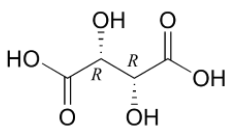
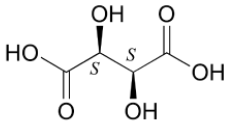
# 3.8: Meso Compounds

The levorotatory and dextrorotatory forms of tartaric acid studied by Louis Pasteur were, as we now know, the (*S*,*S*) and (*R*,*R*) enantiomers, respectively:



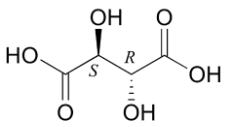
(*R*,*R*)-(+)-tartaric acid
('natural' isomer from grapes)



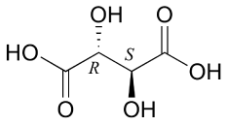
(*S*,*S*)-(-)-tartaric acid

What the 19th century chemists referred to as *'acide racemique'* was just that: a racemic mixture of the *R*,*R* and *S*,*S* enantiomers, the racemization a result of how the natural *R*,*R* isomer had been processed.

But tartaric acid has two chiral centers: shouldn't there be another pair of enantiomers?



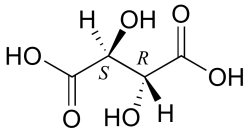
(*S*,*R*)-tartaric acid



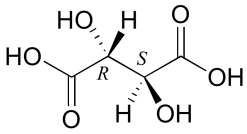
(*R*,*S*)-tartaric acid

There in fact is another stereoisomer of tartaric acid: *but only one*. The two structures above are actually superimposable on one another: ***they are the exact same molecule***. The figure below illustrates this, and also that the structure has a plane of symmetry. However, you should be sure to build models and confirm these assertions for yourself.

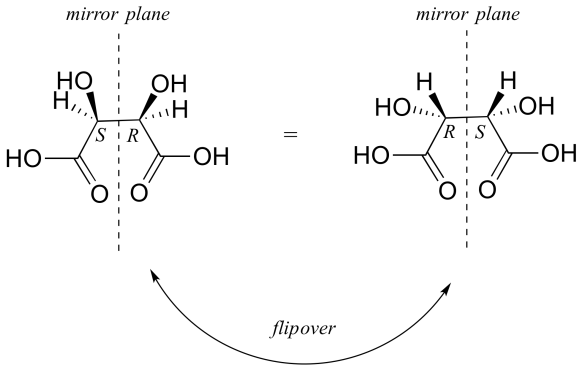
(*S*,*R*)-tartaric acid



(*R*,*S*)-tartaric acid



*rotate right side down*

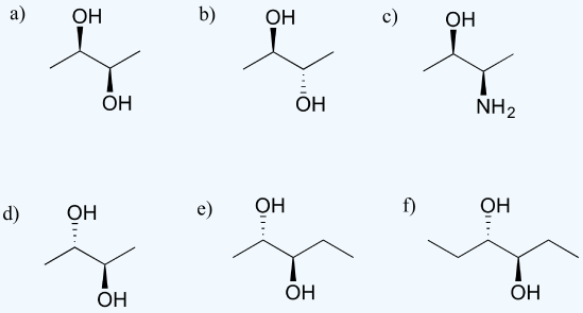



This tartaric acid isomer is an *achiral* diastereomer of the both the levorotatory and dextrorotatory isomers. It is a special case, called a ***meso*** compound: it has two apparent chiral centers but due to its internal symmetry it is not in fact chiral, and does not exhibit optical activity. Note that the *meso* form of tartaric acid did not play a part in Pasteur's experiments.

There are many more possible examples of *meso* compounds, but they really can be considered 'exceptions to the rule' and quite rare in biologically relevant chemistry.

## Exercise 3.23

Which of the following compounds are *meso*? Hint: build models, and then try to find a conformation in which you can see a plane of symmetry.




Solutions to exercises

Khan Academy video tutorial on meso compounds

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