

4.6 CHIRALITY: handedness in Molecules

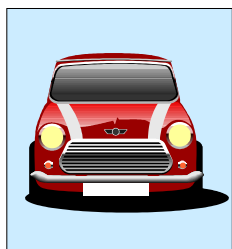
*Many molecules exist in "right-handed"
and "left-handed forms*



1

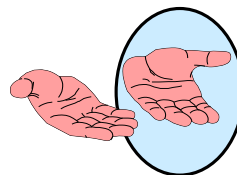
Mirror Images

2



A MIRROR IMAGE IS A REFLECTION

3



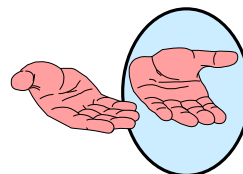
Your left hand is a "mirror image" of your right hand

4



Some mirror images are
'superimposable'

5



Some mirror images are
not superimposable
('non-superimposable')

Nonsuperimposable mirror images have 'right-handed'
and 'left-handed' forms... stereoisomers.

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Molecules have mirror images too.

mirror plane

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Chirality

Pronounced
'kye-rality' like reality

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IN A MOLECULE...

A **carbon** that is tetrahedral (sp^3) and has four different groups attached is called...

a "chiral center"

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Another name is

stereocenter

	H
	F
	Cl
	Br

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A molecule with one stereocenter is 'chiral'.

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It's mirror images are not superimposable

this molecule is chiral

non-superimposable mirror images

note that the fluorine and bromine are interchanged in the mirror image

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Practice with models

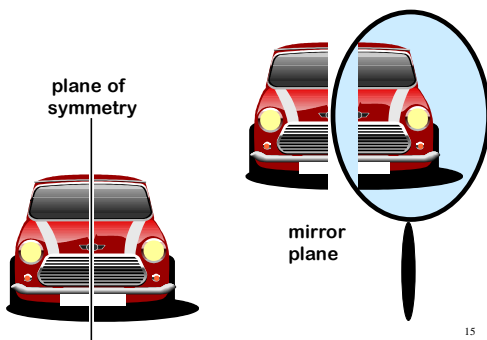
1. Make a molecule with a stereocenter
2. Make it's mirror image
3. Try to superimpose them
Are they the same or different molecules?
4. Interchange two of the atoms.
5. Now try to superimpose them.
Are they the same or different molecules?

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PLANES OF SYMMETRY

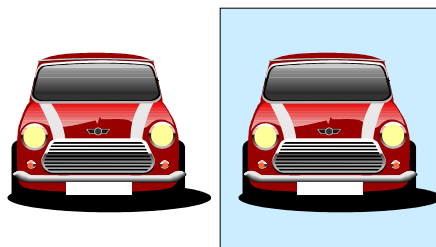
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A SYMMETRIC OBJECT HAS A PLANE OF SYMMETRY
- ALSO CALLED A MIRROR PLANE



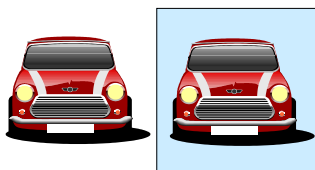
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IF AN OBJECT HAS A PLANE OF SYMMETRY,
ITS MIRROR IMAGE WILL BE IDENTICAL



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IDENTICAL MIRROR IMAGES WILL **SUPERIMPOSE**
(MATCH EXACTLY WHEN PLACED ON TOP OF EACH OTHER)

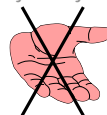


IF AN OBJECT HAS AN IDENTICAL MIRROR IMAGE
IT'S..... 'ACHIRAL'

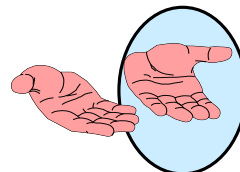
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An object without symmetry is **CHIRAL**

no symmetry



The mirror image
of a chiral object is
different and will not
superimpose on the
original object.



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WHICH OBJECTS ARE SYMMETRIC ?
(mirror image is identical)

achiral

achiral

achiral

chiral

chiral

chiral

chiral

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ACHIRAL
The plane of the paper is a plane of symmetry

TWO IDENTICAL GROUPS RENDERS A TETRAHEDRAL CARBON ACHIRAL

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TWO VIEWS OF THE PLANE OF SYMMETRY

plane of symmetry

side view

edge view

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ACHIRAL
A CARBON ATOM WITH THREE SIMILAR GROUPS IS ALSO ACHIRAL

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TWO VIEWS OF THE PLANE OF SYMMETRY

plane of symmetry

side view

edge view

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The whole secret of the study of nature lies in learning how to use ones eye.

George Sand, author

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