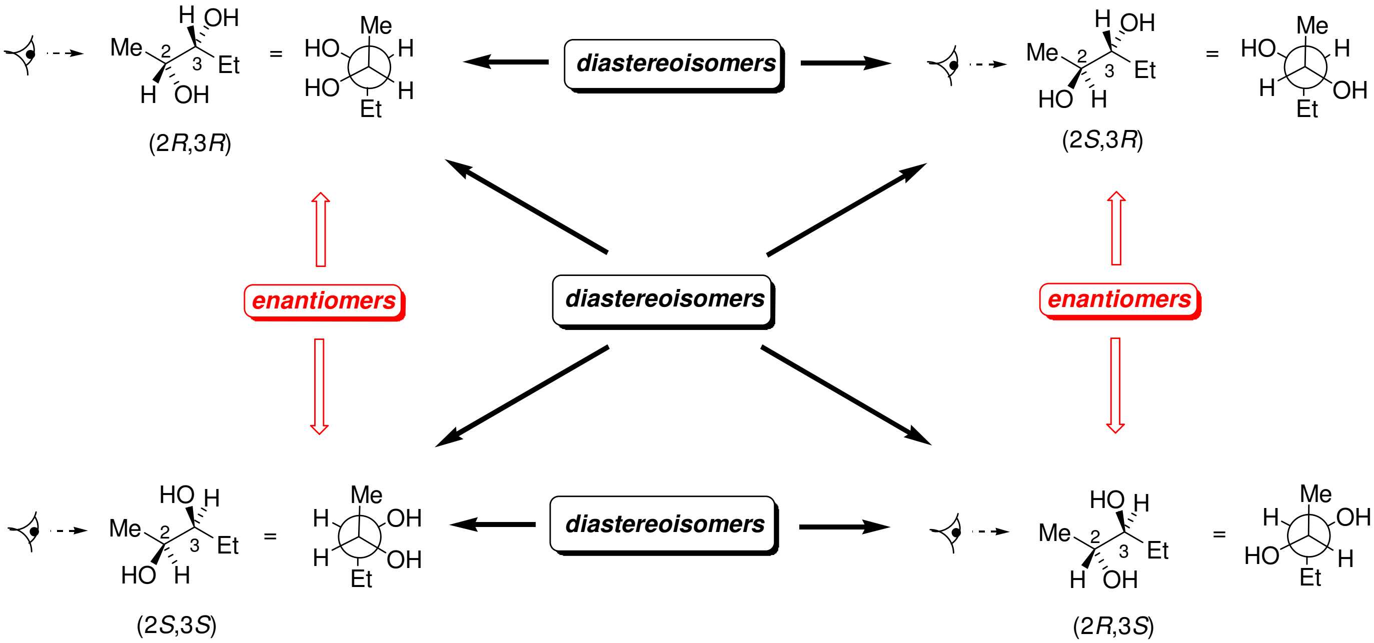
NB. ***Epimers*** are *diastereoisomers* differing in configuration at *just one stereogenic centre.*

Unlike enantiomers, ***diastereoisomers*** have different chemical and physical properties (*e.g.* melting points, solubilities, reactivities *etc.*). This is because the ways in which the electrons associated with the various groups buttress against each other are different in the different diastereoisomers, giving rise to diferent energies and different shapes.

For a molecule containing *n* stereogenic centres there are *a* ***maximum*** *of* 2^n stereoisomer*s.*

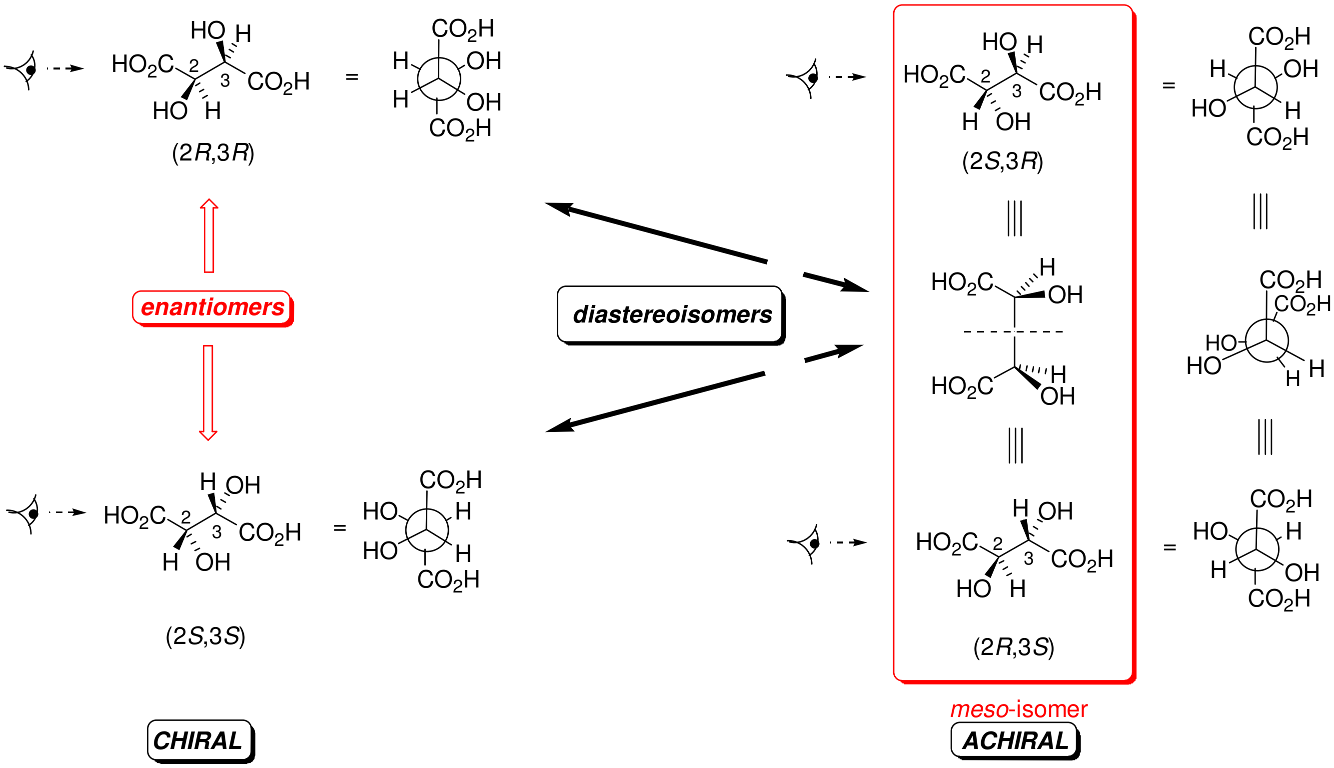
The following discussion is restricted to examples containing 2 stereogenic centres. There are two cases:

1) ***The two stereogenic centres have different sets of groups attached.***
e.g. pentane-2,3-diol



i.e. 4 stereoisomers, two pairs of enantiomers.

2) The two stereogenic centres have the same set of groups attached.
e.g. tartaric acid (2,3-dihydroxybutan-1,4-dioic acid)



i.e. 3 stereoisomers, one pair of enantiomers (chiral) and a ***meso*** isomer (achiral).

Additional stereogenic centres add additional complexity – the *maximum* number of stereoisomers is always 2^n, where n is the number of stereogenic centres, but any isomers having an improper rotation axes will be achiral (*i.e. meso*, as above).

Definition: ***meso*** is a stereodescriptor for an ***achiral*** member of a set of diastereoisomers that also includes at least one chiral member.

Prochirality:

- Enantiotopic groups/substituents
- Diasterotopic groups/substituents
- *pro-R* and *pro-S* sterodescriptors
- *Re* and *Si* faces of *e.g.* carbonyl groups

*****