p.1

Report Sheet: Moledular Models M 0

CAPILANO UNIVERSITY

Department of Chemistry

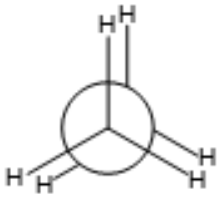
LAST NAME: _____

FIRST NAME: _____ DATE: _____

Read the detailed procedure in the lab manual first, then construct the model and, finally, answer the related questions given on this report sheet.

Part 1 – Bond Rotation and Conformers

1. **Ethane:** *Name both conformations. Circle the conformation of lower energy.*



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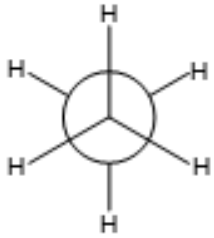
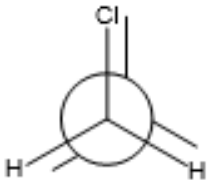


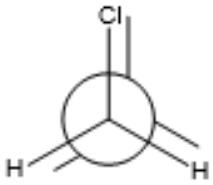
_____

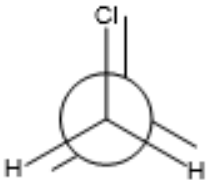
2. **1,2-Dichloroethane:**

Complete the Newman projections for the eclipsed conformations, then circle the conformation(s) with the lower energy.



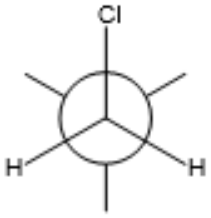
non-equivalent



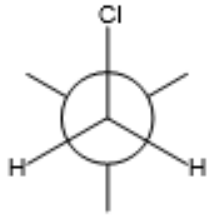


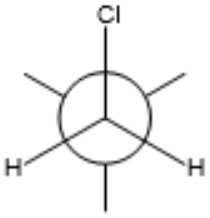
equivalent

Complete the Newman projections for the staggered conformations, then circle the conformation(s) with the lower energy.



anti





gauche

Report Sheet:	Moledular Models	CHEM 110
CAPILANO UNIVERSITY Department of Chemistry	LAST NAME: _____ SEC # ____ LOCKER # ____ FIRST NAME: _____ DATE: _____	

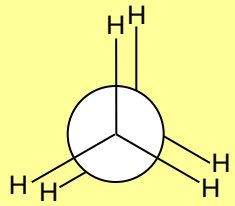
Read the detailed procedure in the lab manual first, then construct the model and, finally, answer the related questions given on this report sheet.

Part 1 – Bond Rotation and Conformers

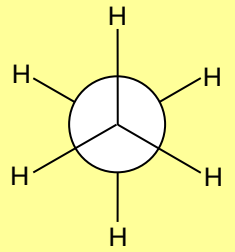
1. **Ethane:** *Name both conformations. Circle the conformation of lower energy.*

H H H

Newman Projections

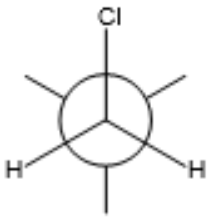
- 

bonds overlapping
ECLIPSED

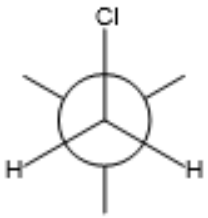
- 

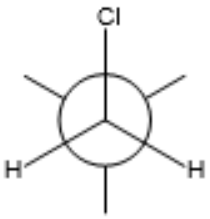
bonds not overlapping
STAGGERED

Complete the Newman projections for the staggered conformations, then circle the conformation(s) with the lower energy.



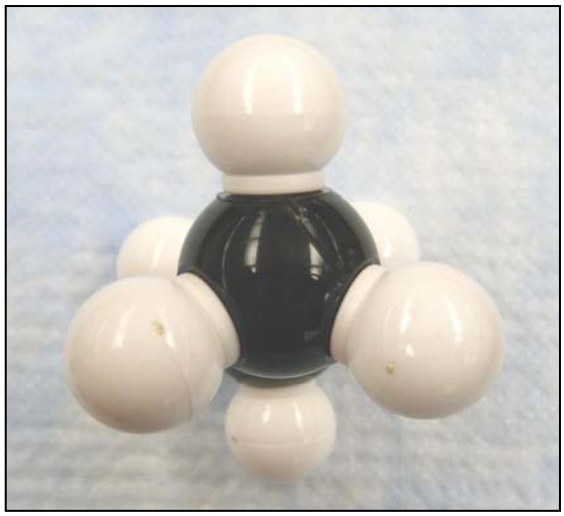
anti



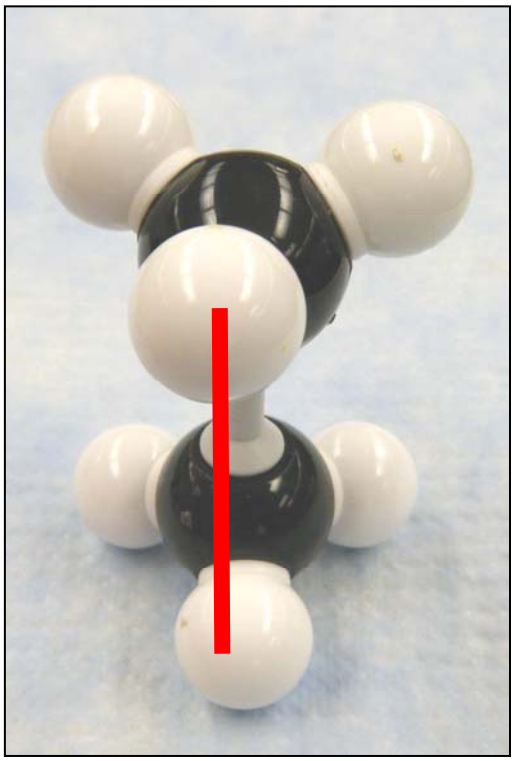


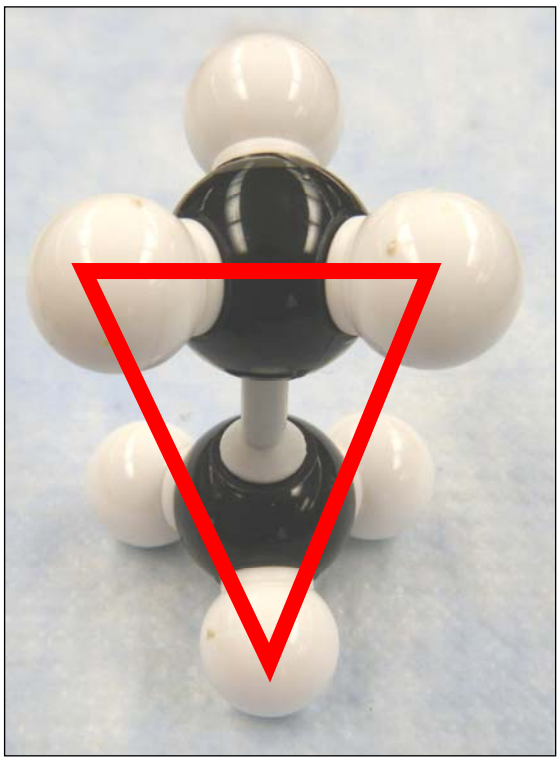
gauche

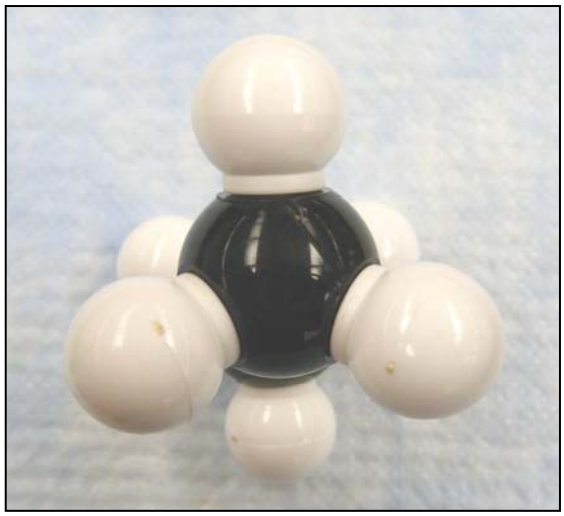
Eclipsed vs Staggered Ethane



Eclipsed vs Staggered Ethane







Report Sheet: **Moledular Models** **CHEM 110**

CAPILANO UNIVERSITY
Department of Chemistry

LAST NAME: _____ SEC # _____ LOCKER # _____

FIRST NAME: _____ DATE: _____

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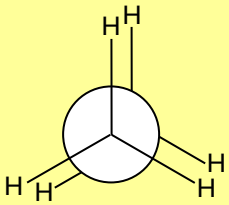
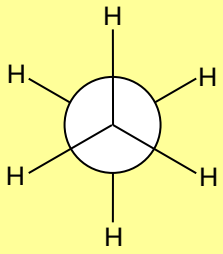
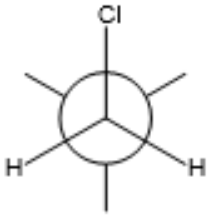
Part 1 – Bond Rotation and Conformers

1. **Ethane:** *Name both conformations. Circle the conformation of lower energy.*

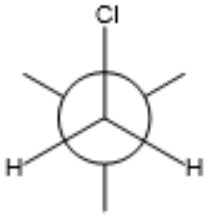
Newman Projections

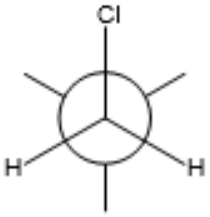
-  **bonds overlapping** ***ECLIPSED***
-  **bonds not overlapping** ***STAGGERED***

Complete the Newman projections for the staggered conformations, then circle the conformation(s) with the lower energy.



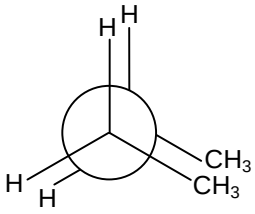
anti





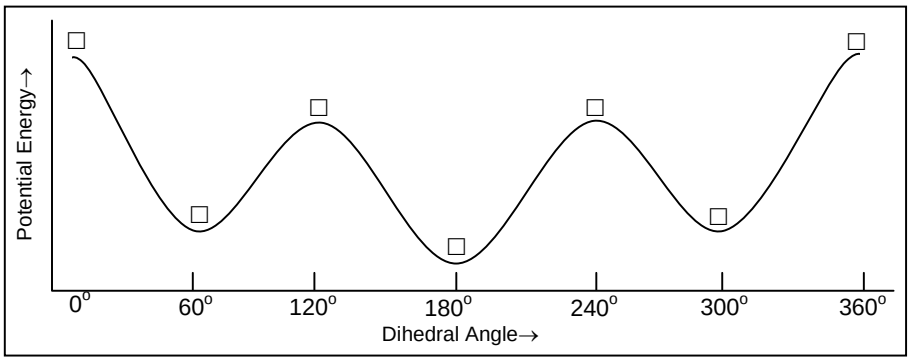
gauche

1. **Butane:** *What is the name of the following conformation? Circle th* *) of your response:*

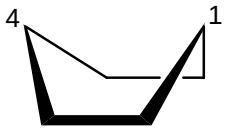


(a) Anti
(b) Gauche
(c) Eclipsed
(d) Staggered

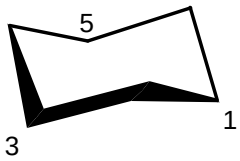
Check (☑) the position(s) where the above conformation would (could) be on the following energy curve:

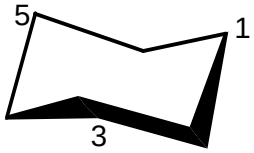


5. **Cyclohexane:** *Draw the uppermost C-H bonds (at C_1 and C_4):*

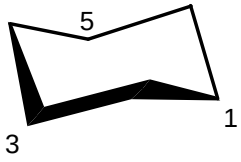


6. **Cyclohexane:** *Draw the axial and equatorial hydrogen bonds on the chair conformers given below:*

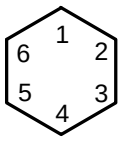


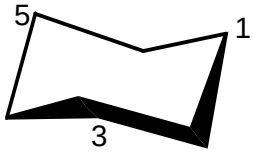


7. **Chlorocyclohexane:** *On each of the two chair conformers below, show the position of the chlorine atom **only** (at carbon 1). Clearly label the Cl as axial (**a**) or equatorial (**e**). Circle the more stable conformation. Then, for each conformer, use dash-line-wedge notation on the accompanying sketch to indicate the position of the Cl atom relative to the ring.*

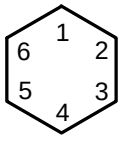


Cl





Cl



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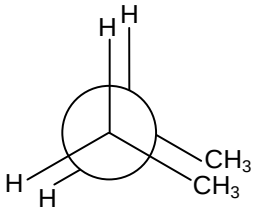

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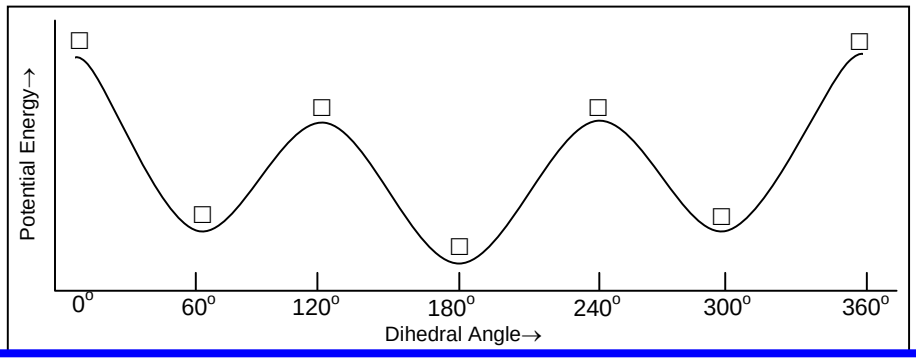

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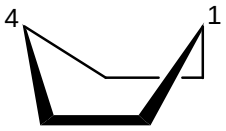
cyclohexane



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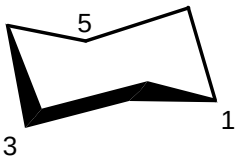

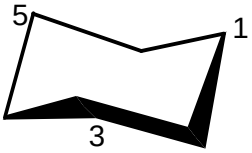

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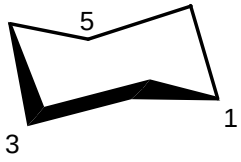
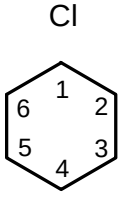
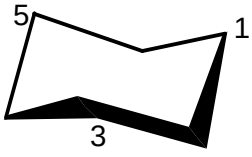
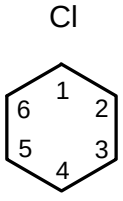
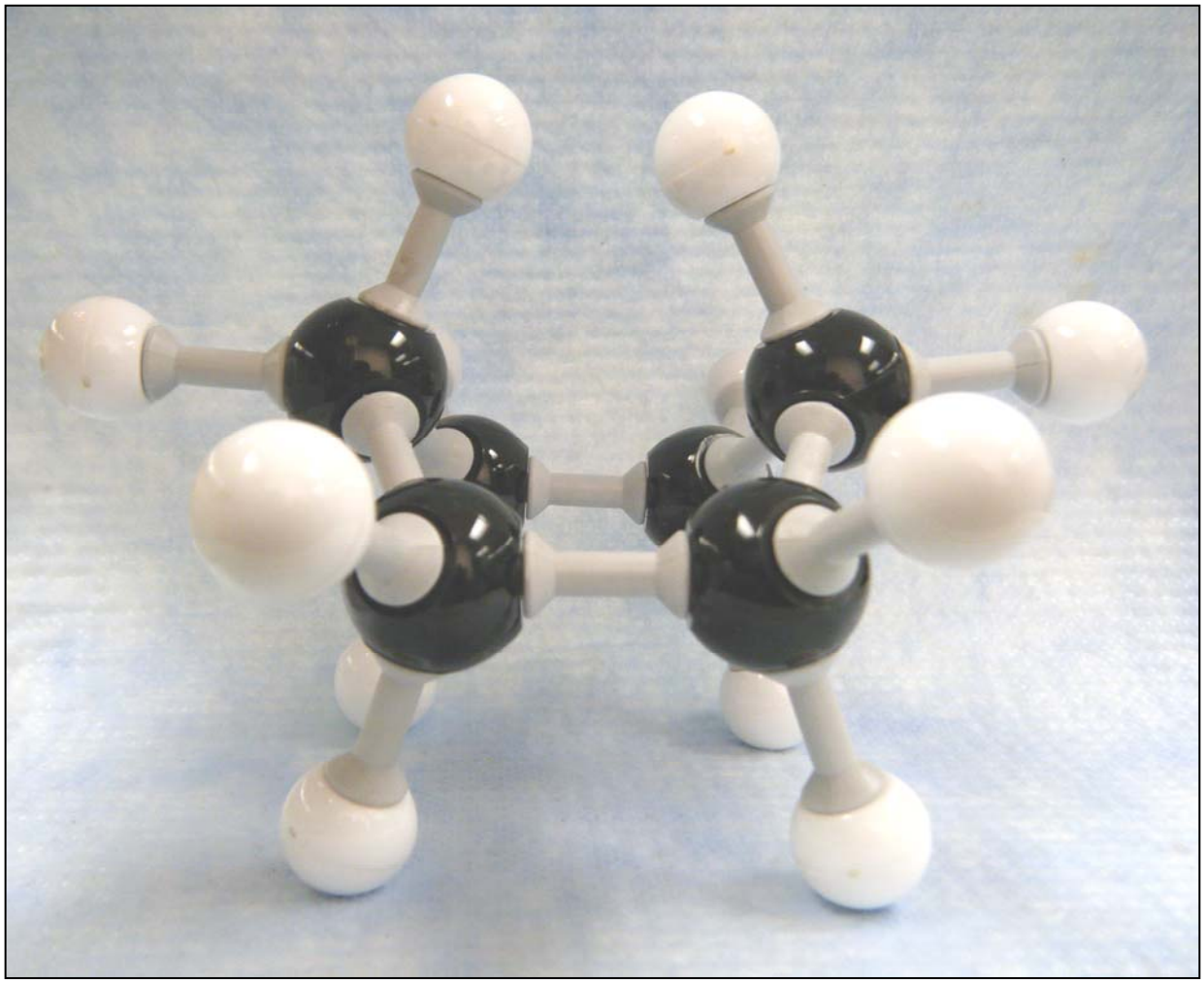




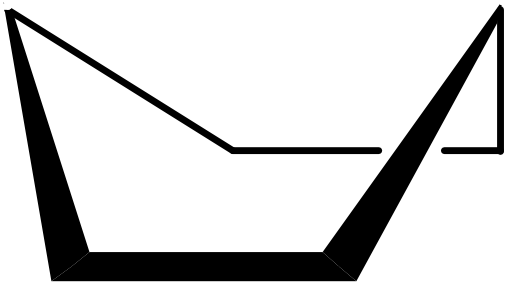




Cyclohexane in Boat Conformation

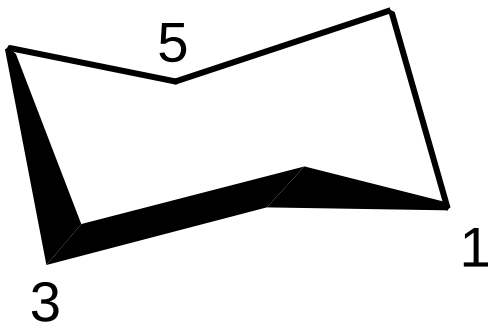


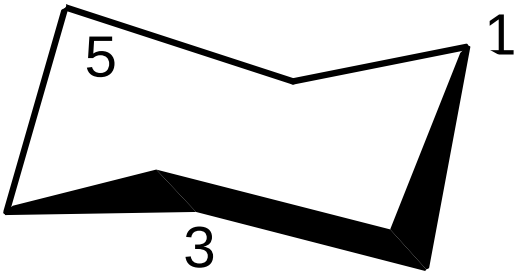
Cyclohexanes



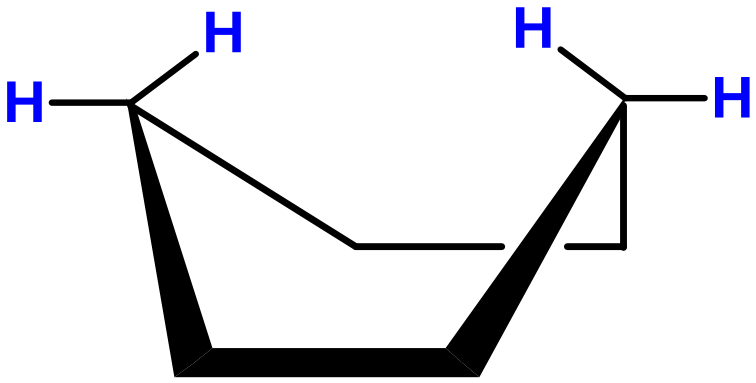
Boat conformation

2 chair conformations:





Cyclohexanes



Boat conformation

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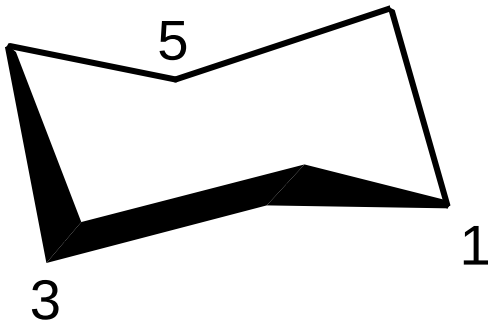
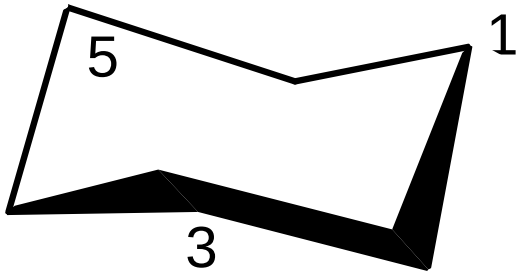
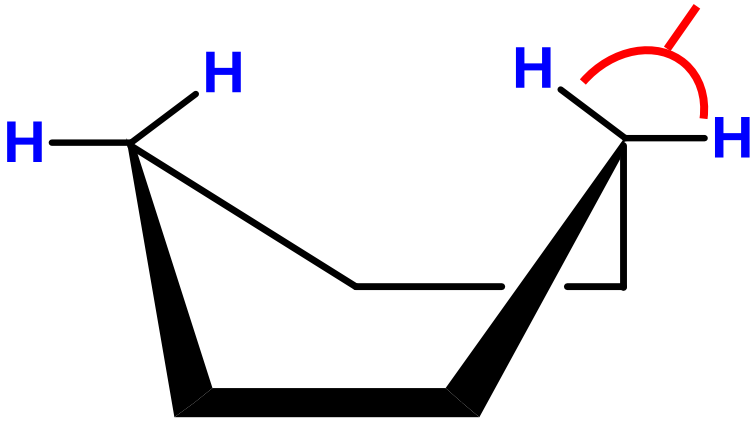




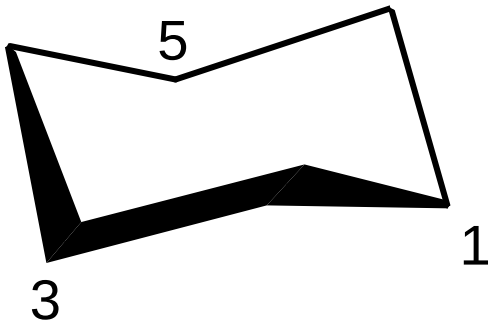
Cyclohexanes

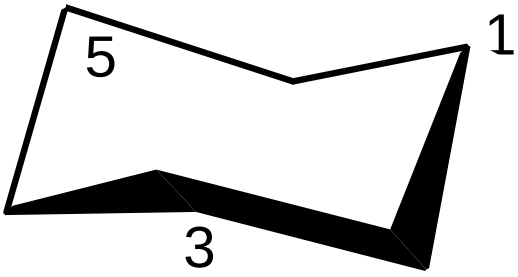
109.5° **for *sp*³**



Boat conformation

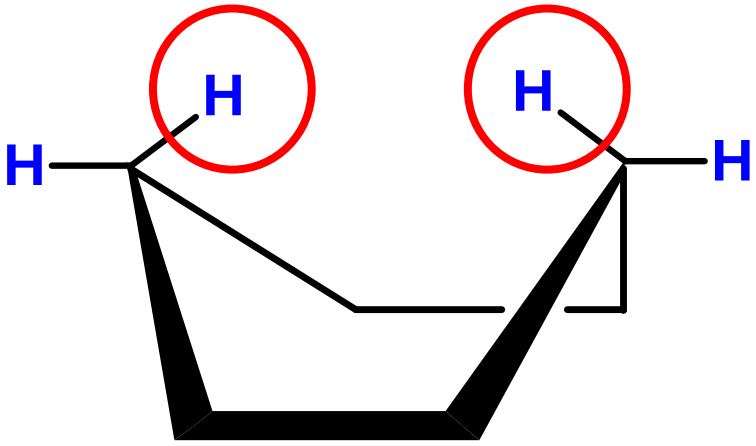
2 chair conformations:





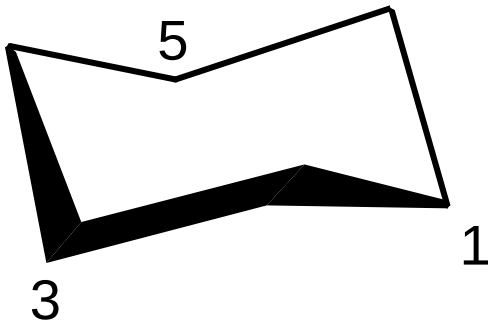
Cyclohexanes

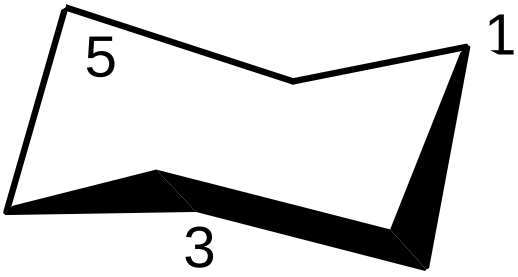
‘flag-pole” hydrogens



Boat conformation

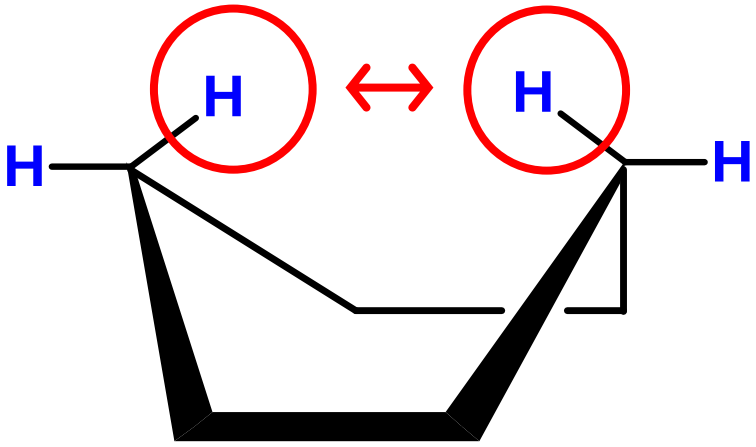
2 chair conformations:





Cyclohexanes

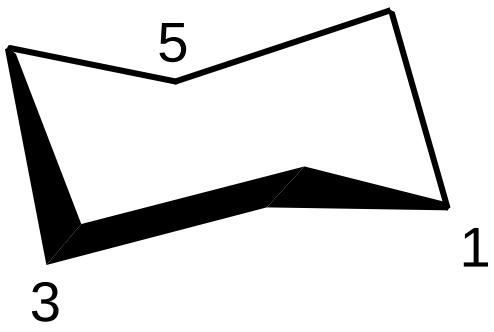
‘flag-pole” hydrogens

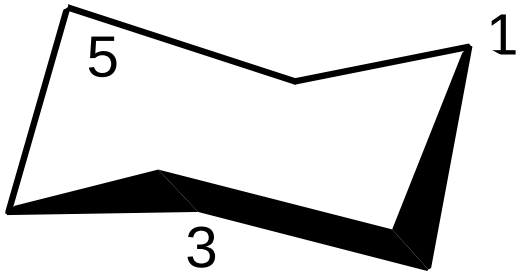


Boat conformation

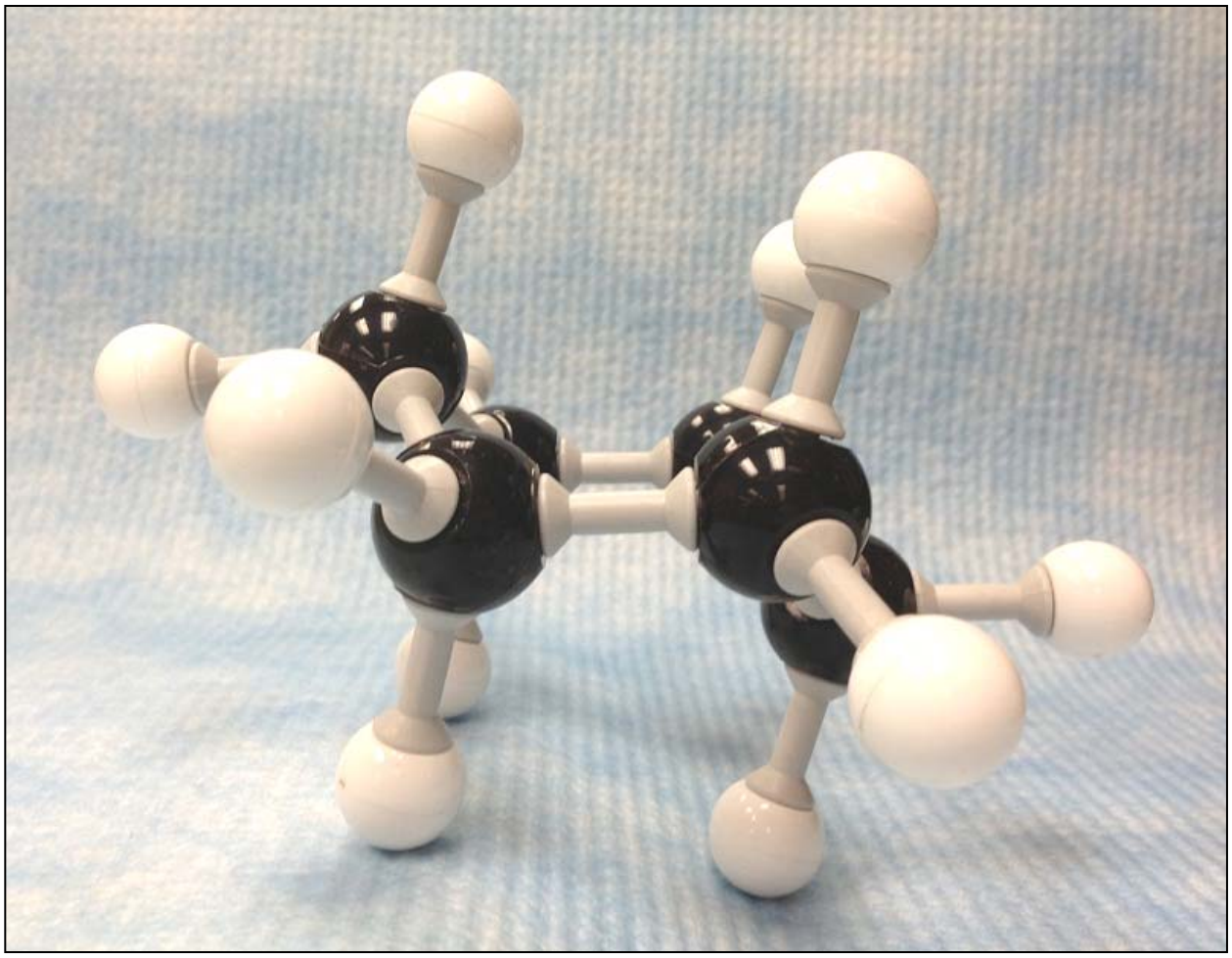
Repulsion, hence high energy conformation.

2 chair conformations:

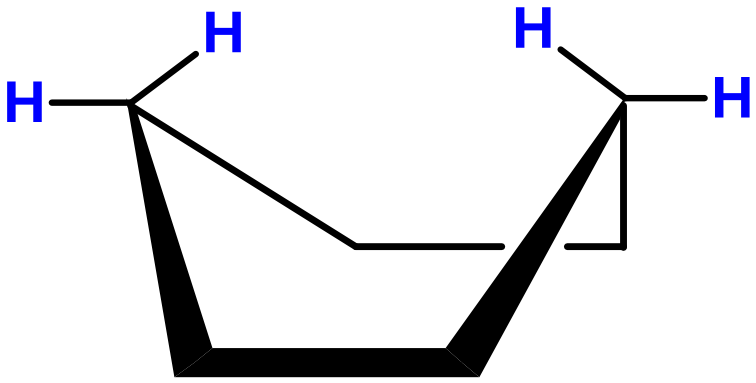




Cyclohexane in Chair Conformation

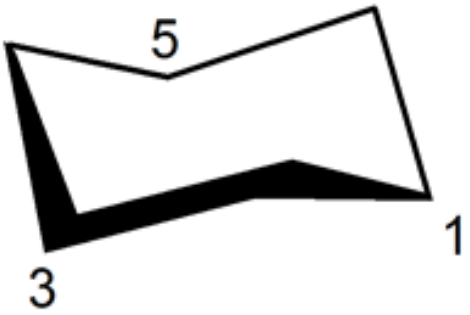


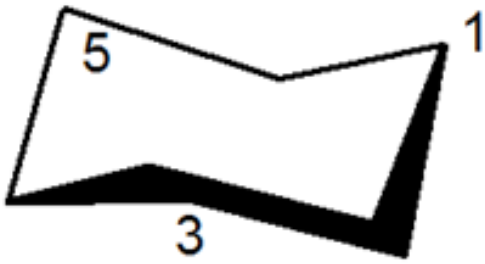
Cyclohexanes



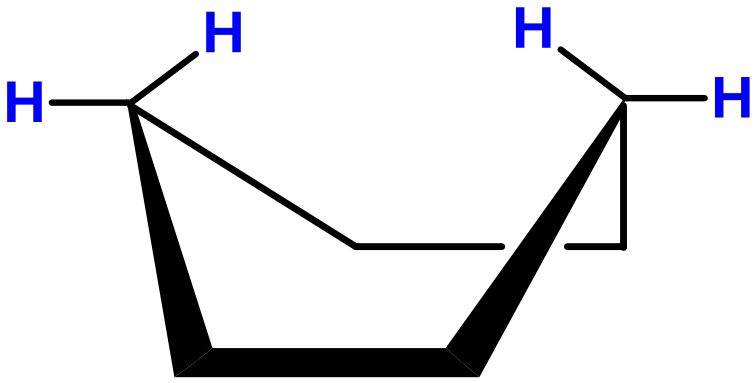
Boat conformation

2 chair conformations:



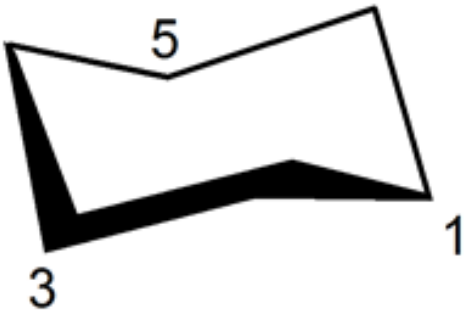


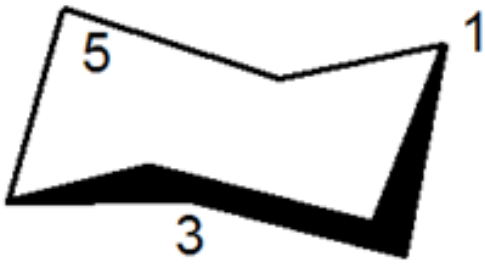
Cyclohexanes



Boat conformation

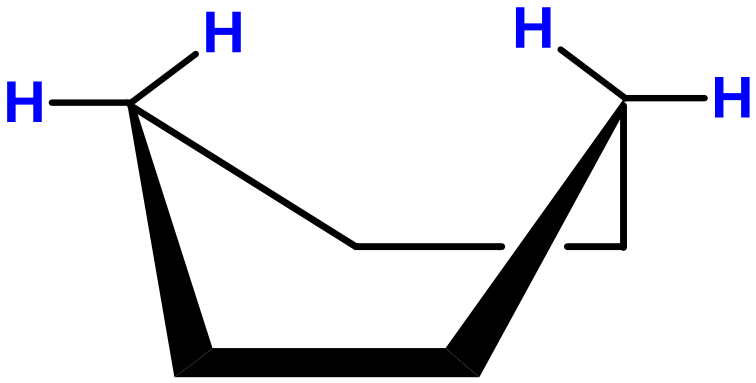
2 chair conformations:





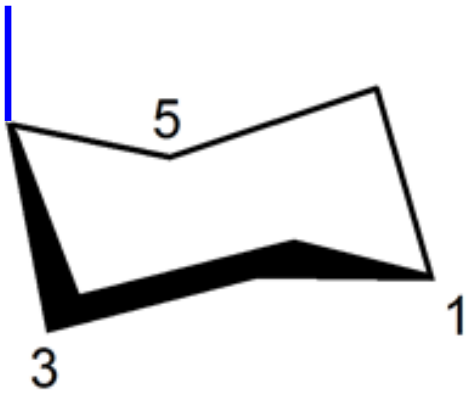
add 6 axial bonds…3 UP

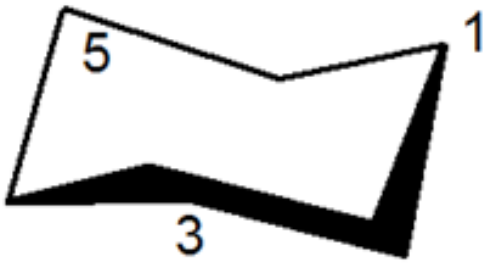
Cyclohexanes



Boat conformation

2 chair conformations:





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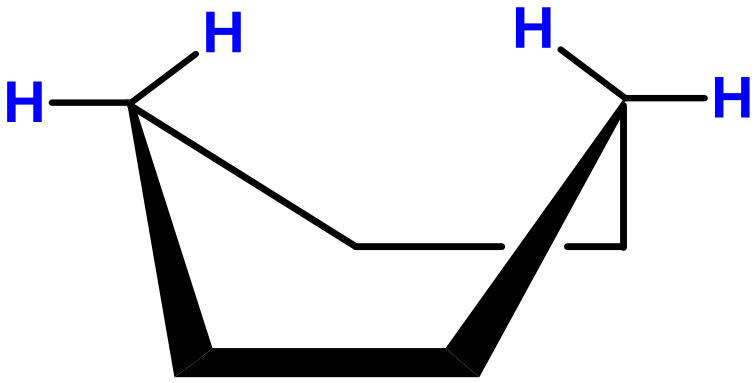
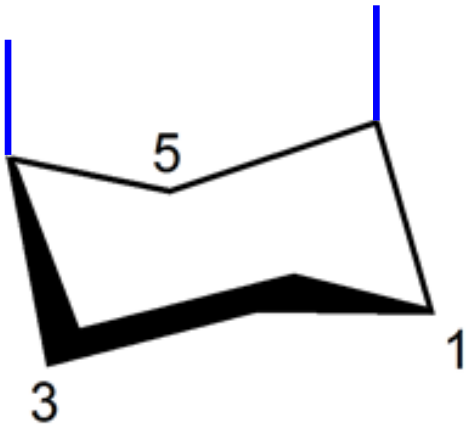
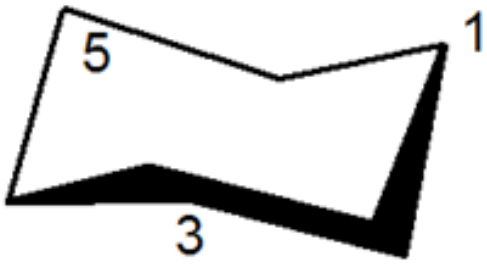
Cyclohexanes



Boat conformation

2 chair conformations:





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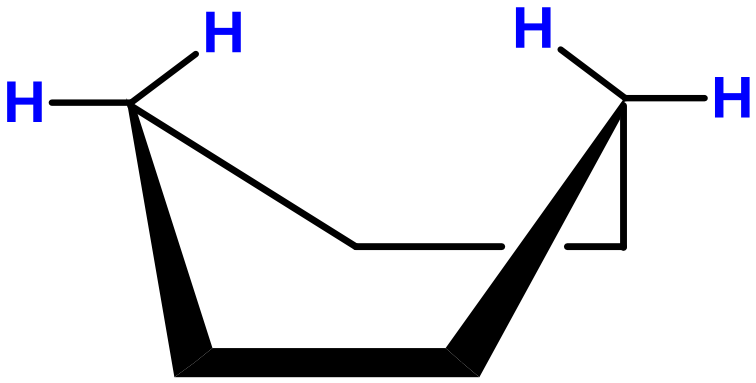
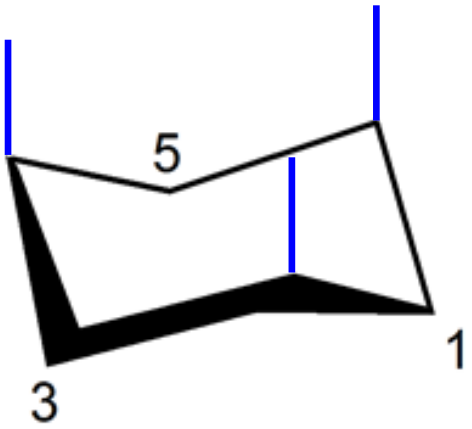
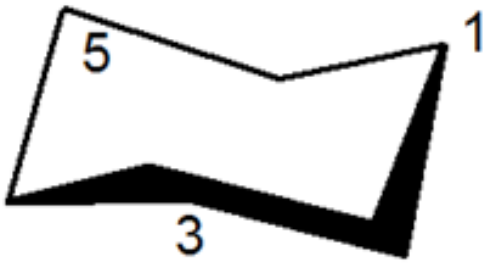
Cyclohexanes



Boat conformation

2 chair conformations:





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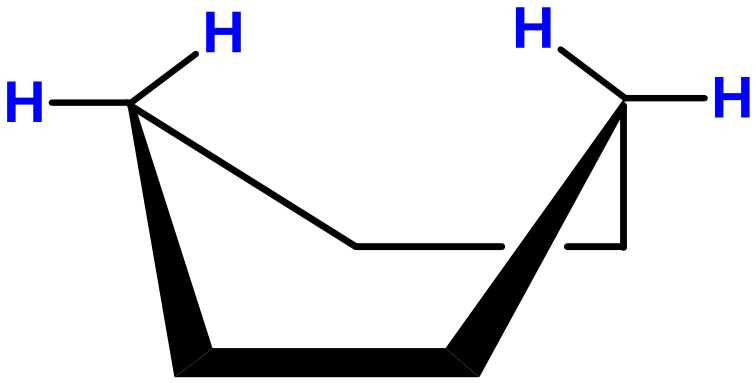
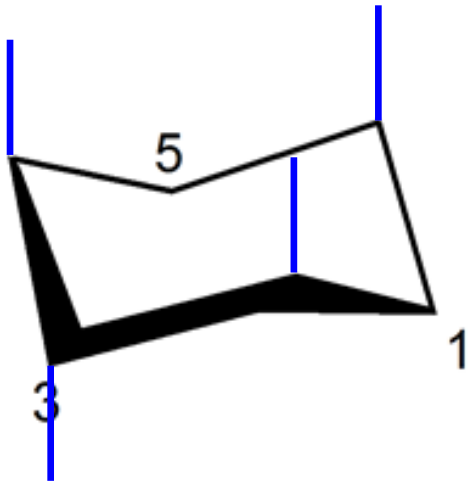
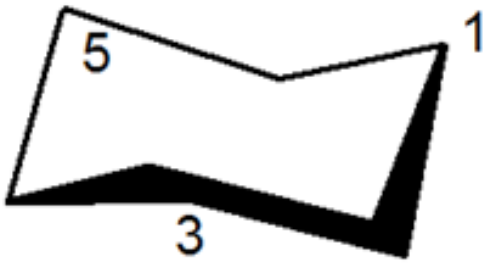
Cyclohexanes



Boat conformation

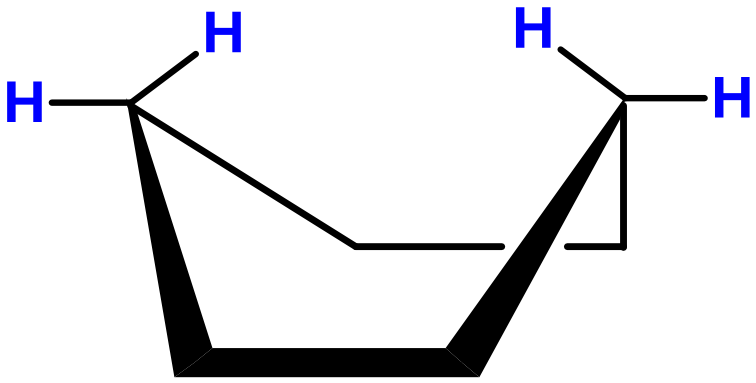
2 chair conformations:





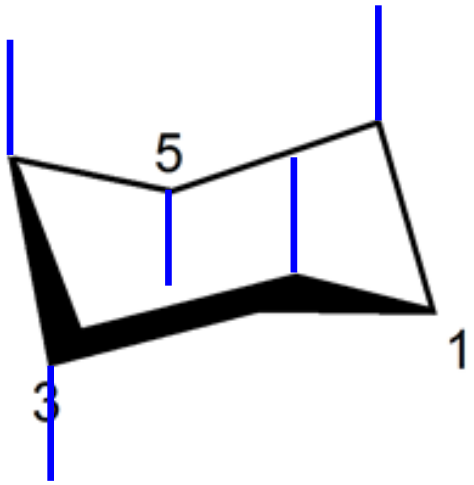
add 6 axial bonds…3 UP & 3 DOWN

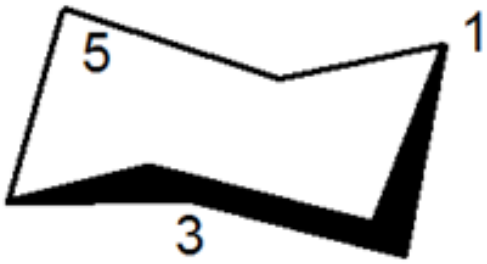
Cyclohexanes



Boat conformation

2 chair conformations:





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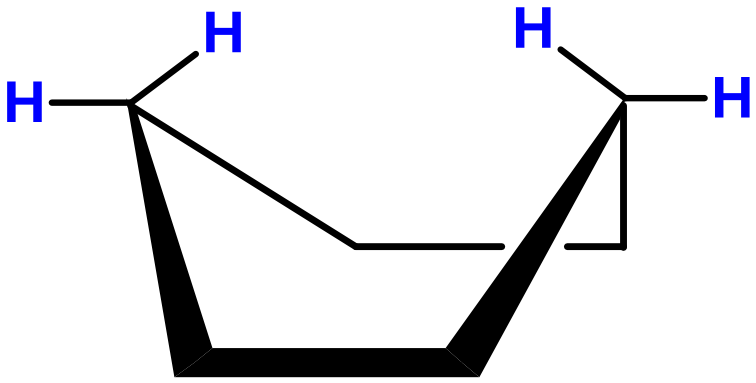
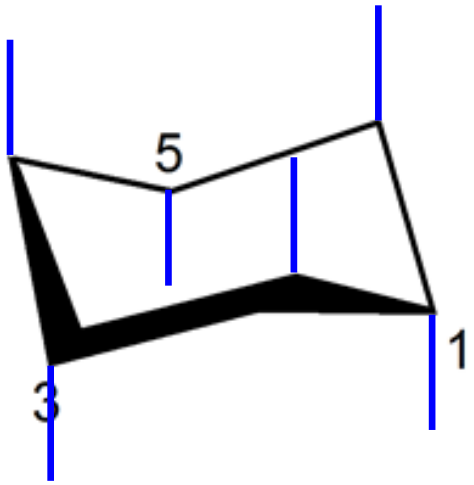
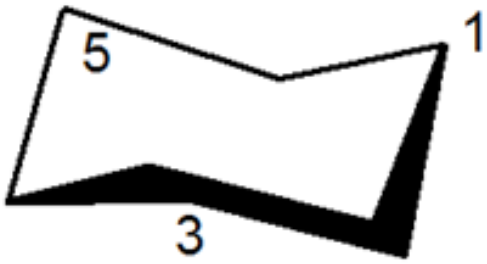
Cyclohexanes



Boat conformation

2 chair conformations:





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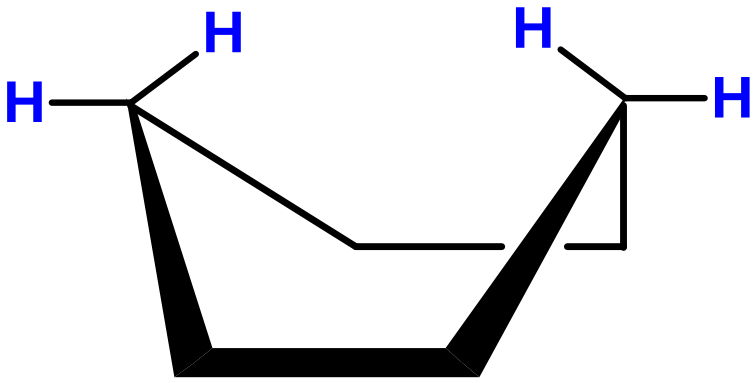
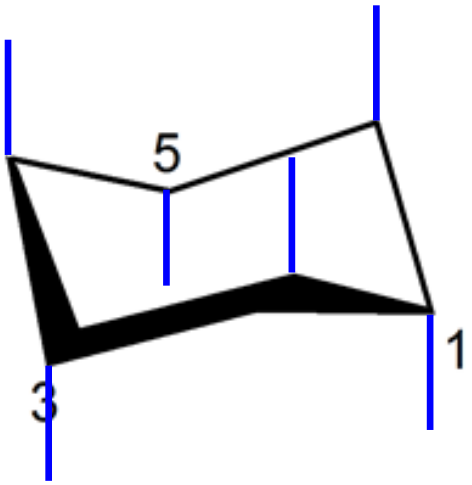
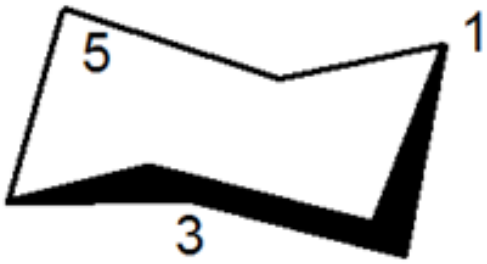


Boat conformation

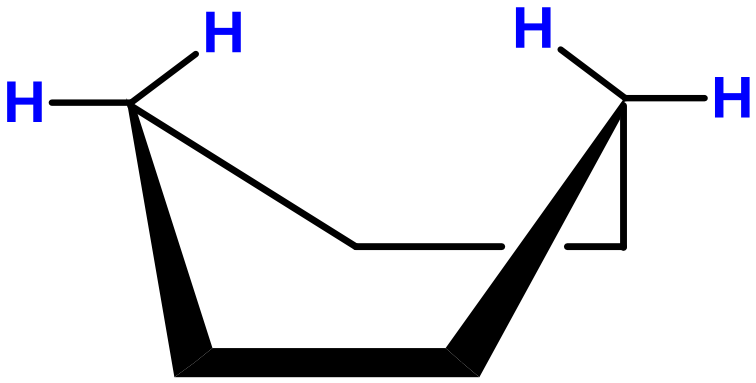
2 chair conformations:





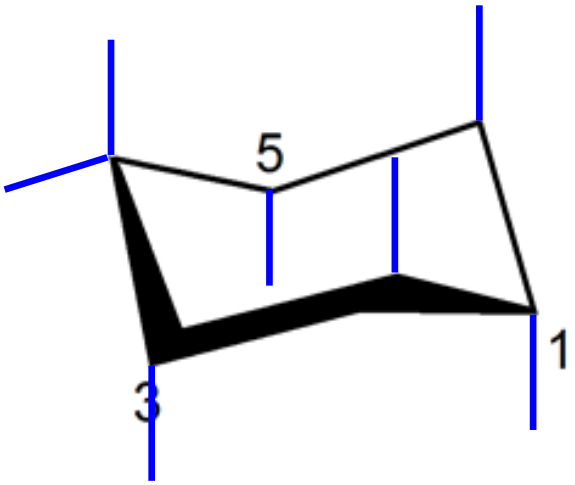
add 6 equatorials in alternating fashion

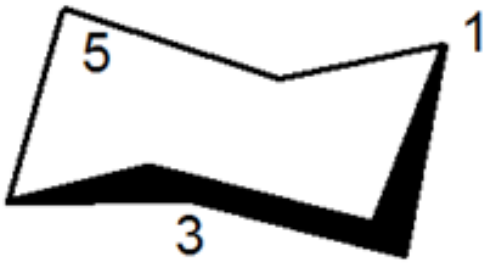
Cyclohexanes



Boat conformation

2 chair conformations:





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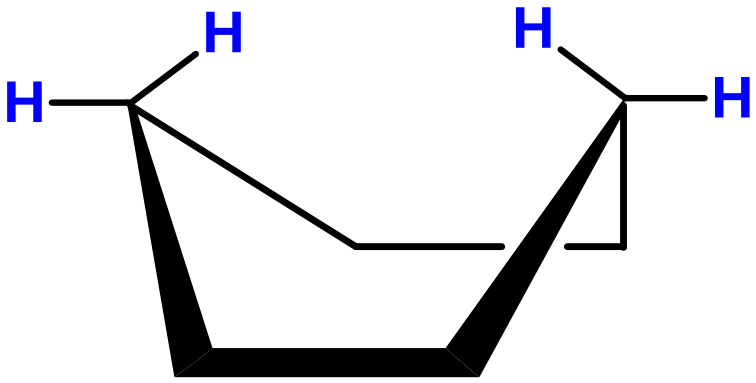
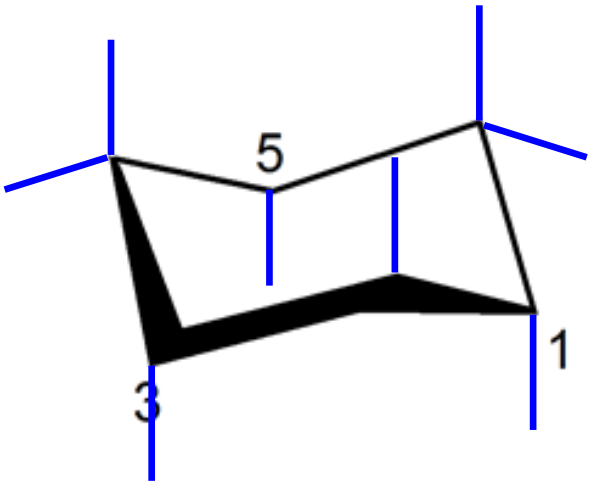
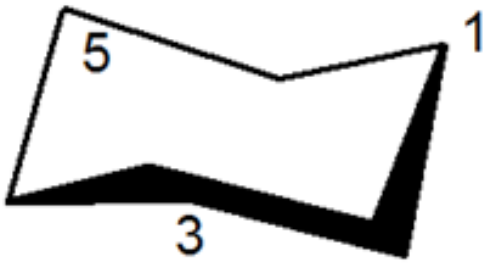
Cyclohexanes



Boat conformation

2 chair conformations:





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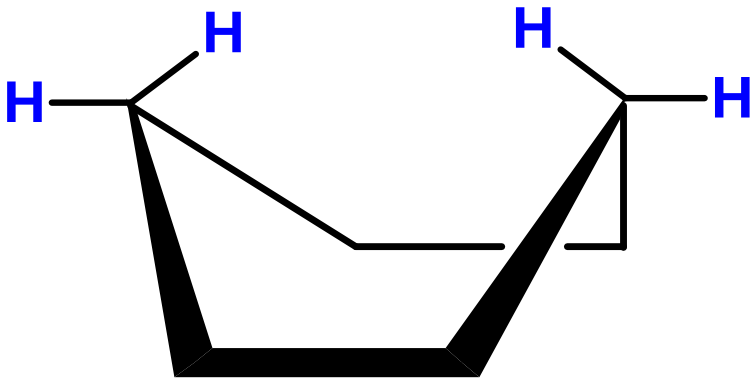
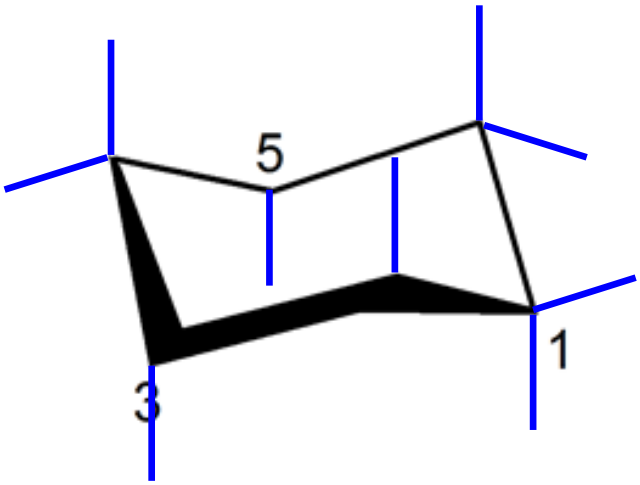
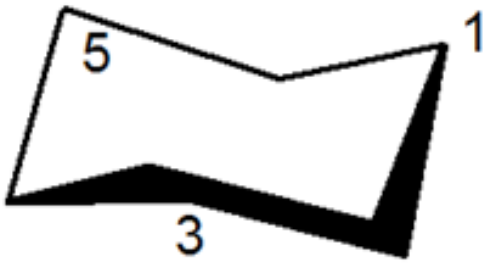
Cyclohexanes



Boat conformation

2 chair conformations:





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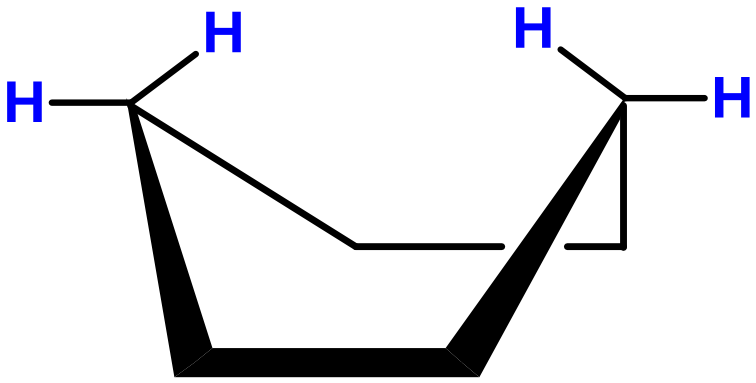
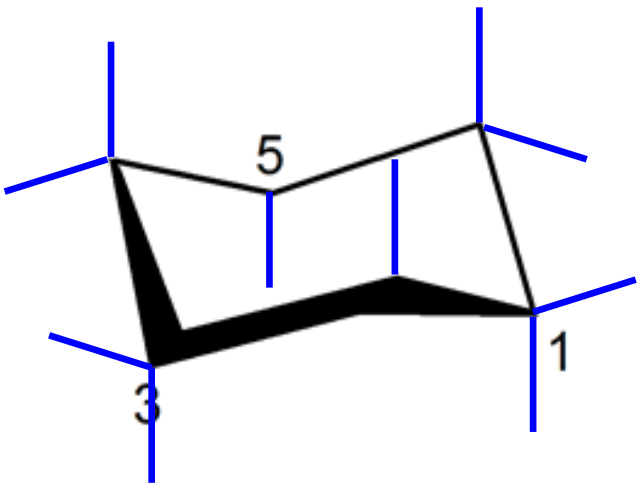
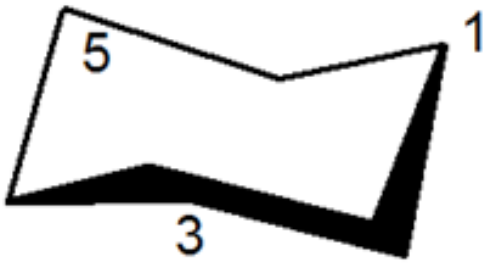
Cyclohexanes



Boat conformation

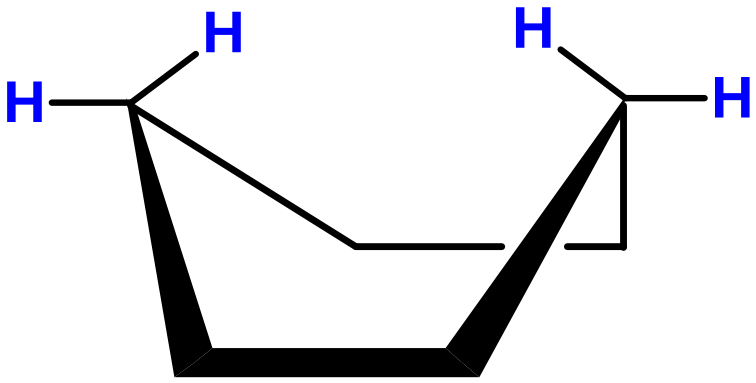
2 chair conformations:





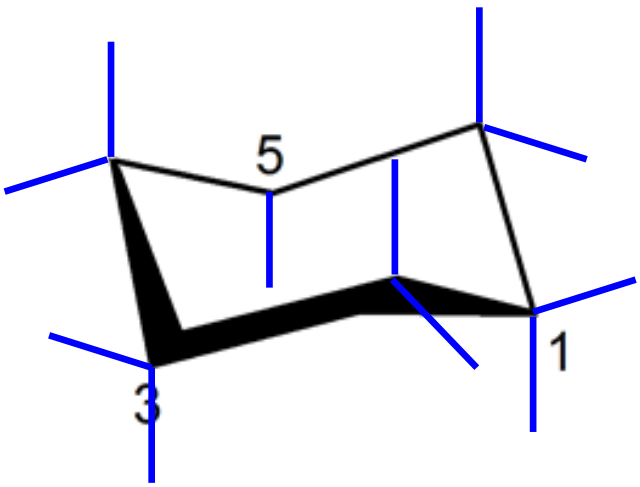
add 6 equatorials in alternating fashion

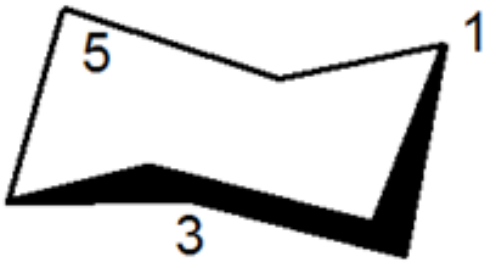
Cyclohexanes



Boat conformation

2 chair conformations:





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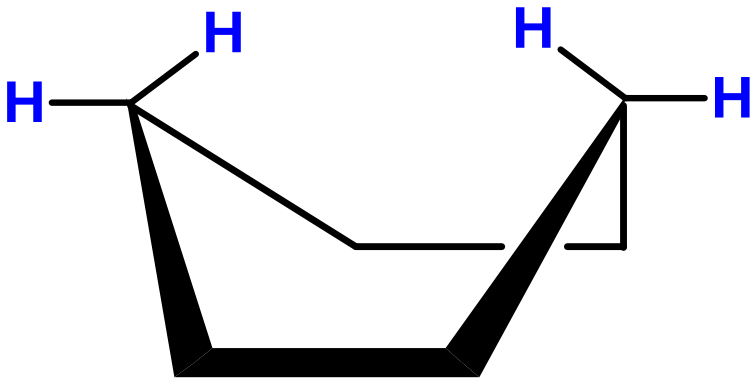
Cyclohexanes



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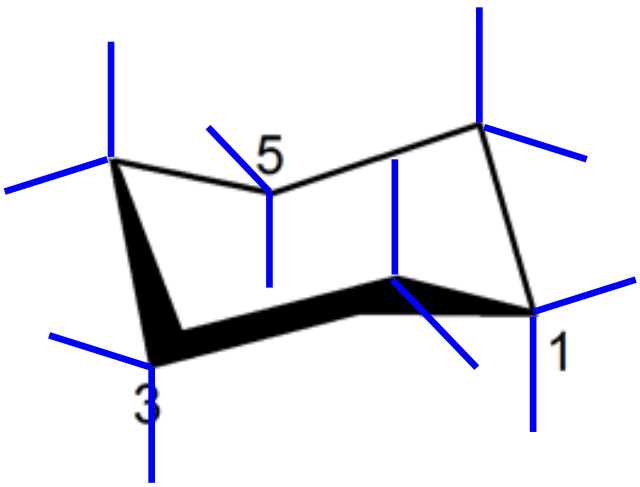

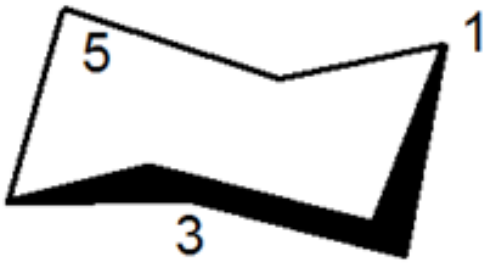

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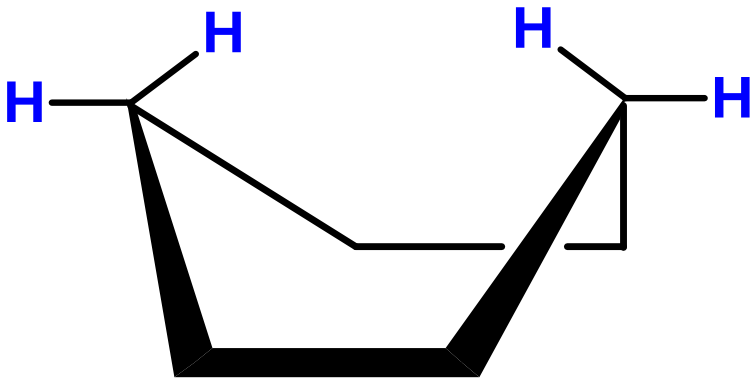

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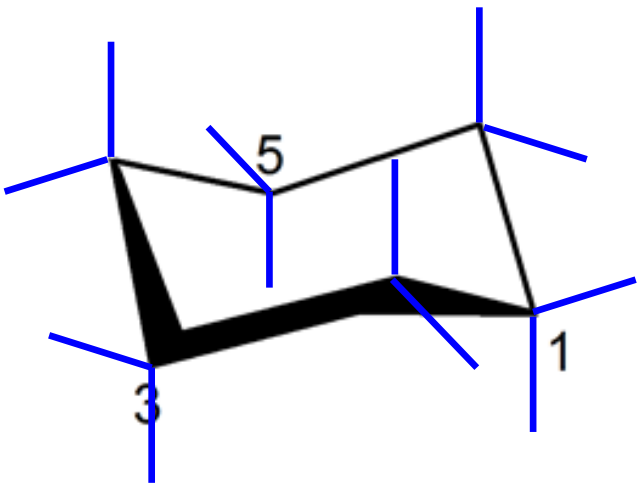
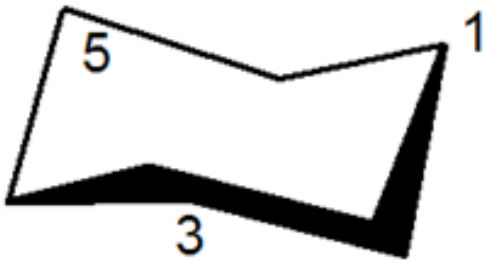
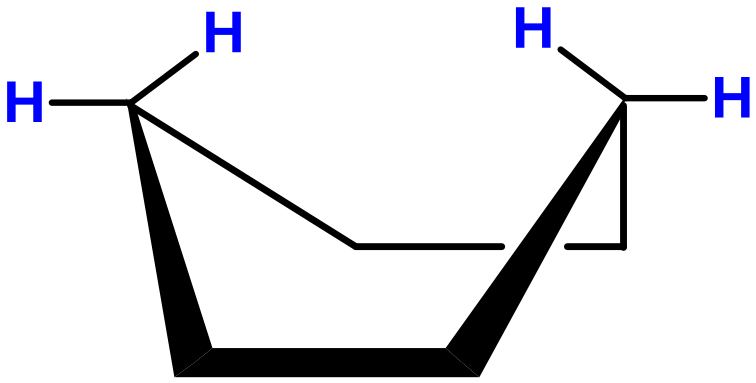




label the equatorial bonds

Cyclohexanes



Boat conformation

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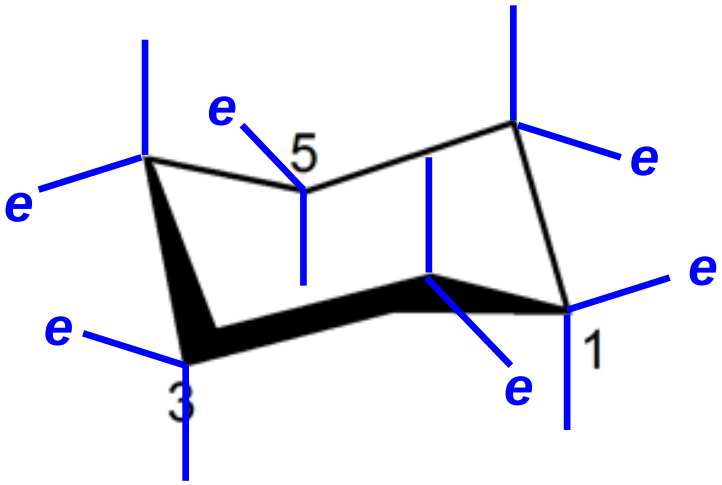

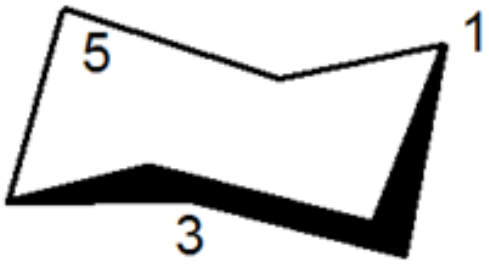

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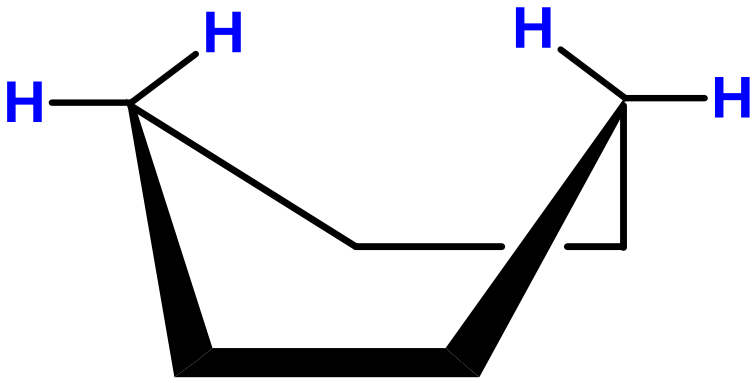

Boat conformation

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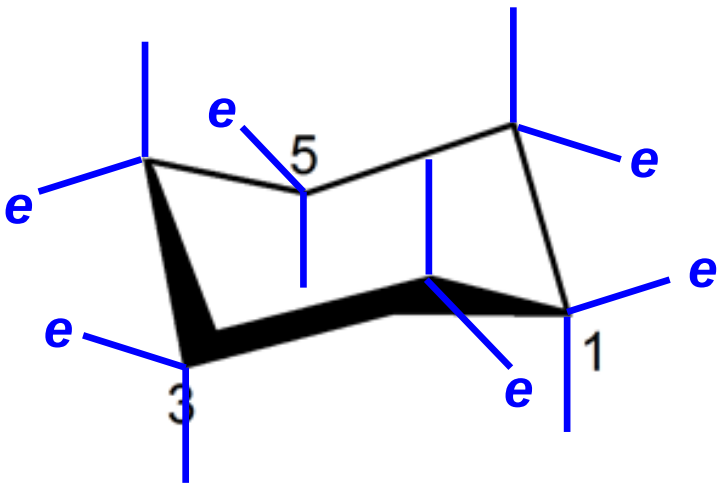
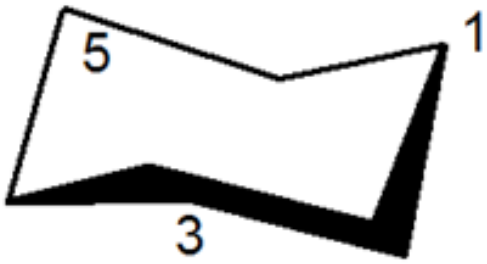
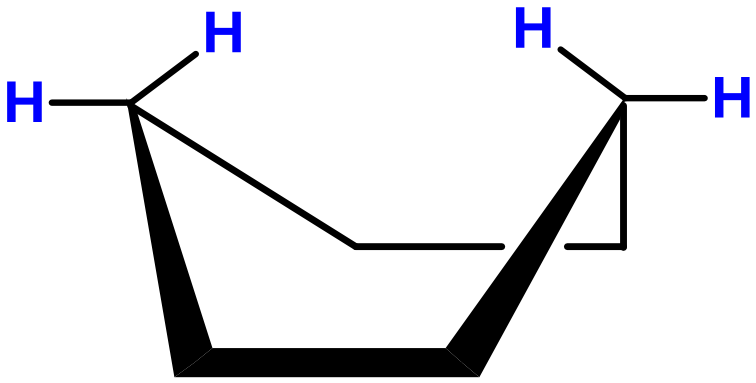




label the axial bonds

Cyclohexanes



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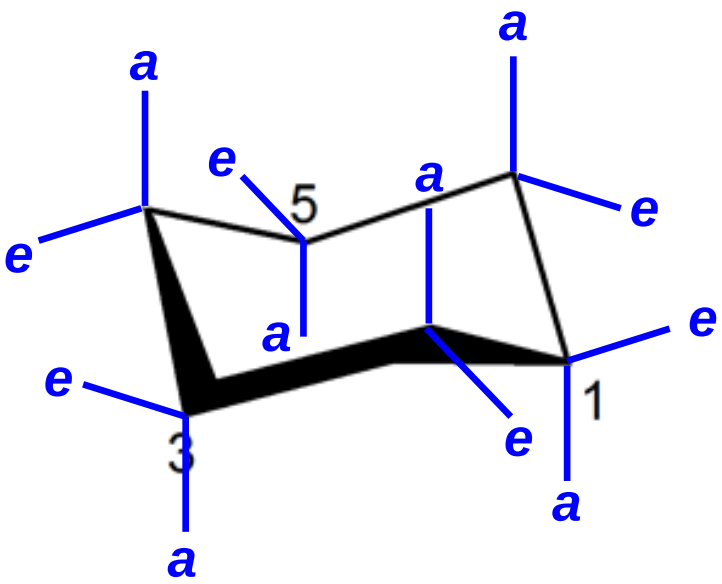
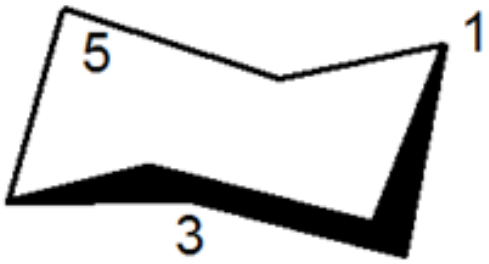
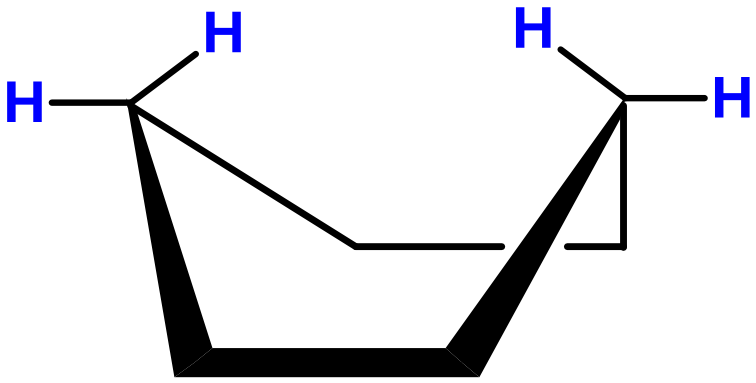
2 chair conformations:





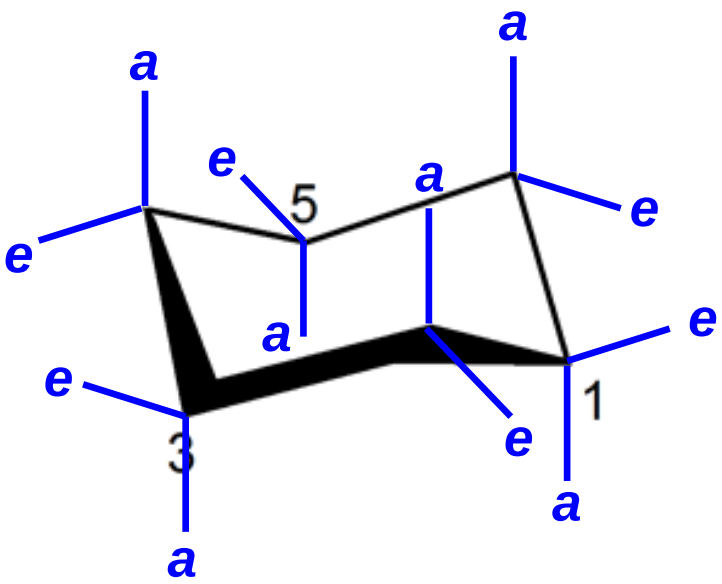
label the axial bonds

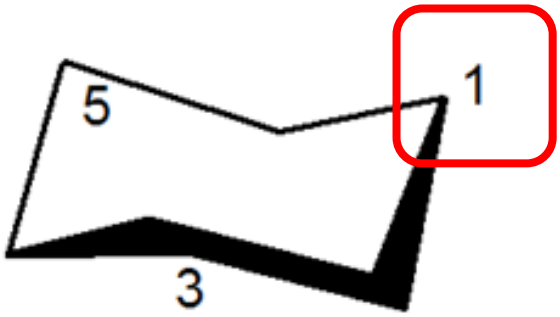
Cyclohexanes



Boat conformation

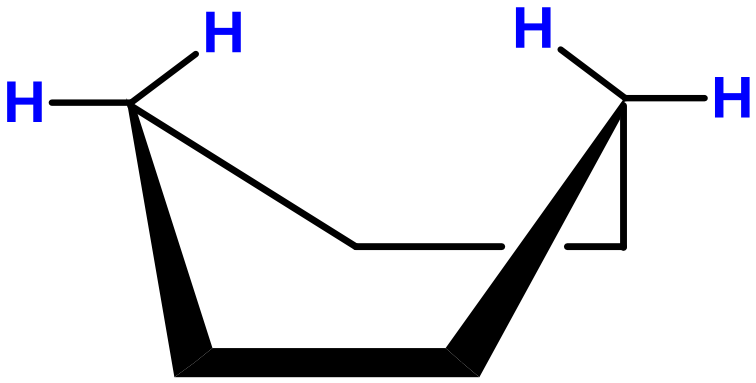
2 chair conformations:





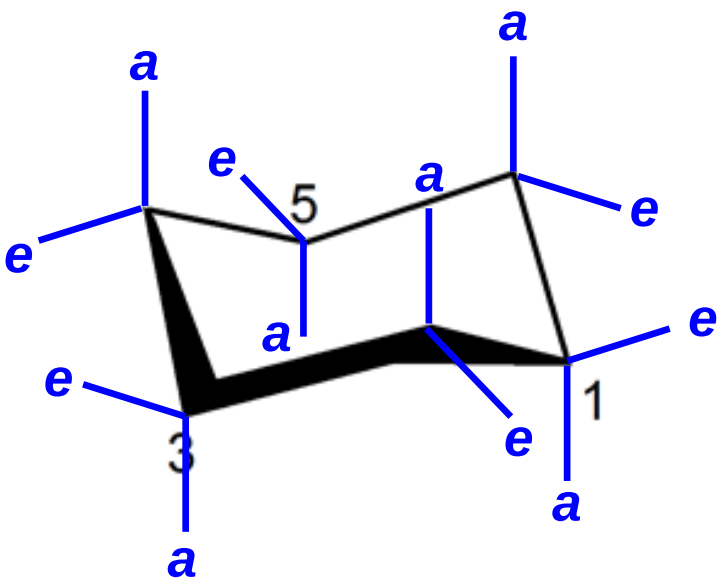
Carbon 1 puckered UP in other conformer.

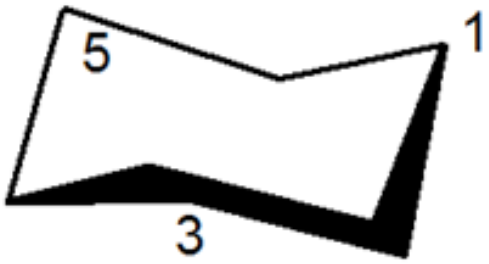
Cyclohexanes



Boat conformation

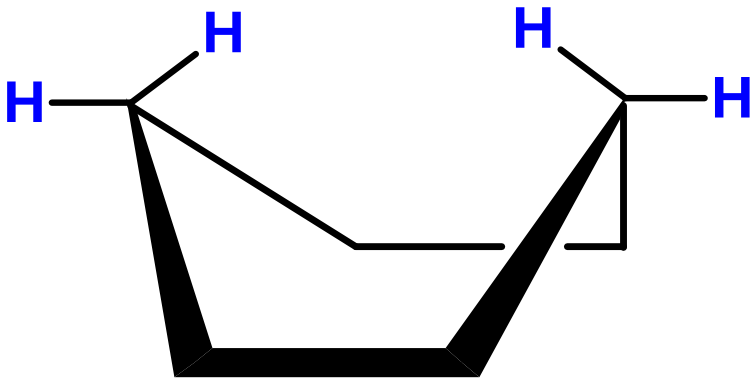
2 chair conformations:





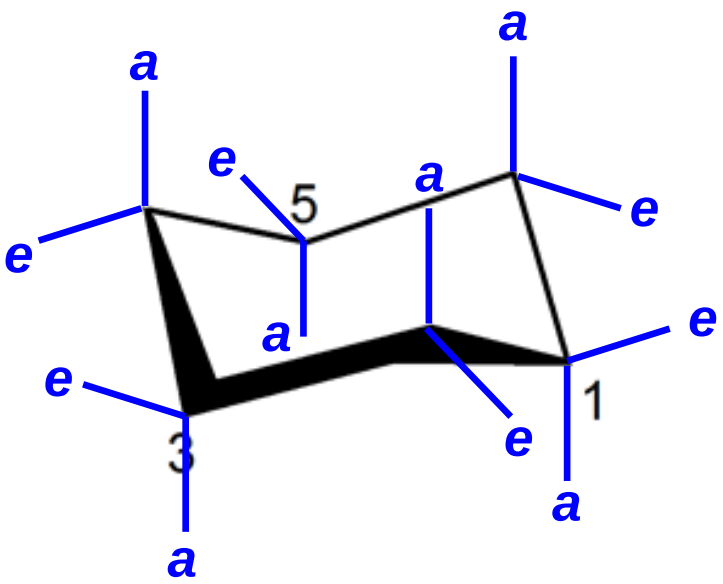
3 axials UP

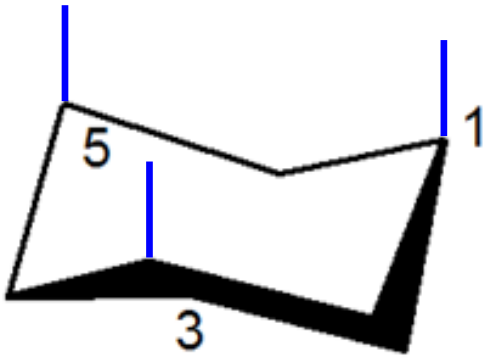
Cyclohexanes



Boat conformation

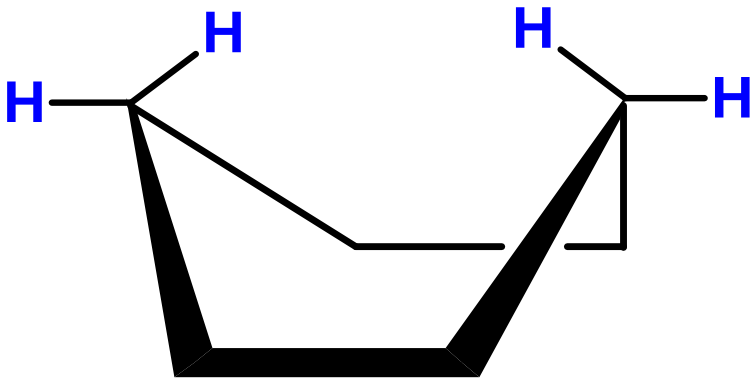
2 chair conformations:





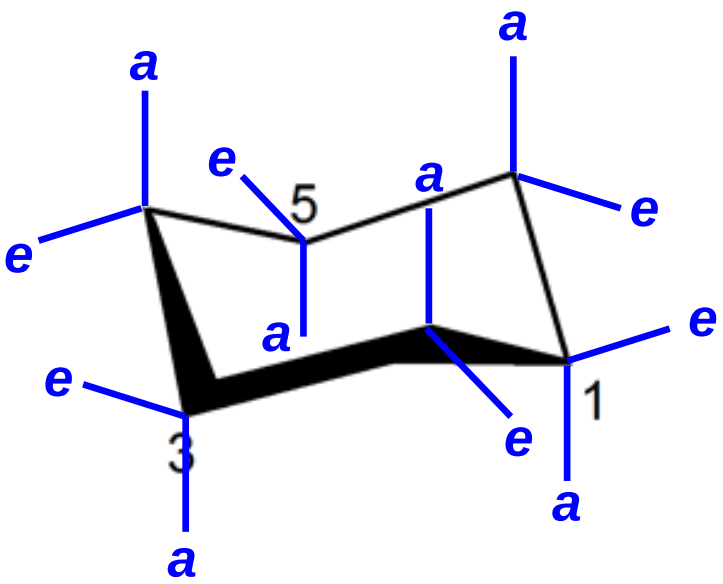
3 axials UP

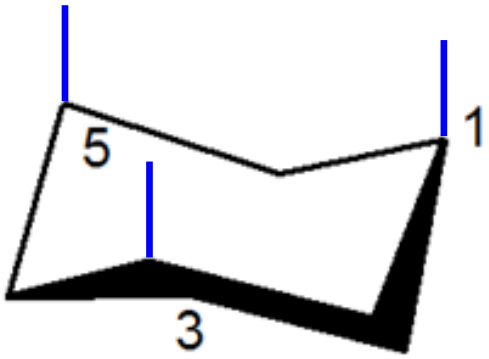
Cyclohexanes



Boat conformation

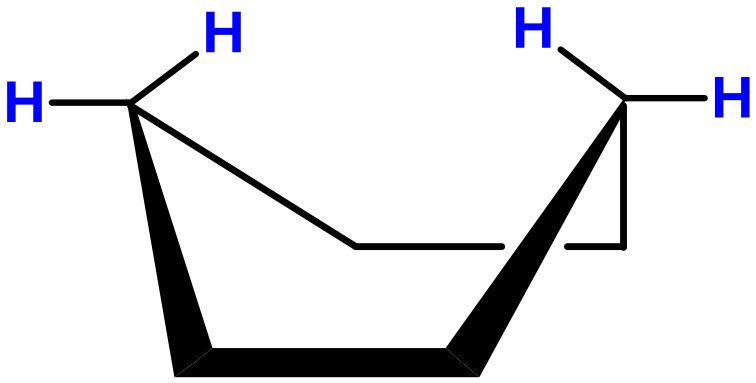
2 chair conformations:





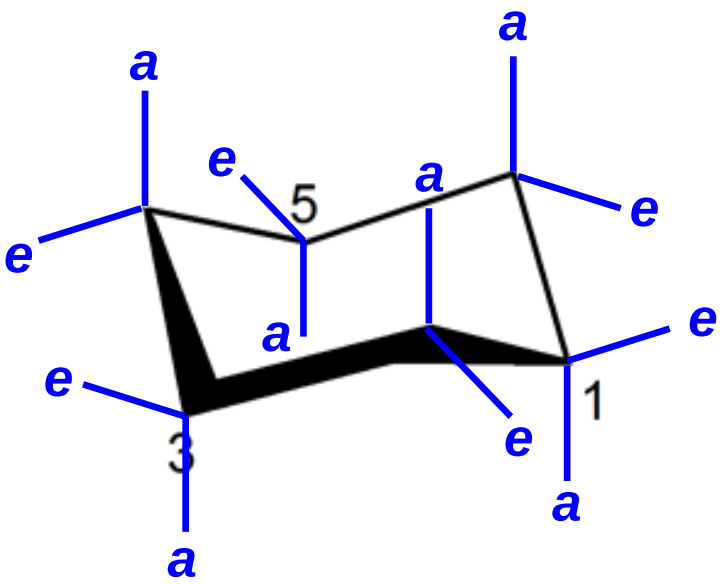
3 axials DOWN

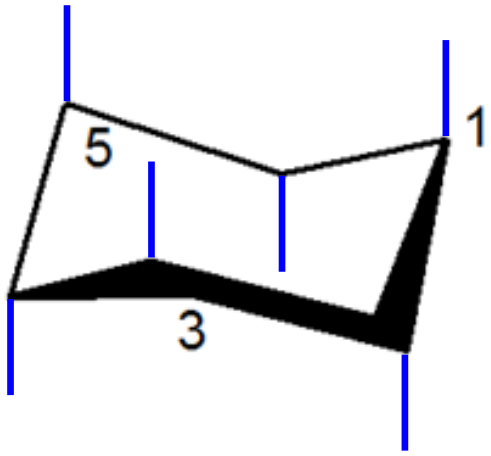
Cyclohexanes



Boat conformation

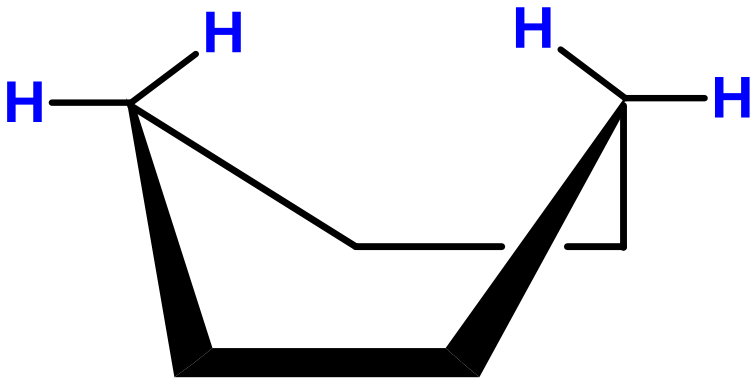
2 chair conformations:





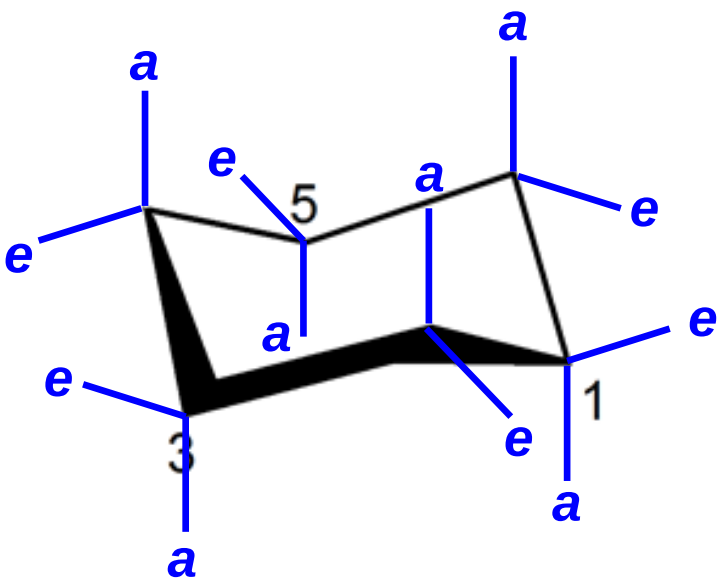
3 axials DOWN

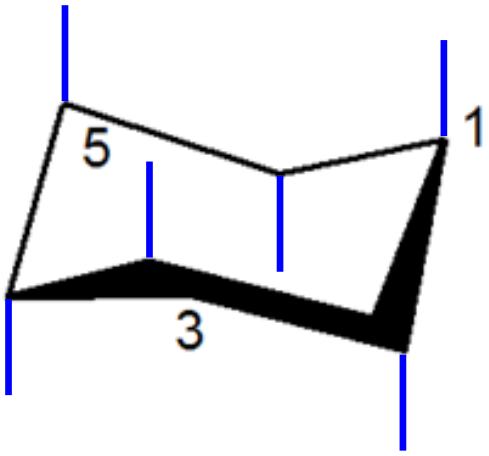
Cyclohexanes



Boat conformation

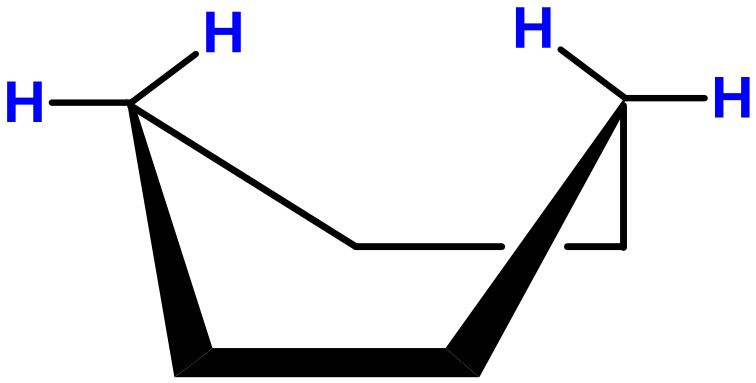
2 chair conformations:





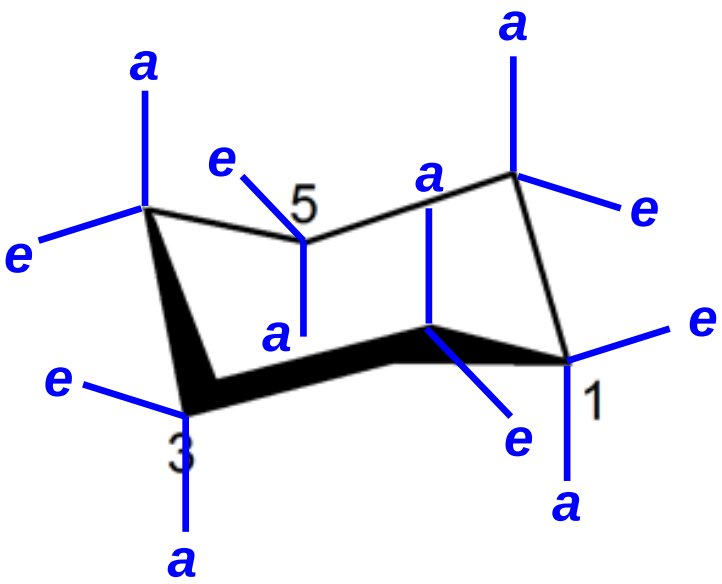
6 equatorials

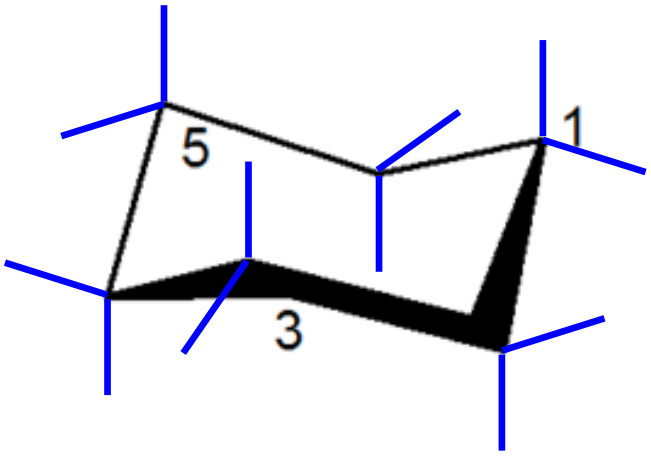
Cyclohexanes



Boat conformation

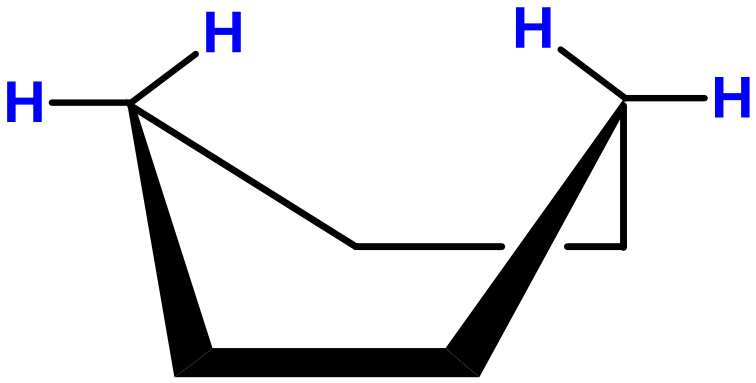
2 chair conformations:





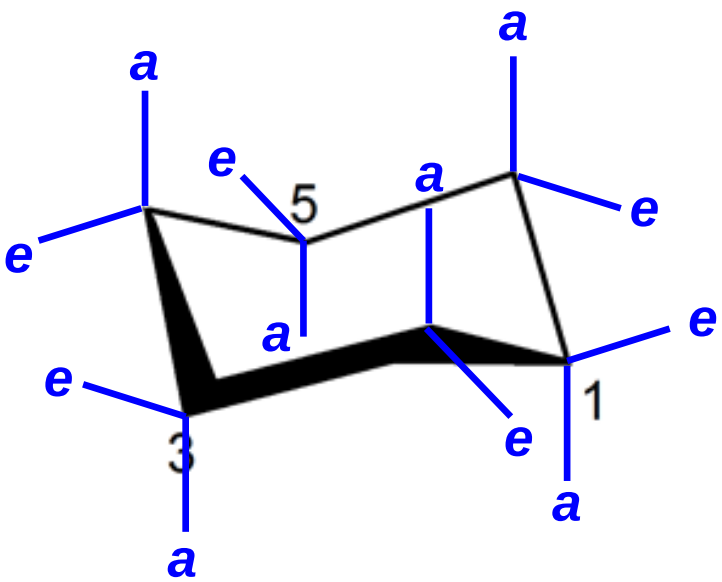
6 equatorials

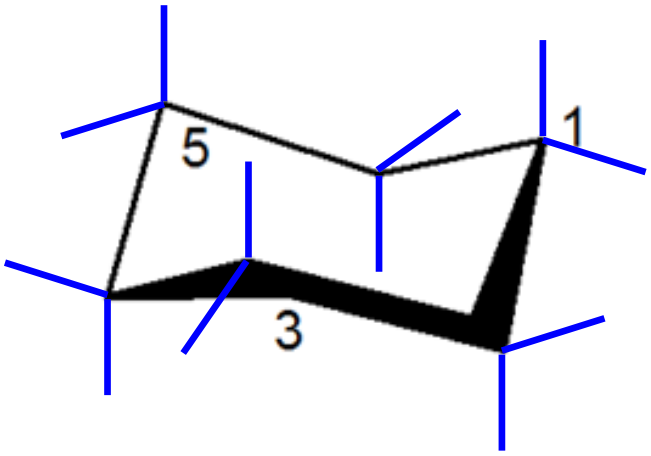
Cyclohexanes



Boat conformation

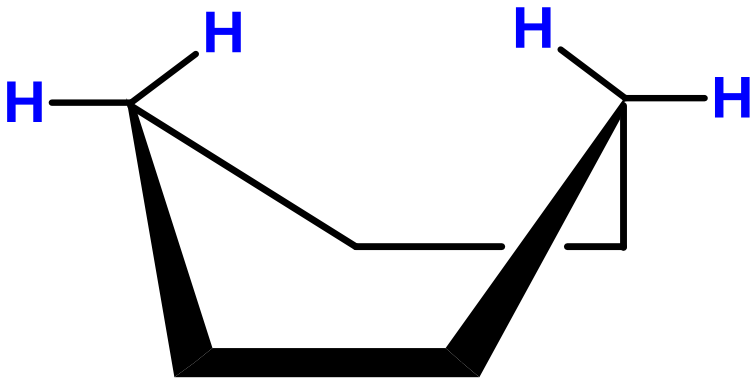
2 chair conformations:





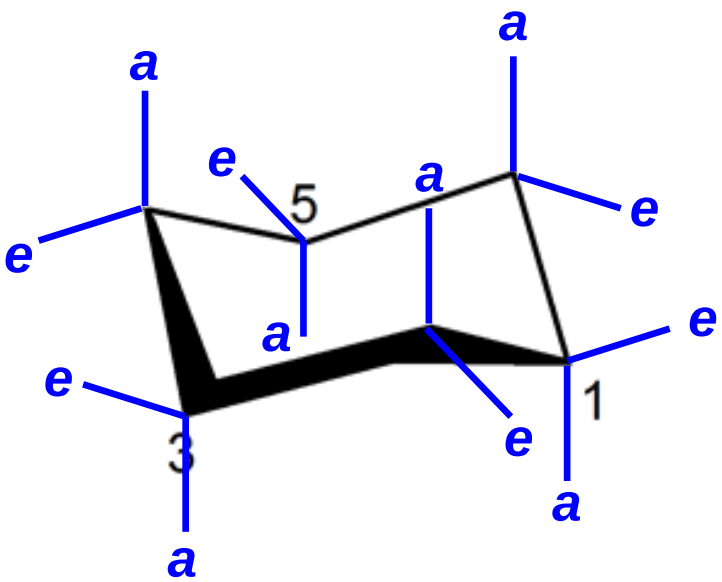
label the 12 bonds

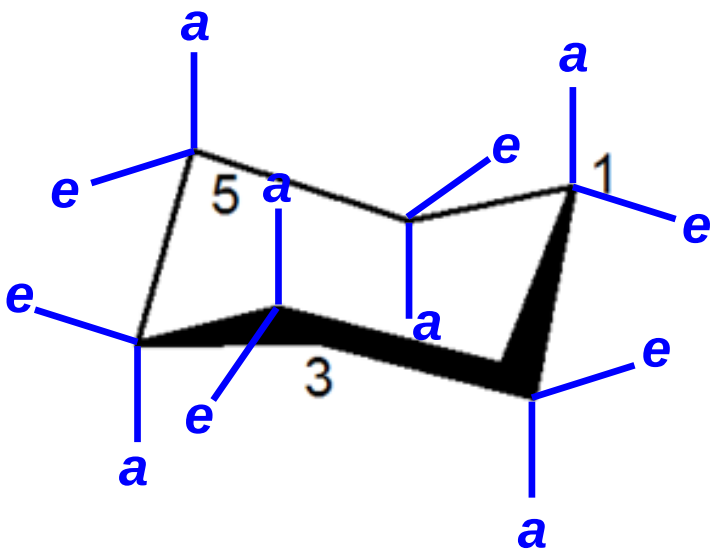
Cyclohexanes



Boat conformation

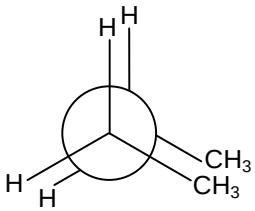
2 chair conformations:





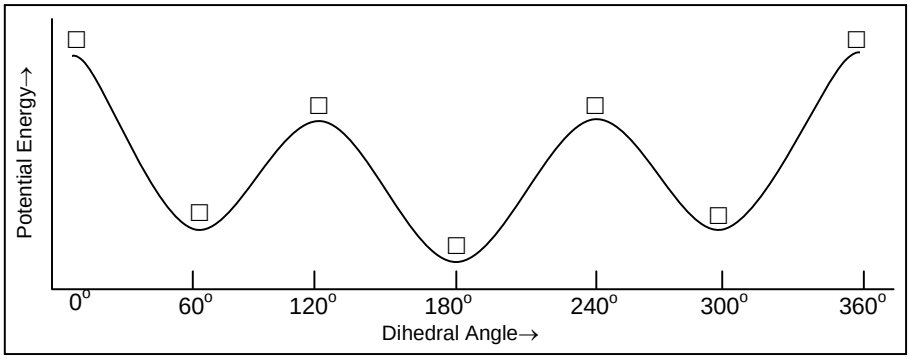
label the 12 bonds

1. **Butane:** *What is the name of the following conformation? Circle th* *of your response:*

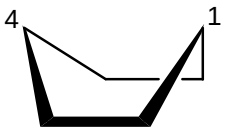


(a) Anti
(b) Gauche
(c) Eclipsed
(d) Staggered

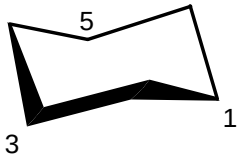
Check (☑) the position(s) where the above conformation would (could) be on the following energy curve:

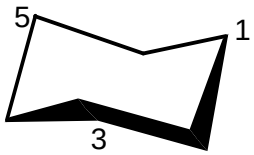


5. **Cyclohexane:** *Draw the uppermost C-H bonds (at C_1 and C_4):*



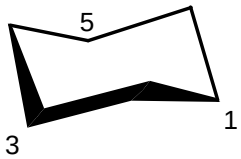
6. **Cyclohexane:** *Draw the axial and equatorial hydrogen bonds on the chair conformers given below:*



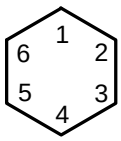


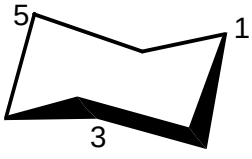
substituted cyclohexanes

7. **Chlorocyclohexane:** *chlorine atom **only** (at* *more stable conformation. Then, for each conformer, use dash-line-wedge notation on the accompanying sketch to indicate the position of the Cl atom relative to the ring.*

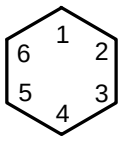


Cl

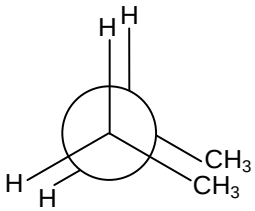




Cl

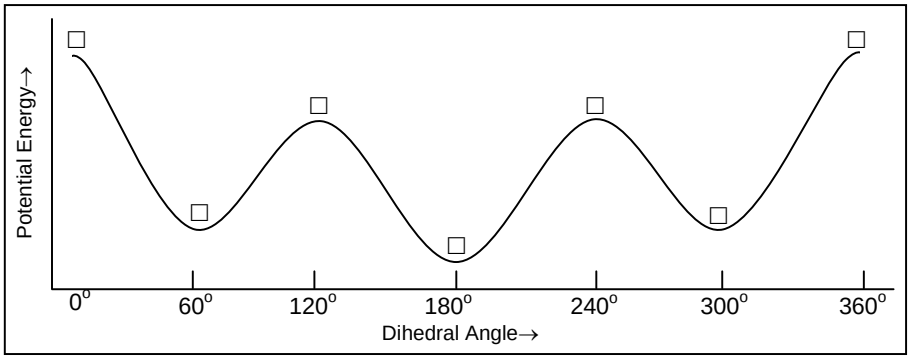


1. **Butane:** *What is the name of the following conformation? Circle th* *of your response:*

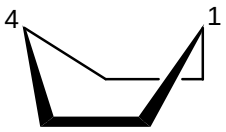


(a) Anti
(b) Gauche
(c) Eclipsed
(d) Staggered

Check (☑) the position(s) where the above conformation would (could) be on the following energy curve:



5. **Cyclohexane:** *Draw the uppermost C-H bonds (at C_1 and C_4):*



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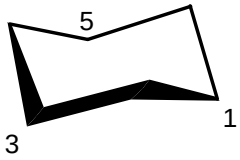
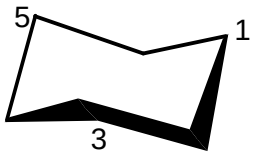
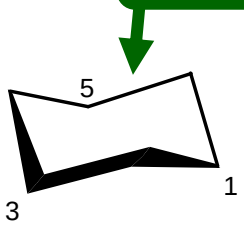


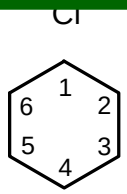


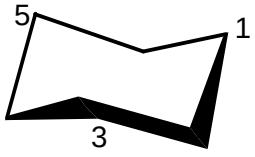
substituted cyclohexanes

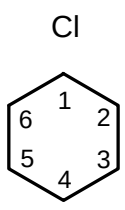
7. **Chlorocyclohexane:** *chlorine atom **only** (at* *nformer, use dash-line-wedge notation on the accomp* *of the Cl atom relative to the ring.*

edge-on view









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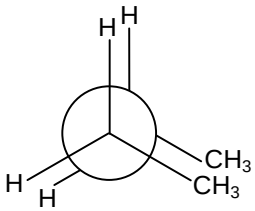

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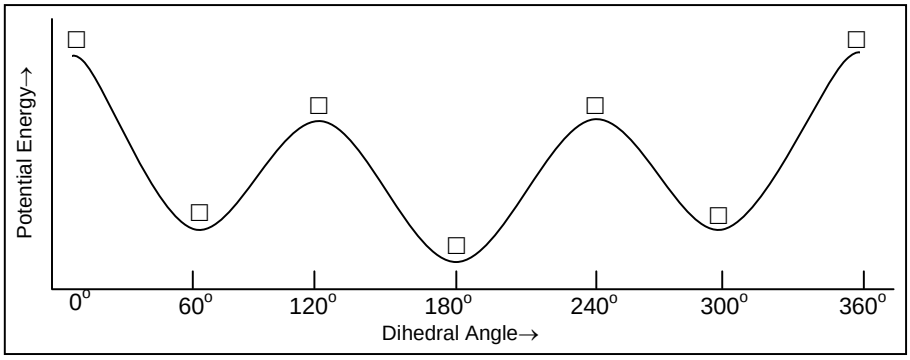

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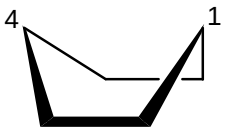

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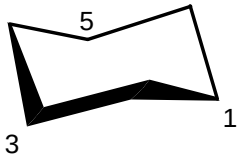
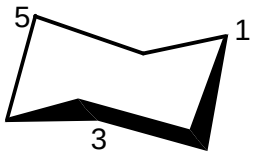
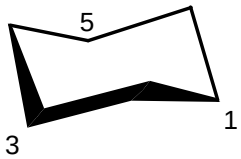


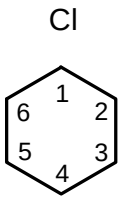


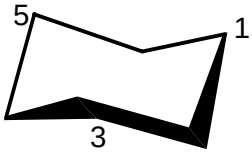
substituted cyclohexanes

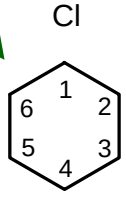
7. **Chlorocyclohexane:** *chlorine atom **only** (at* *more stable conformation. Then, f* *tation on the accompanying sketch to indicate th* .

top-down view



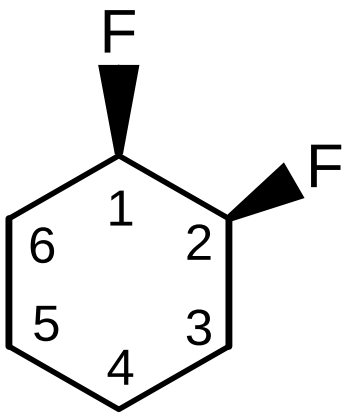






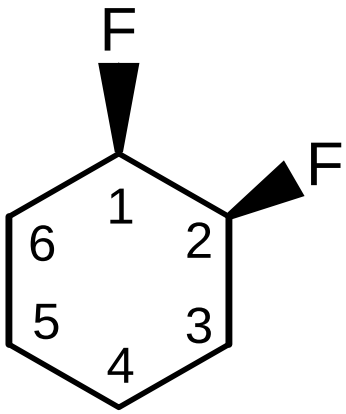
Now, look at:

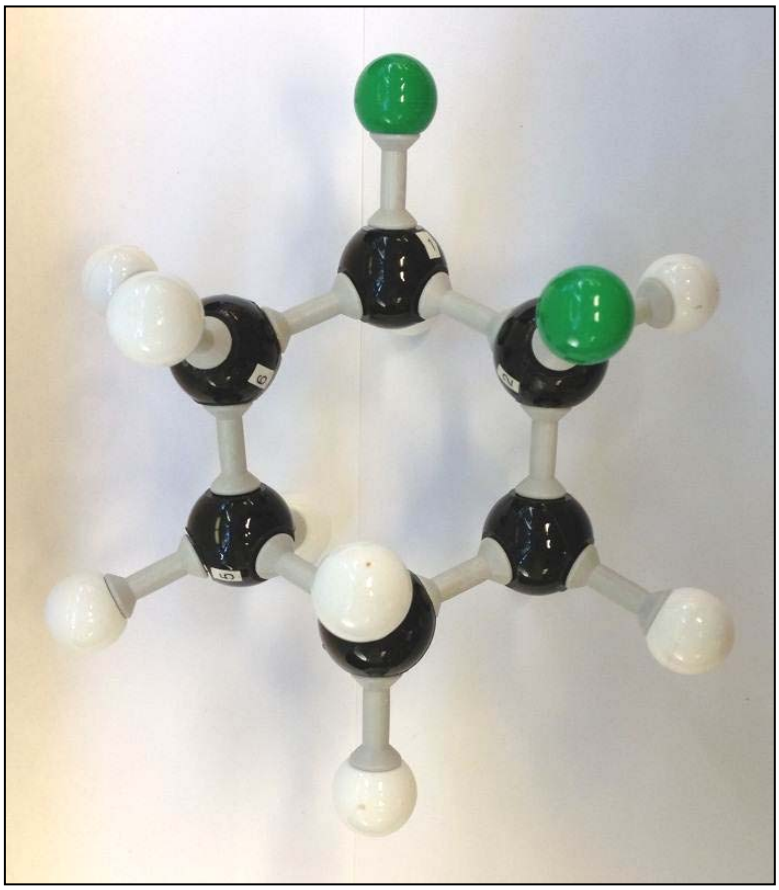
cis-1,2-difluorocyclohexane:



Now, look at:

cis-1,2-difluorocyclohexane:

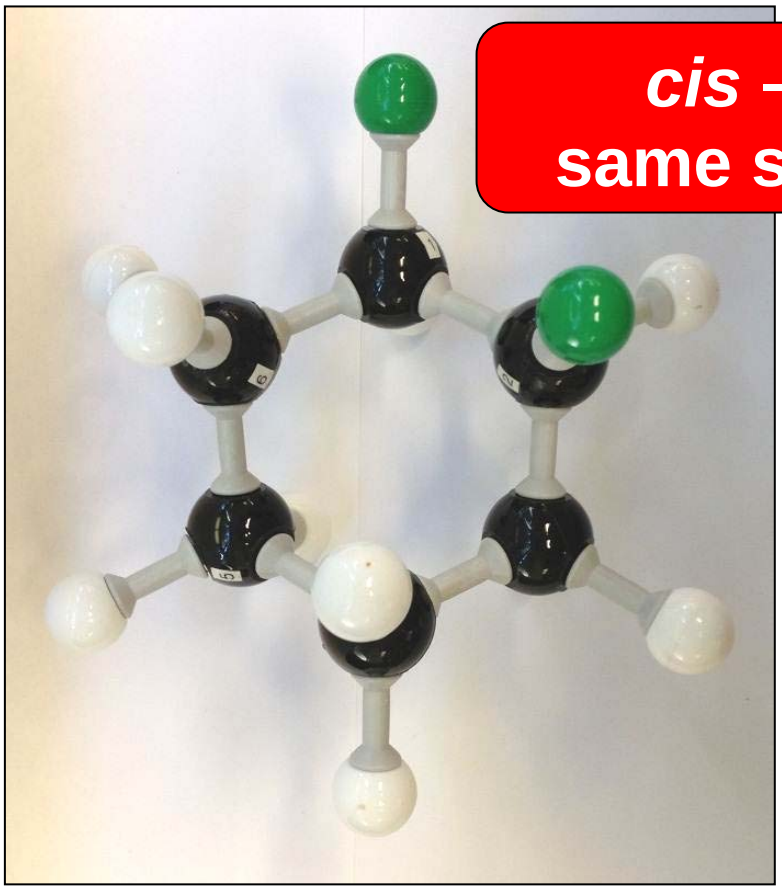




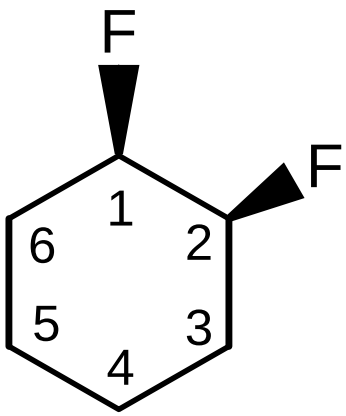
Top-Down View

Now, look at:

cis-1,2-difluorocyclohexane:

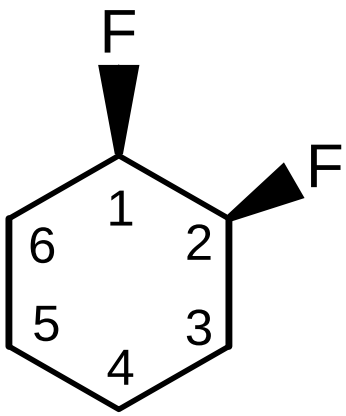


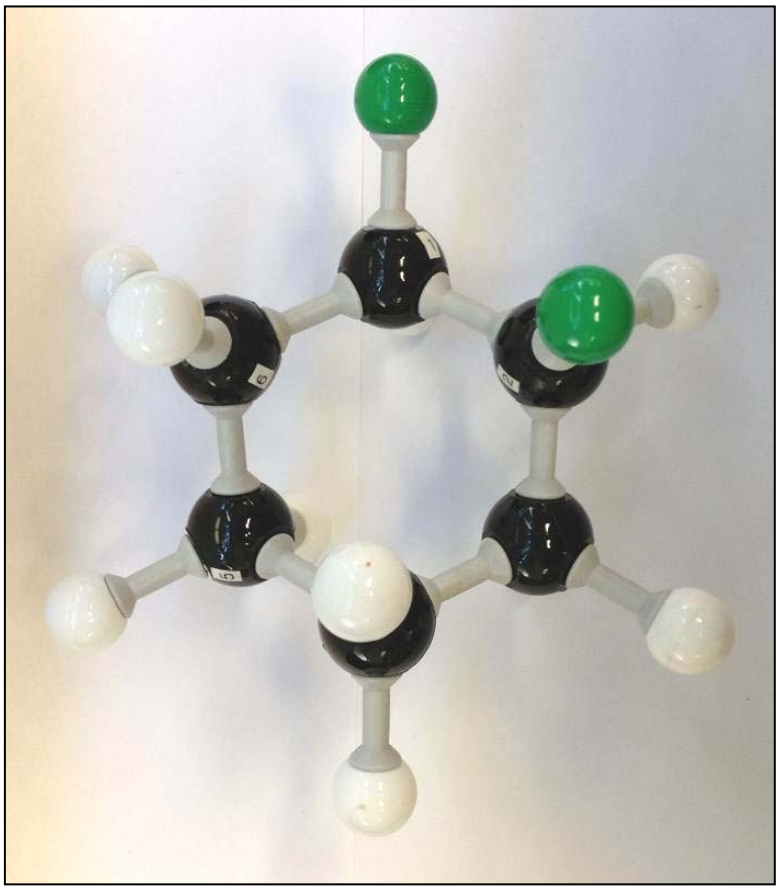
cis – same side

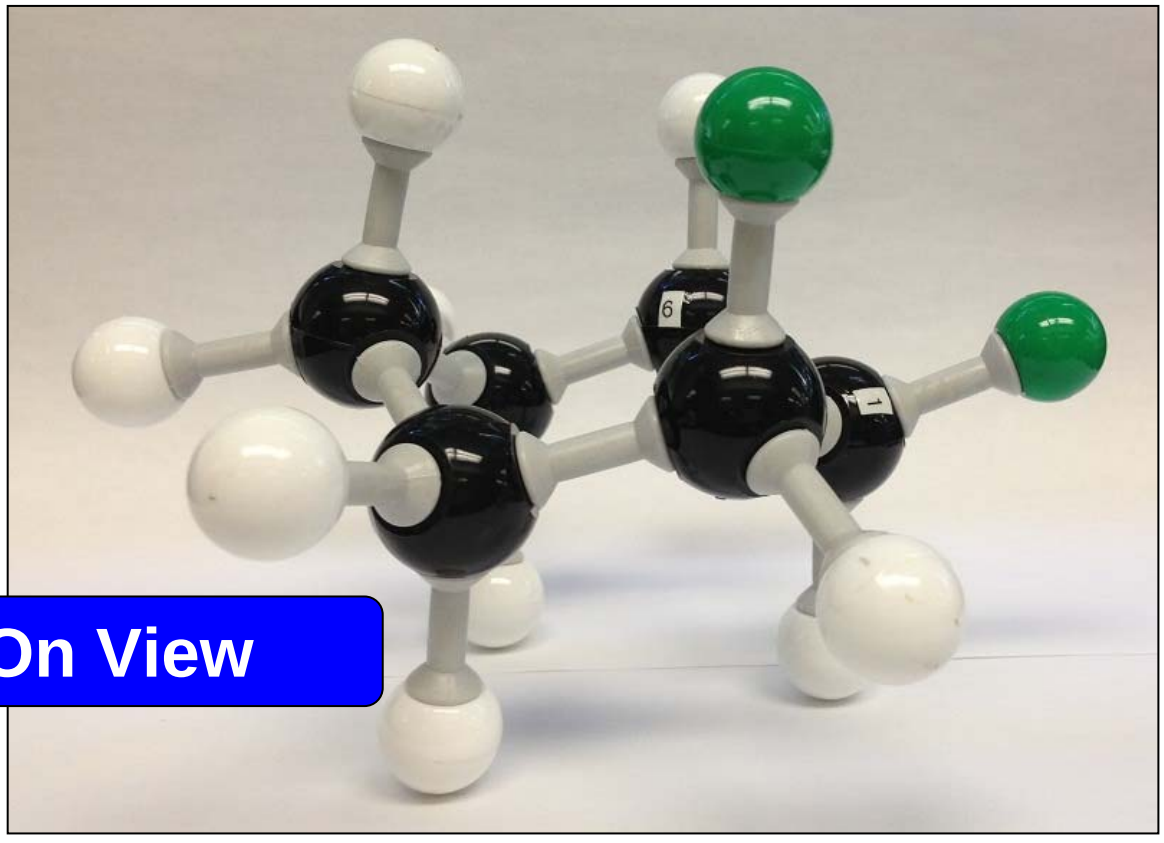


Now, look at:

cis-1,2-difluorocyclohexane:



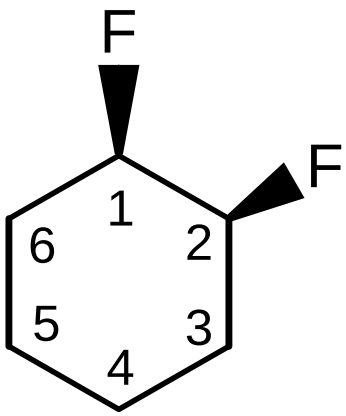


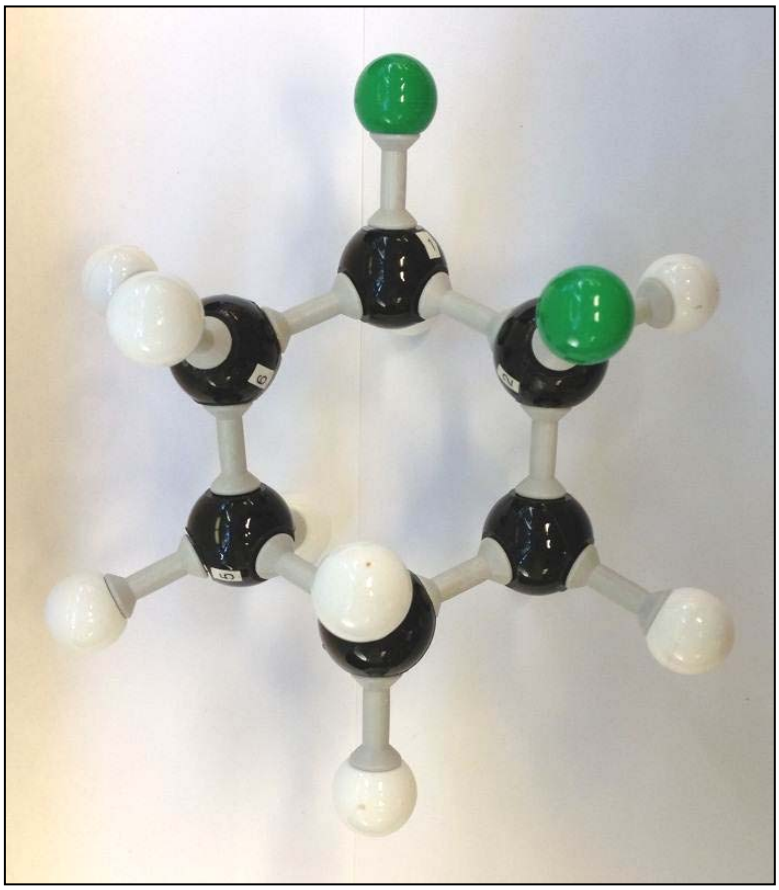


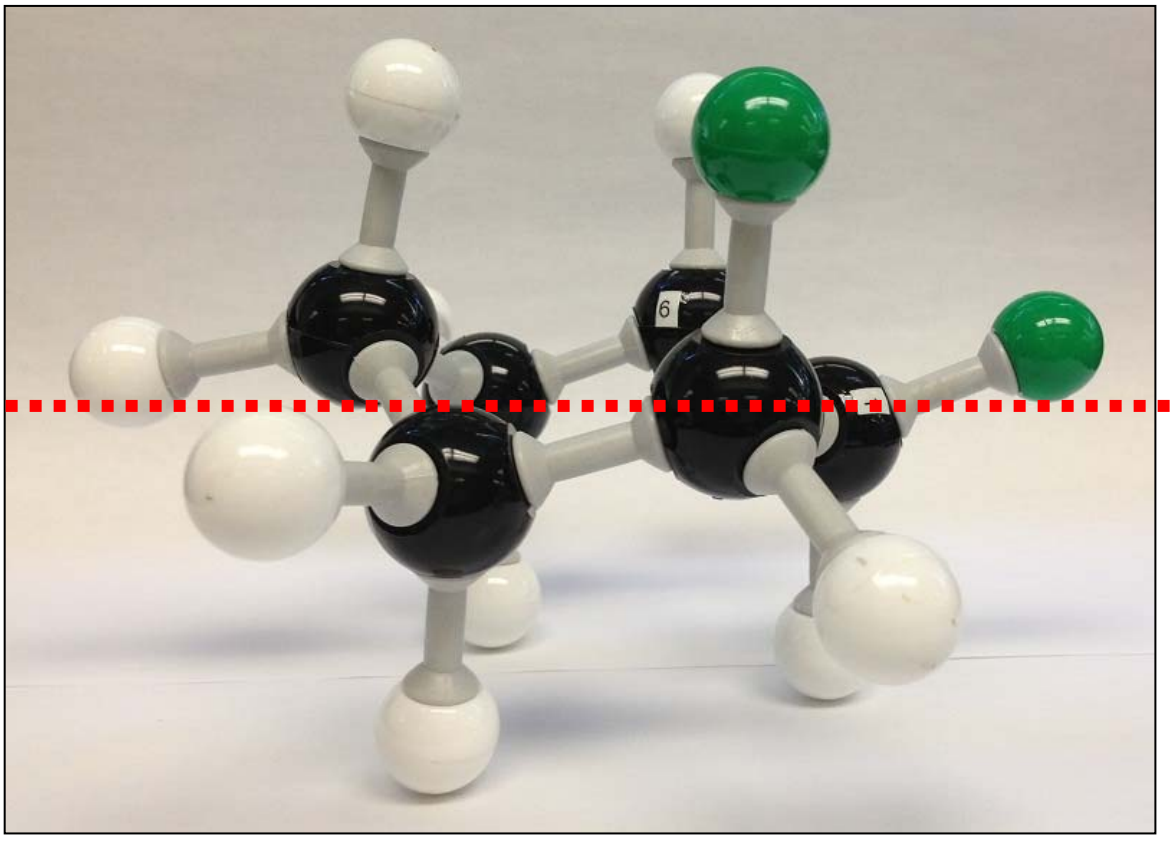
Edge-On View

Now, look at:

cis-1,2-difluorocyclohexane:

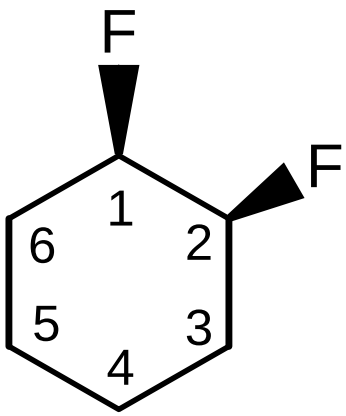


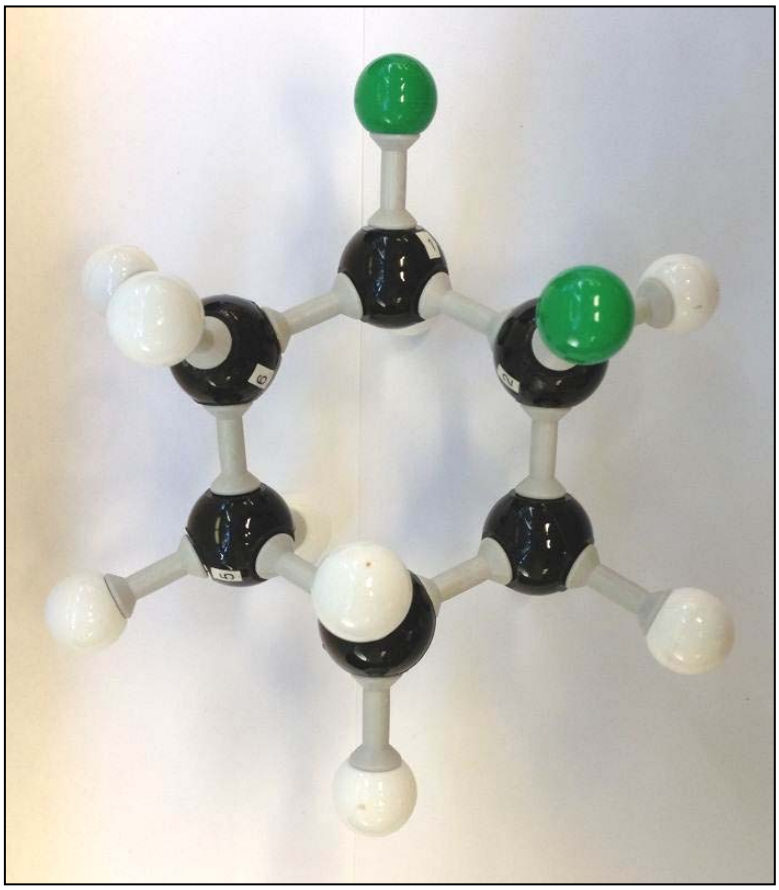




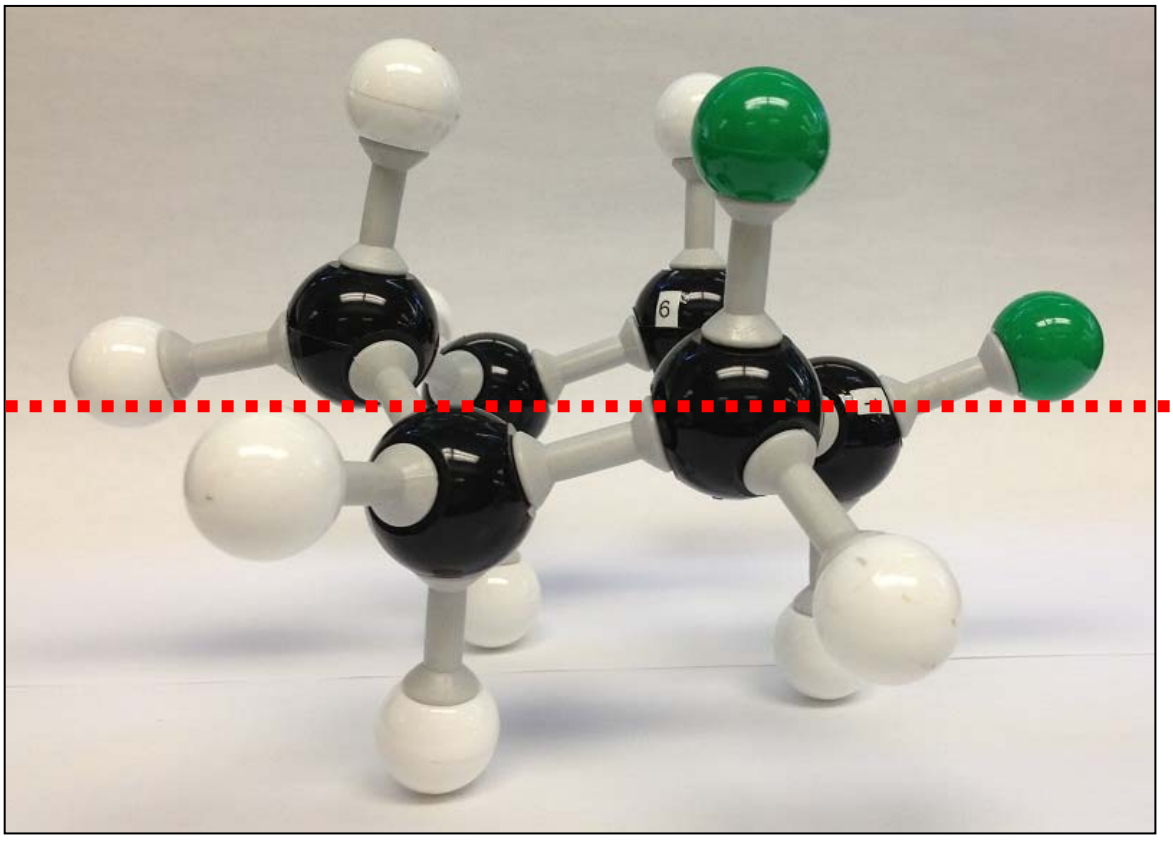
Now, look at:

cis-1,2-difluorocyclohexane:



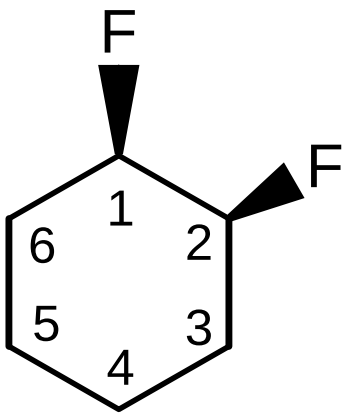


***cis* – same side**

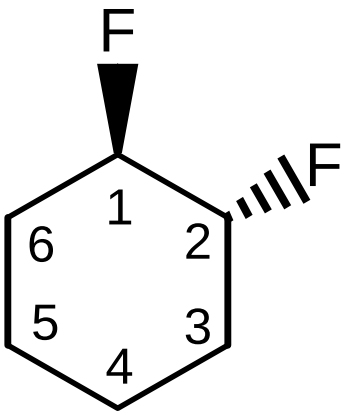


Now, look at:

cis-1,2-difluorocyclohexane:

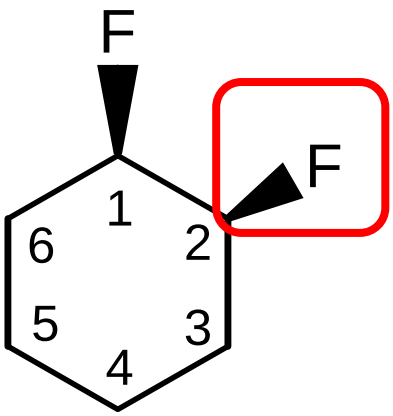


Compare trans:

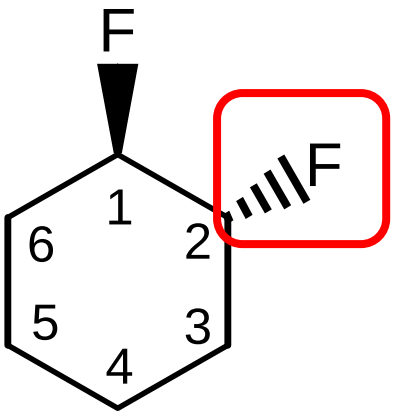


Now, look at:

cis-1,2-difluorocyclohexane:

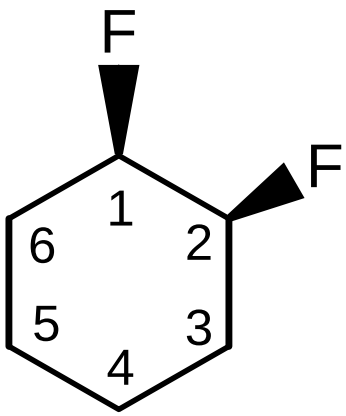


Compare trans:

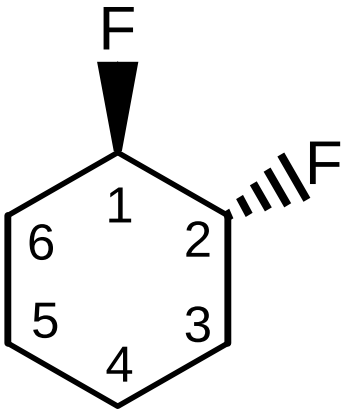


Now, look at:

cis-1,2-difluorocyclohexane:

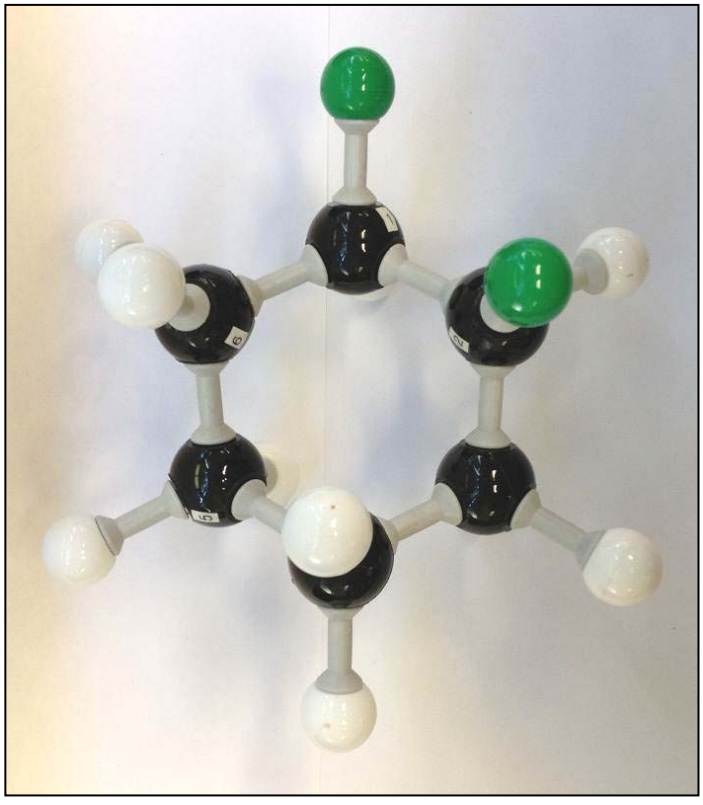


Compare trans:

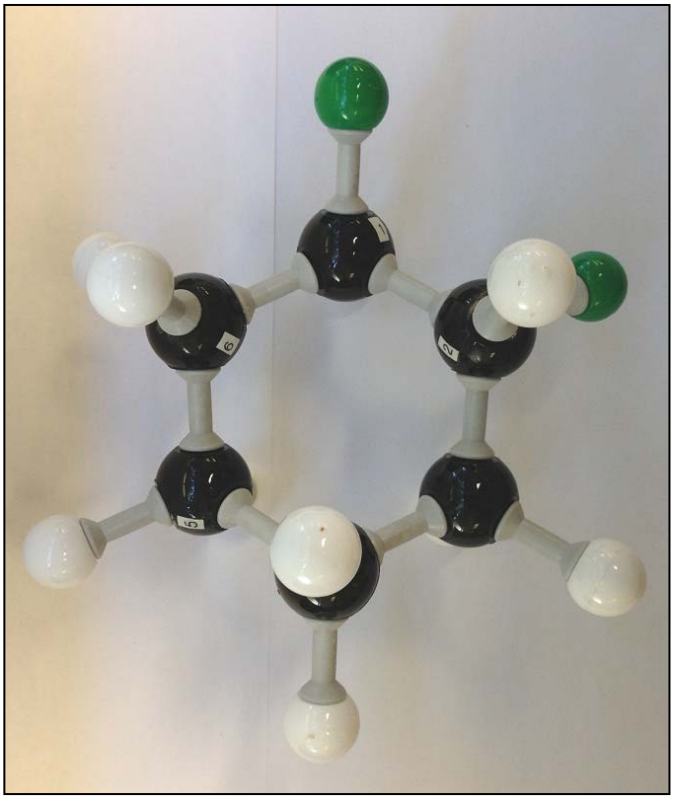


Top-Down View

***cis* – same side**

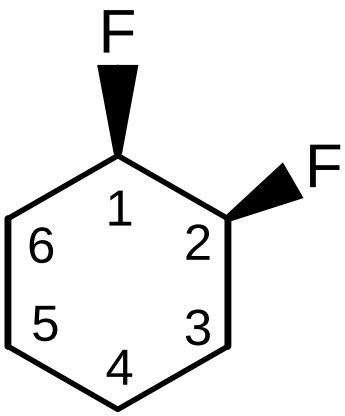


***trans* – opposite sides**

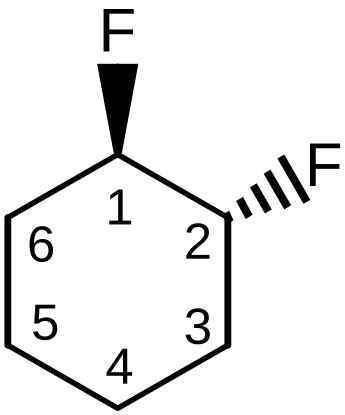


Now, look at:

cis-1,2-difluorocyclohexane:

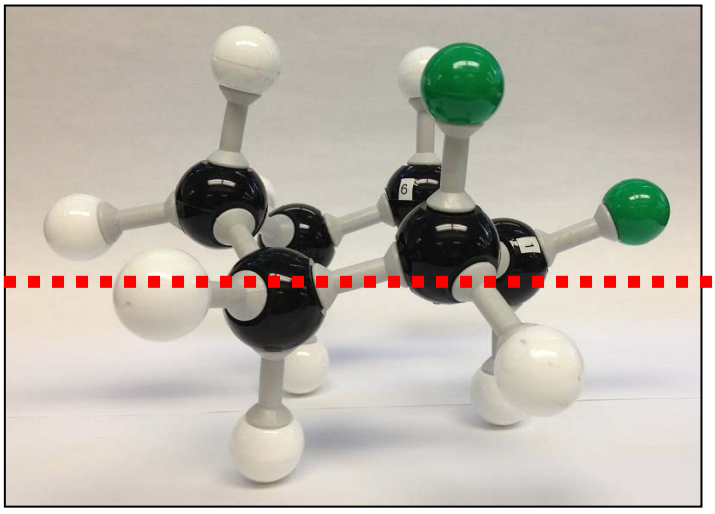


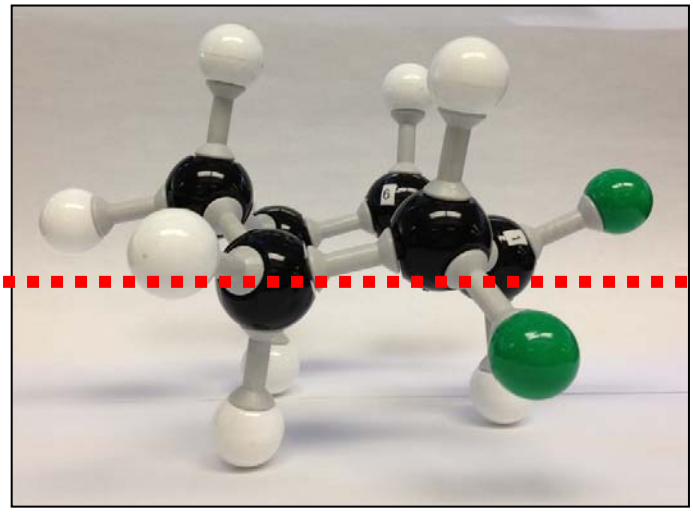
Compare trans:



cis – same side

trans – opposite sides

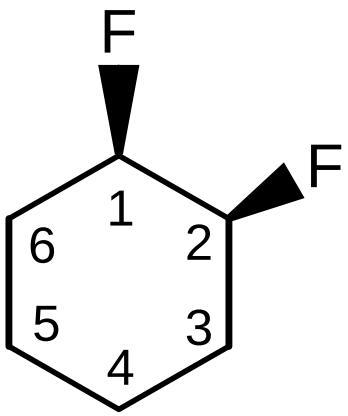




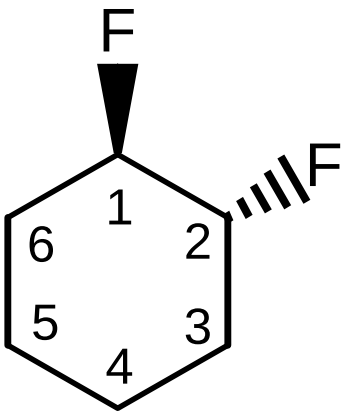
Edge-On View

Now, look at:

cis-1,2-difluorocyclohexane:



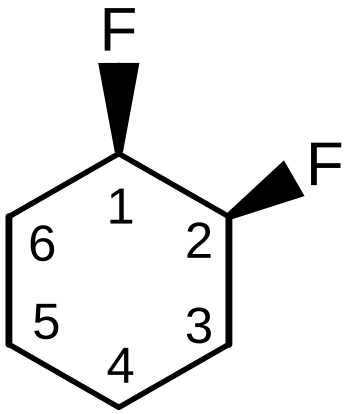
Compare trans:



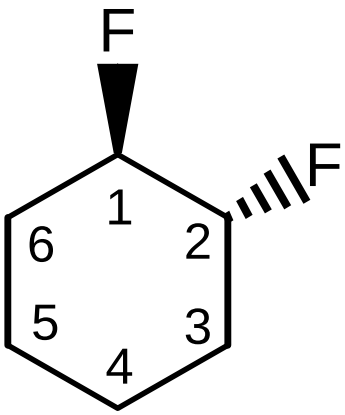
Draw the 2 conformations of trans.

Now, look at:

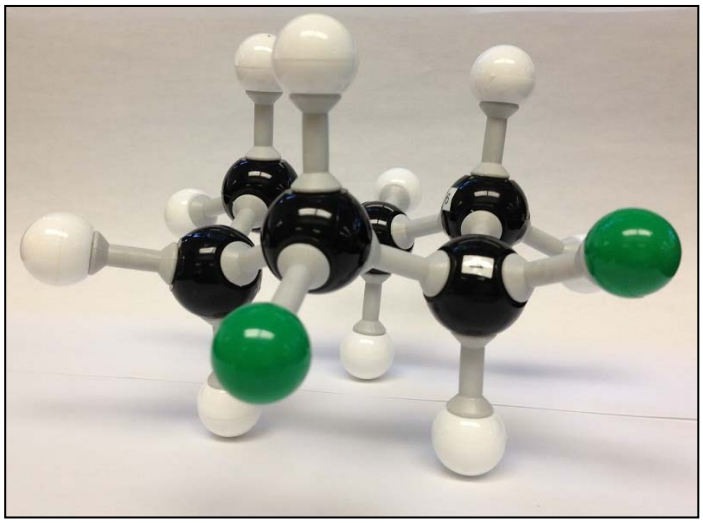
cis-1,2-difluorocyclohexane:

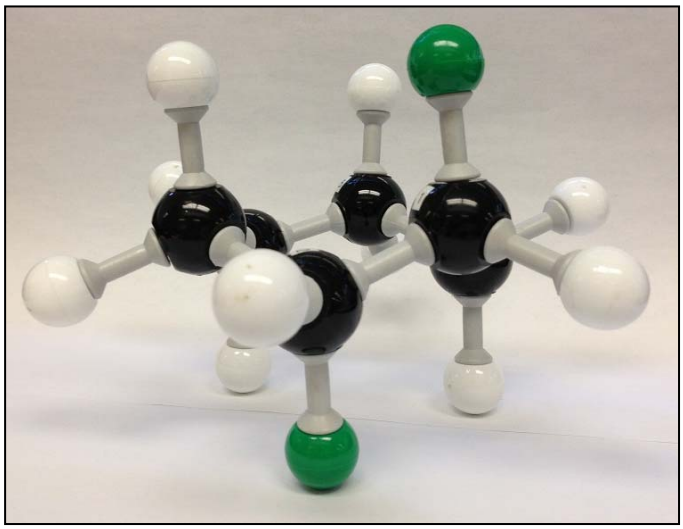


Compare trans:



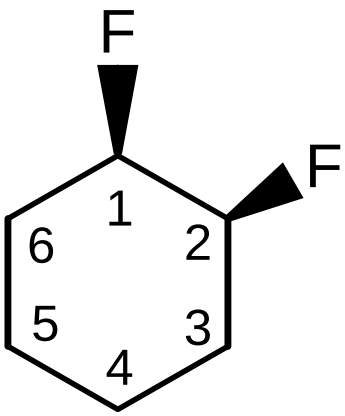
Draw the 2 conformations of trans.



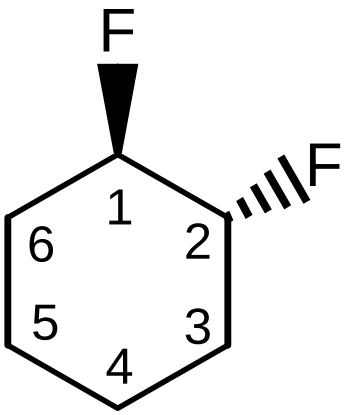


Now, look at:

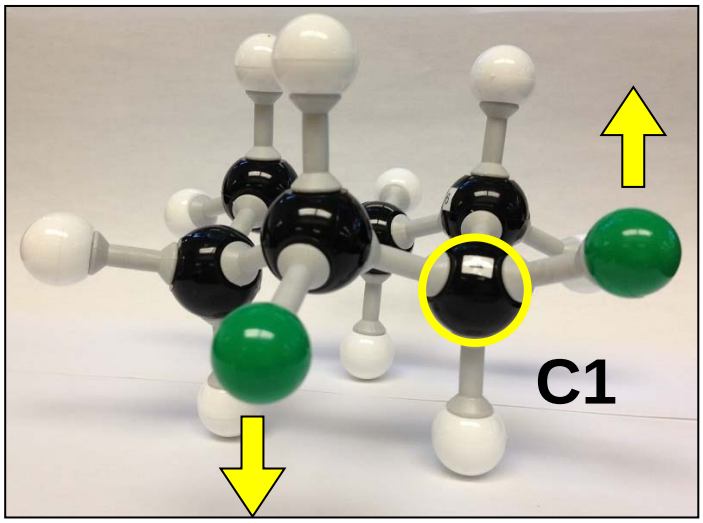
cis-1,2-difluorocyclohexane:

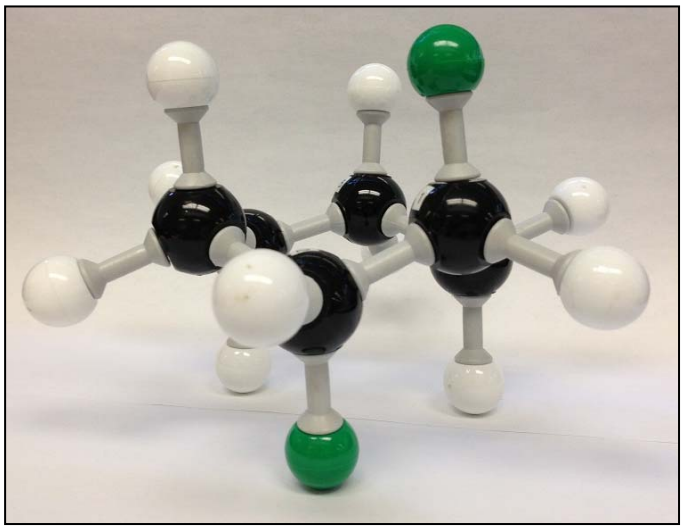


Compare trans:



Draw the 2 conformations of trans.

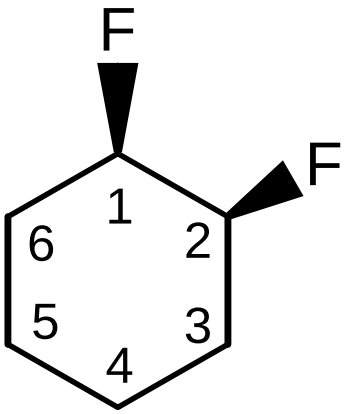




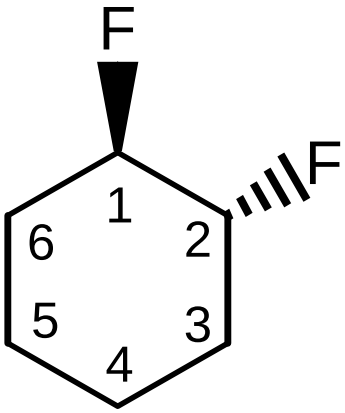
equatorial

Now, look at:

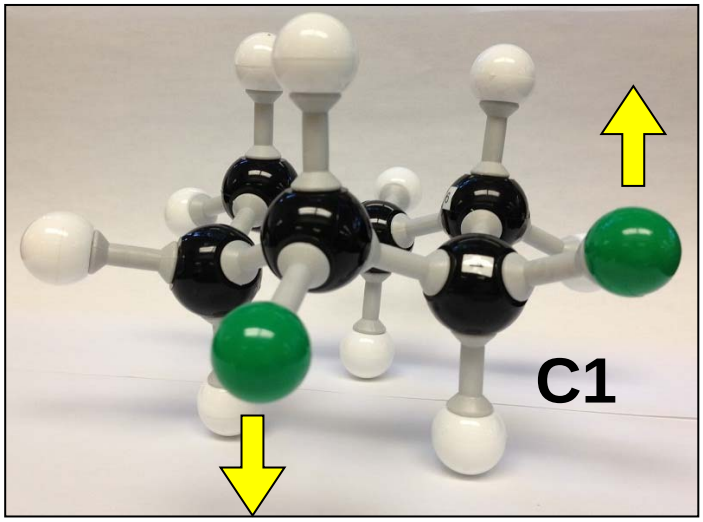
cis-1,2-difluorocyclohexane:

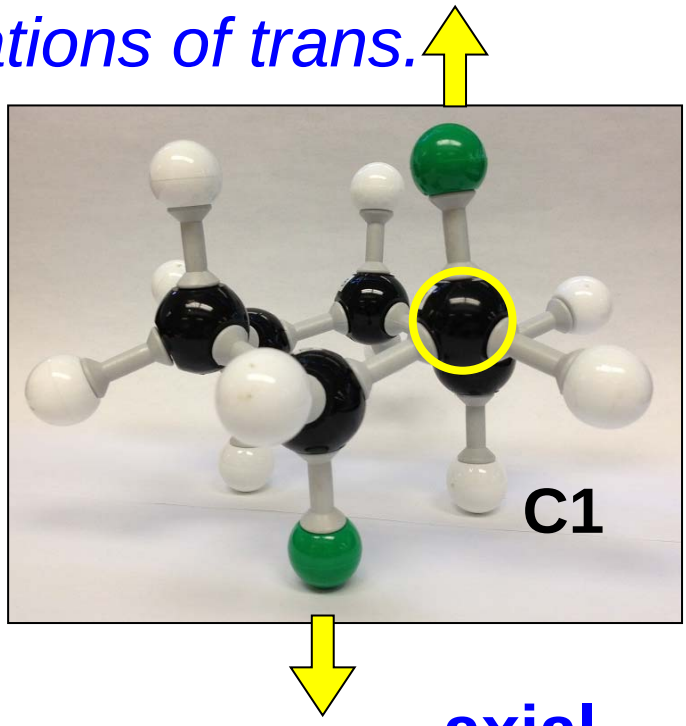


Compare trans:



Draw the 2 conformations of trans.



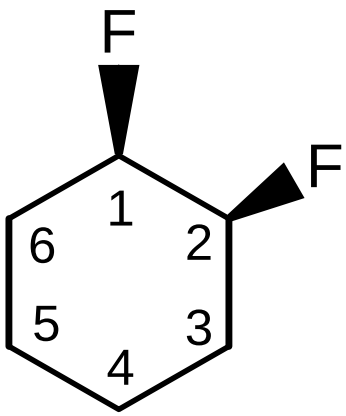


equatorial

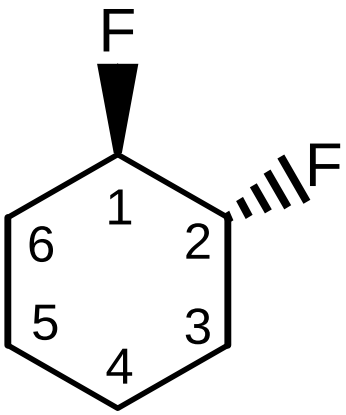
axial

Now, look at:

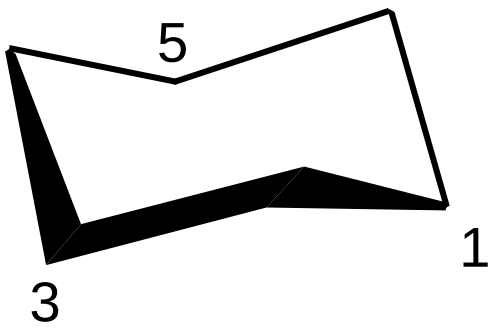
cis-1,2-difluorocyclohexane:

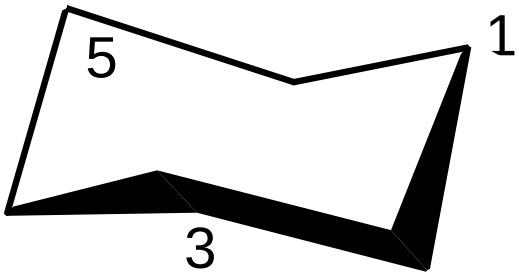


Compare trans:



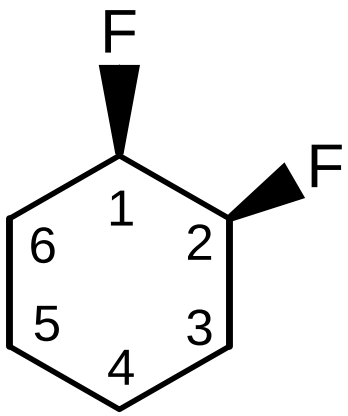
Draw the 2 conformations of trans.



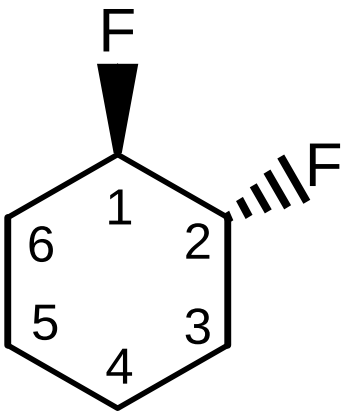


Now, look at:

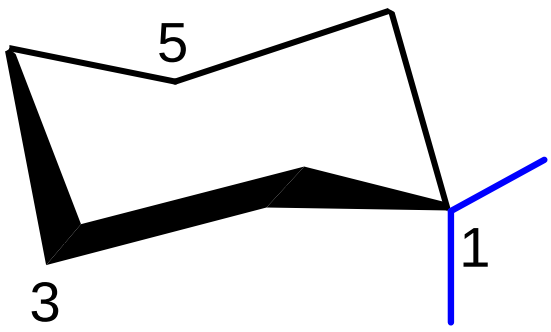
cis-1,2-difluorocyclohexane:

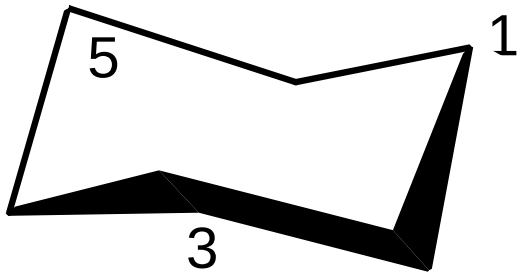


Compare trans:



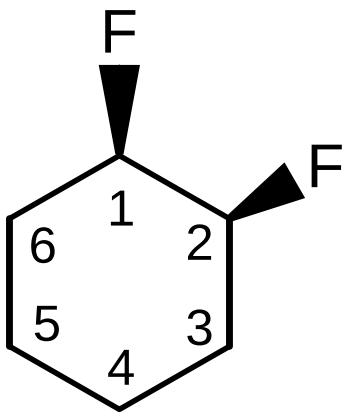
Draw the 2 conformations of trans.



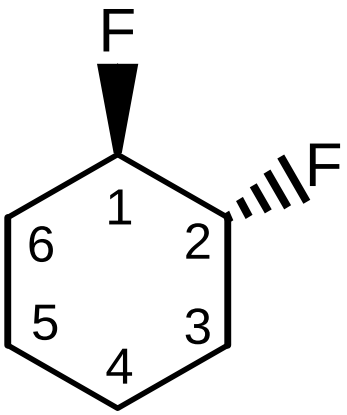


Now, look at:

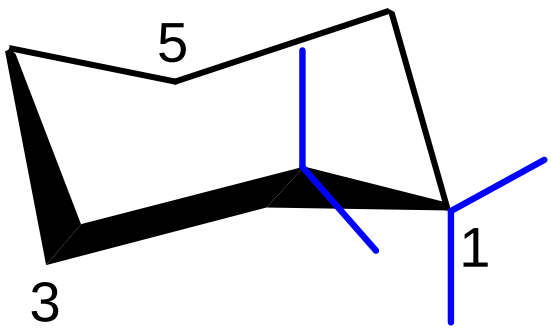
cis-1,2-difluorocyclohexane:

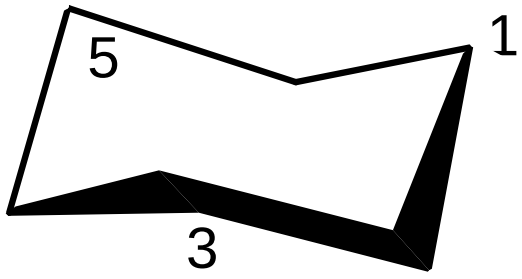


Compare trans:



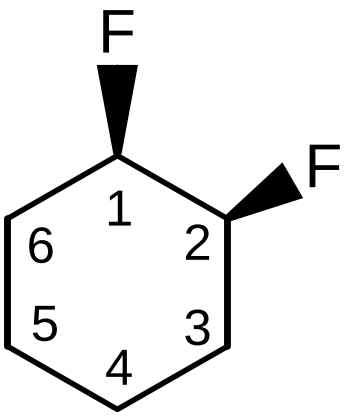
Draw the 2 conformations of trans.



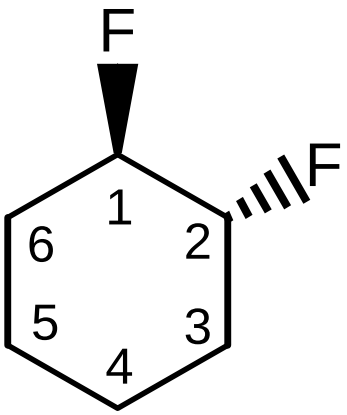


Now, look at:

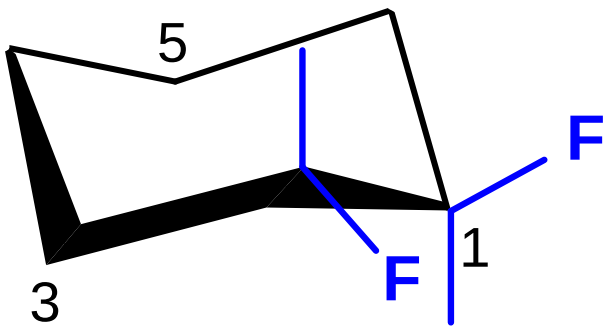
cis-1,2-difluorocyclohexane:

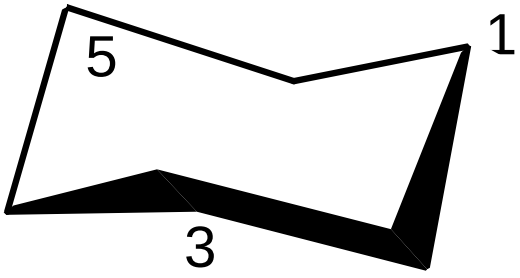


Compare trans:



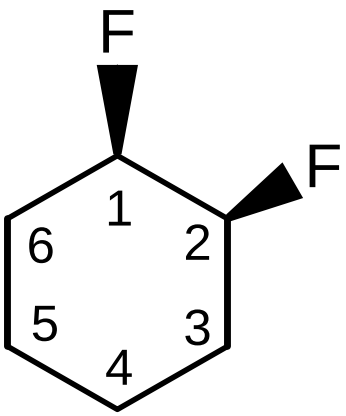
Draw the 2 conformations of trans.



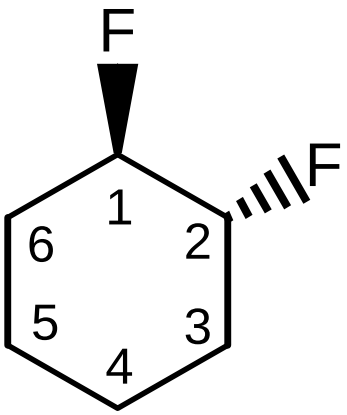


Now, look at:

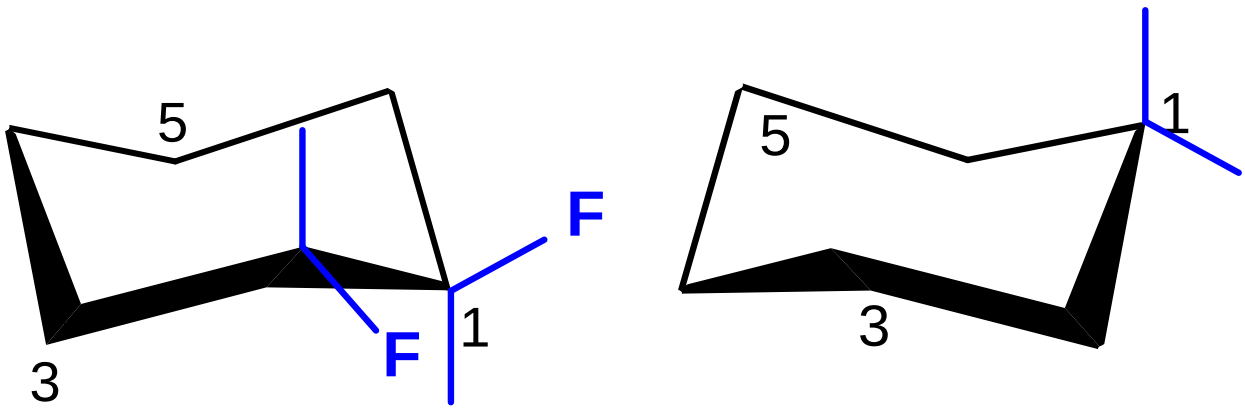
cis-1,2-difluorocyclohexane:



Compare trans:

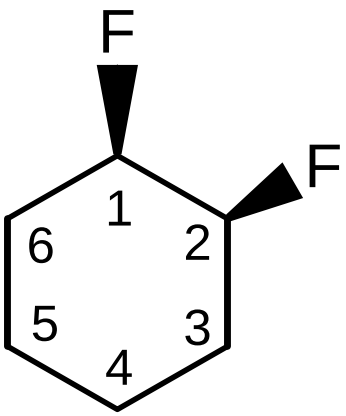


Draw the 2 conformations of trans.

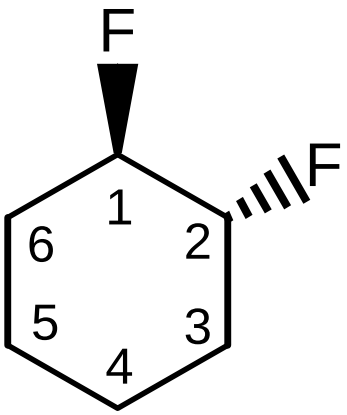


Now, look at:

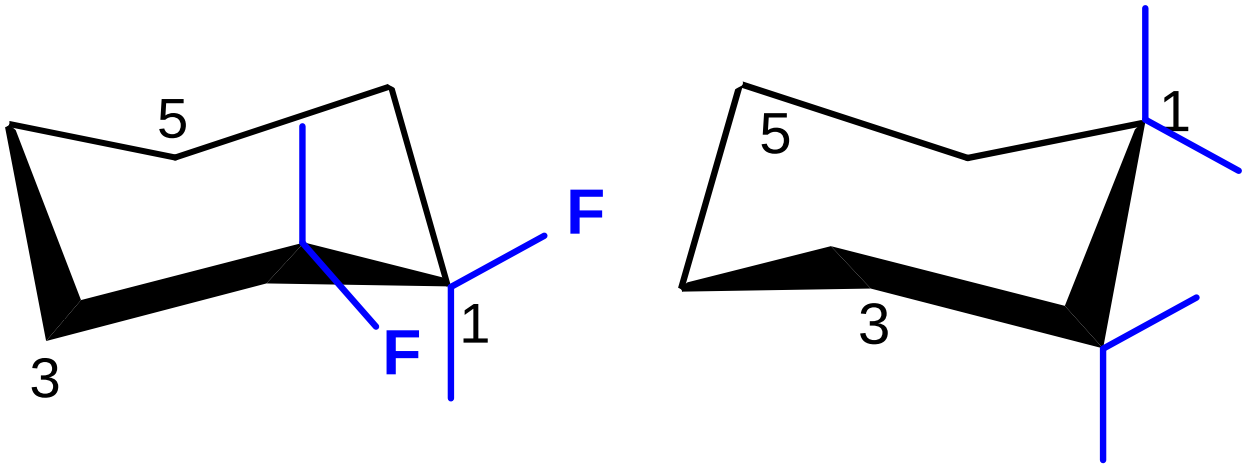
cis-1,2-difluorocyclohexane:



Compare trans:

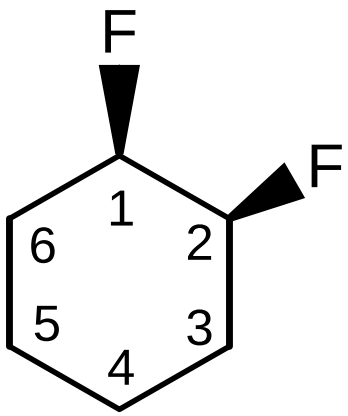


Draw the 2 conformations of trans.

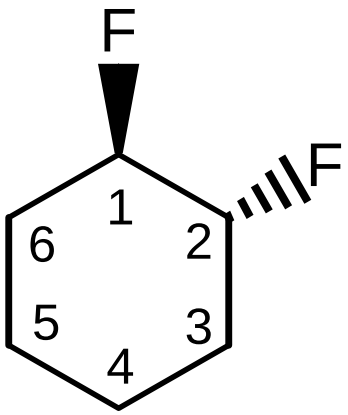


Now, look at:

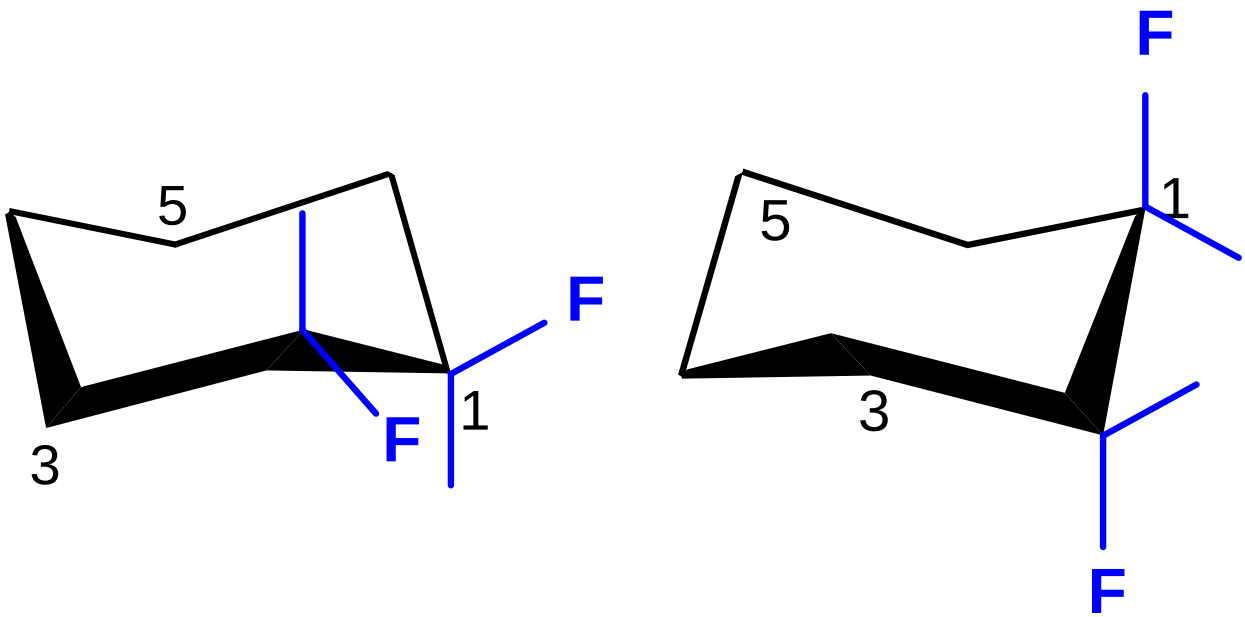
cis-1,2-difluorocyclohexane:



Compare trans:

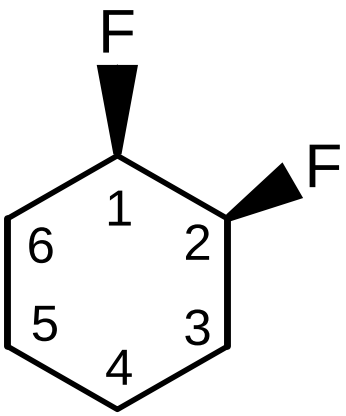


Draw the 2 conformations of trans.

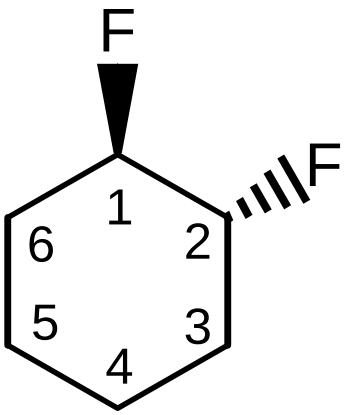


Now, look at:

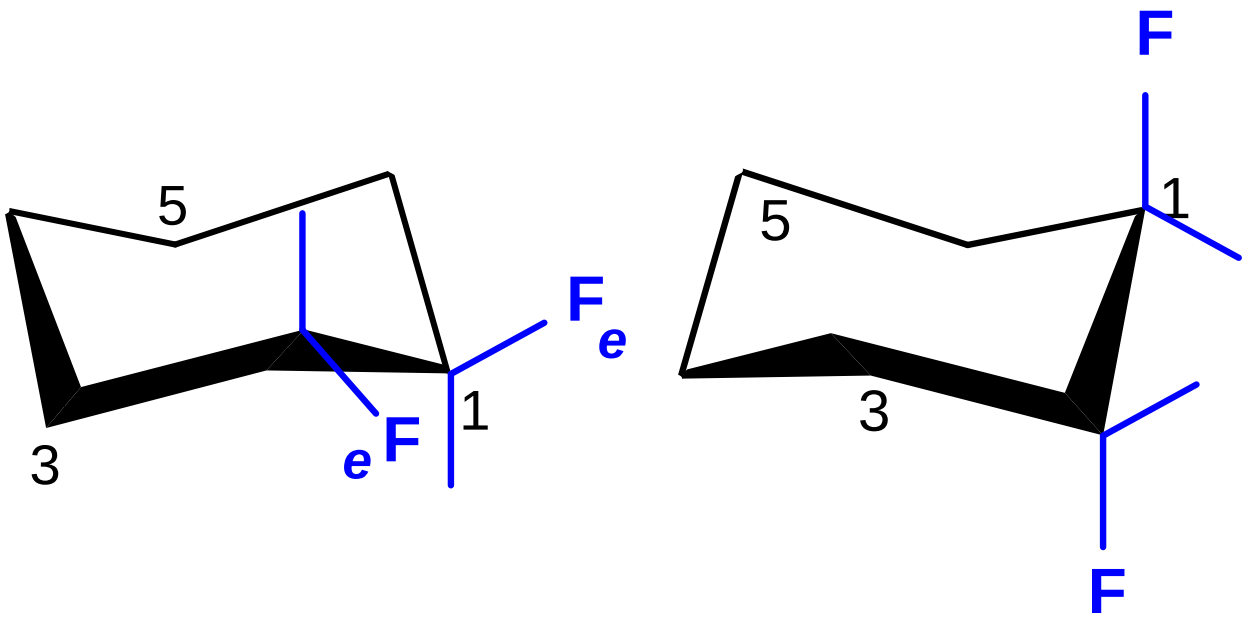
cis-1,2-difluorocyclohexane:



Compare trans:

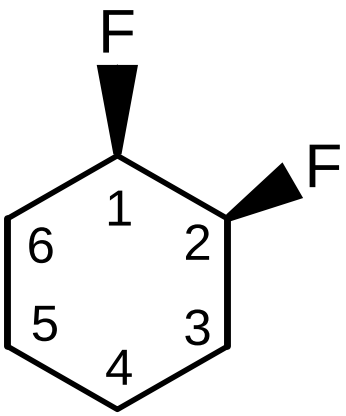


Draw the 2 conformations of trans.

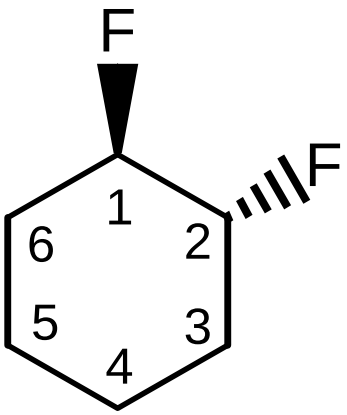


Now, look at:

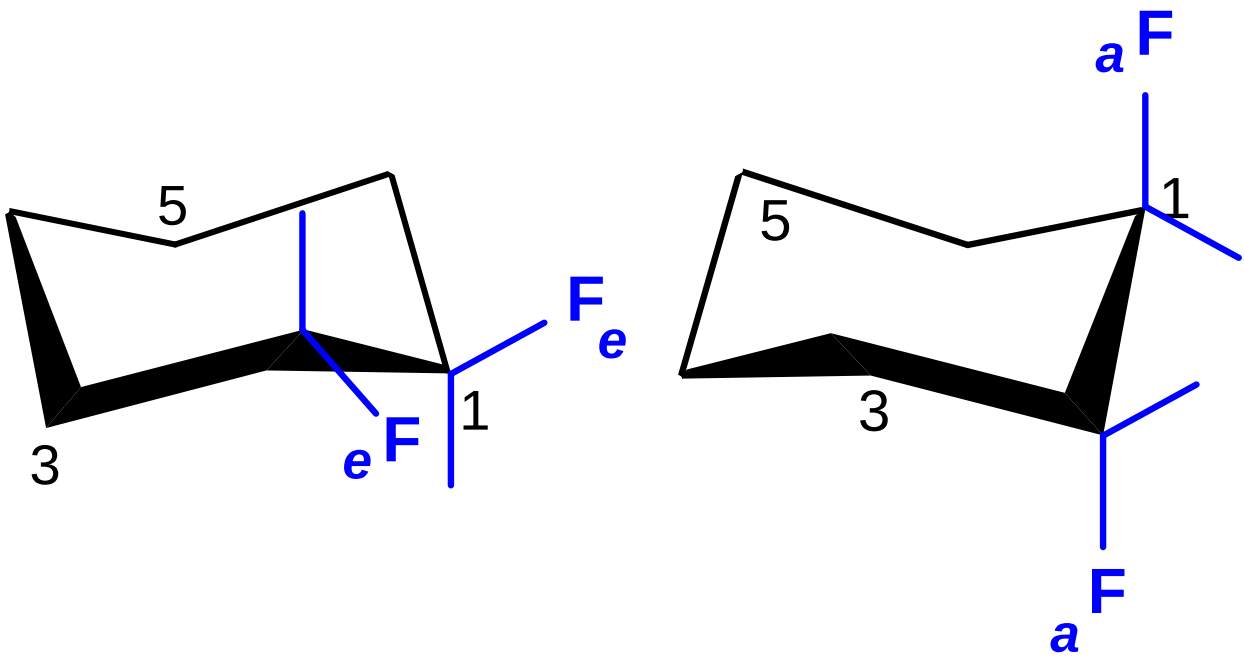
cis-1,2-difluorocyclohexane:



Compare trans:

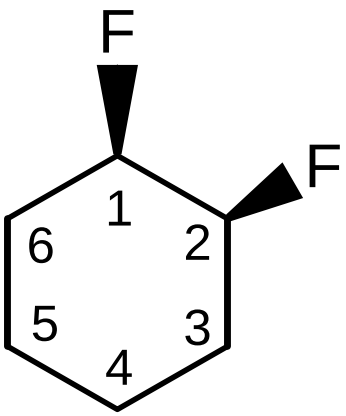


Draw the 2 conformations of trans.

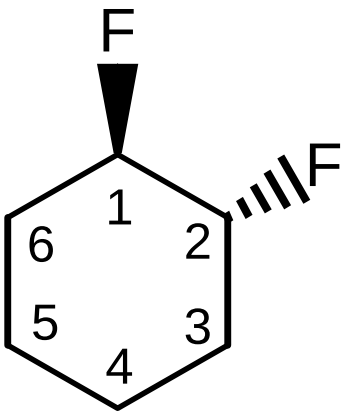


Now, look at:

cis-1,2-difluorocyclohexane:

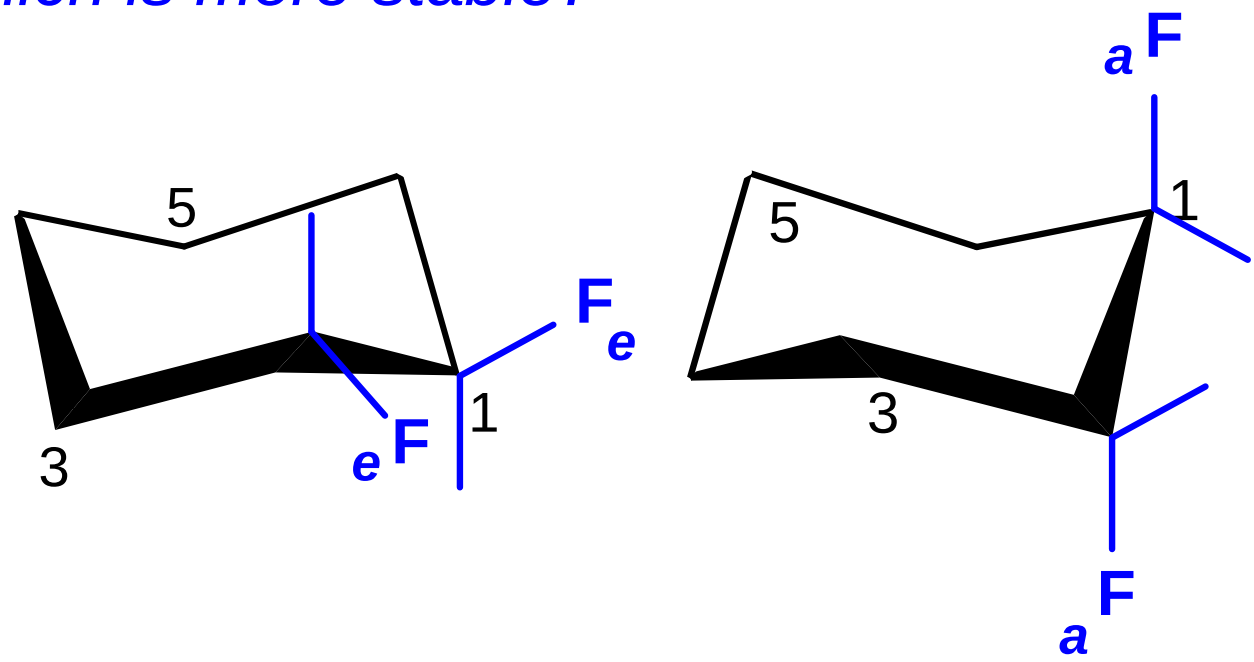


Compare trans:



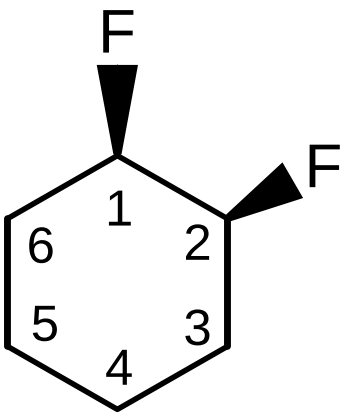
Draw the 2 conformations of trans.

Which is more stable?

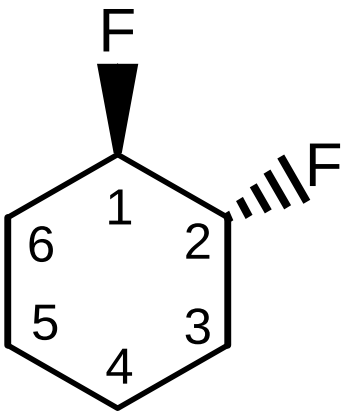


Now, look at:

cis-1,2-difluorocyclohexane:

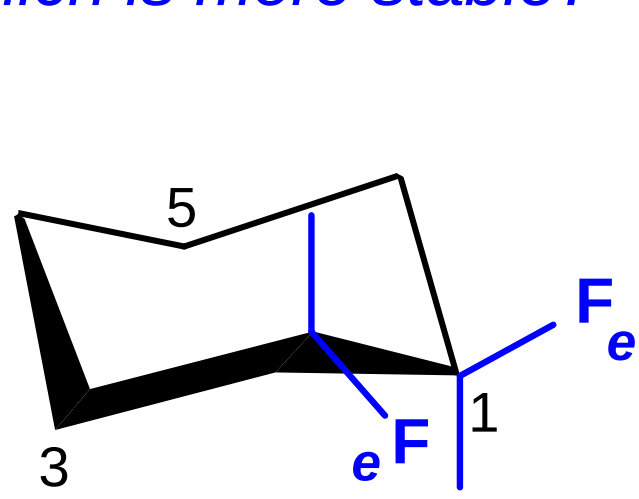


Compare trans:

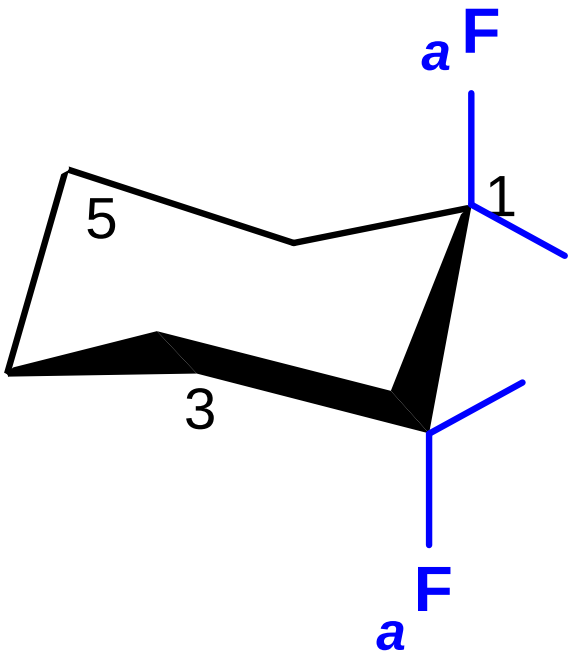


Draw the 2 conformations of trans.

Which is more stable?

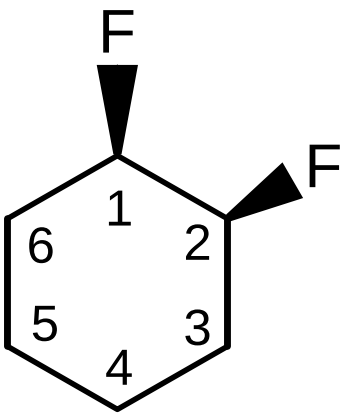


lower E

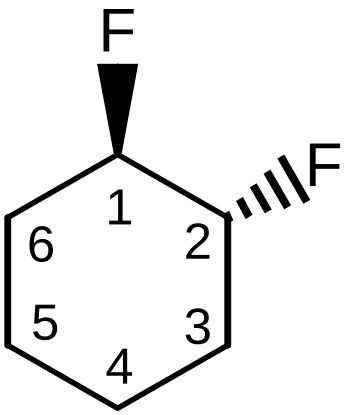


Now, look at:

cis-1,2-difluorocyclohexane:

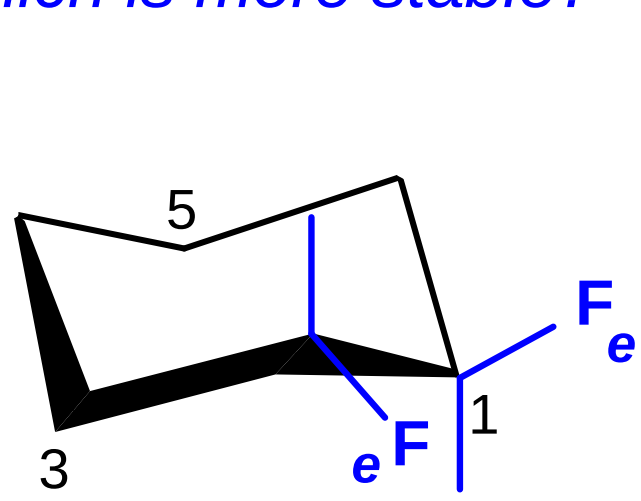


Compare trans:

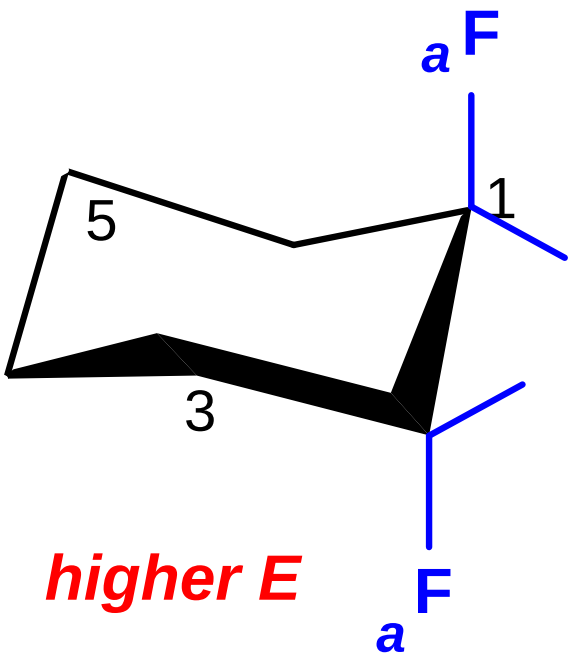


Draw the 2 conformations of trans.

Which is more stable?



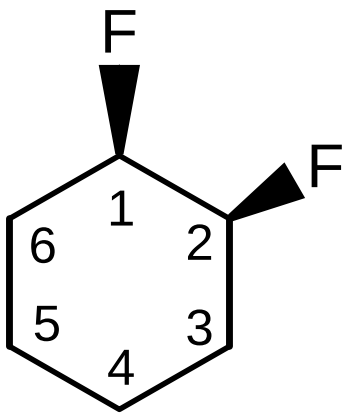
lower E



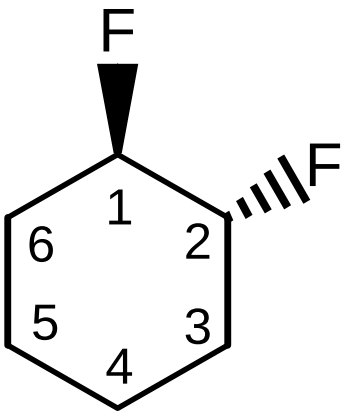
higher E

Now, look at:

cis-1,2-difluorocyclohexane:

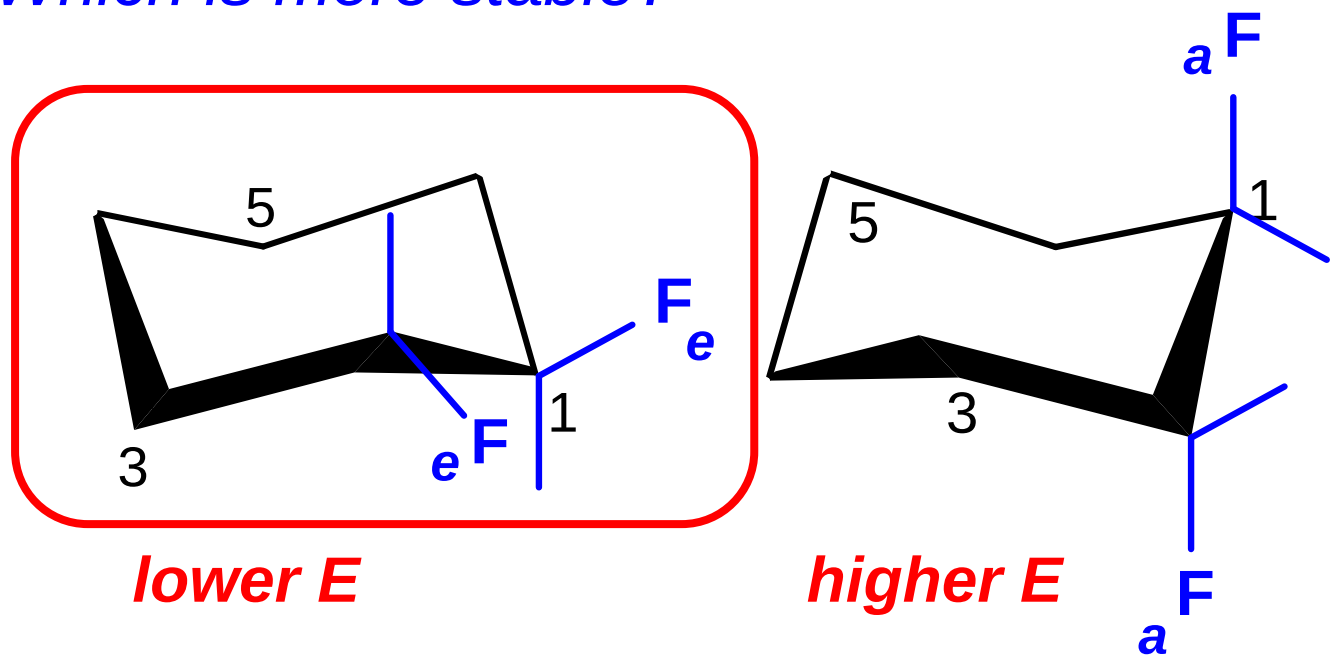


Compare trans:



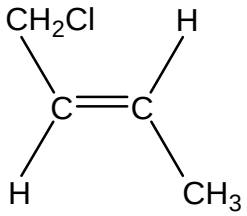
Draw the 2 conformations of trans.

Which is more stable?



Part 2 – Geometrical Isomerism

1. *Name the compound drawn below:* ☐ **1-chloro-*cis*-2-butene** ☐ **1-chloro-*trans*-2-butene**



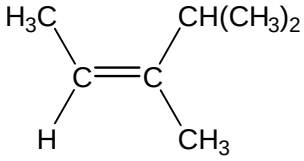
Specify the configuration (E or Z) _____

Is it possible to convert this to the other isomer without breaking any bonds? _____

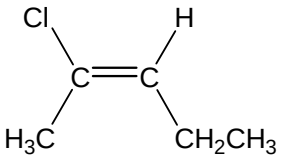
2. **geometric isomers** *mpound:* _____

Are all trans compounds assigned an E configuration? _____

3. *For each alkene, circle the group (or atom) on each C of the double bond that has the higher priority. Identify whether the geometry is E or Z by checking the appropriate choice.*

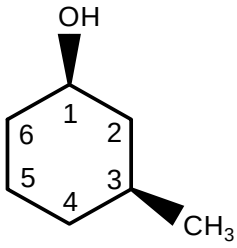


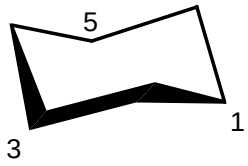
☐ *E* or ☐ *Z*

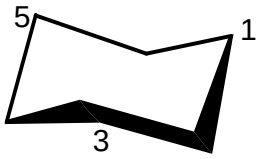


☐ *E* or ☐ *Z*

5. *Construct a model of the **cis*-3-methylcyclohexanol** shown below. Complete the two chair conformations, showing the position of the **hydroxyl** and **methyl** groups **only**. Do **not** include the hydrogens. Clearly label the substituents as axial (**a**) or equatorial (**e**).*







Part 3 – Optical Isomerism

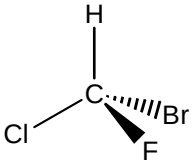
1. **Bromo-chloromethane:** *Are the two molecules of CH_2ClBr superimposable?* _____

Is CH_2ClBr chiral or achiral? _____

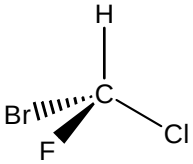
2. **Bromo-chloro-fluoromethane:**

Are the two molecules of CHClBrF superimposable on each other? _____

Assign an R or S configuration to each enantiomer:

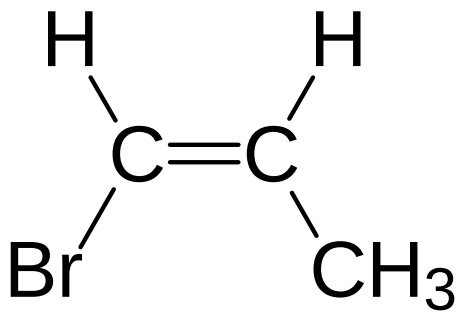


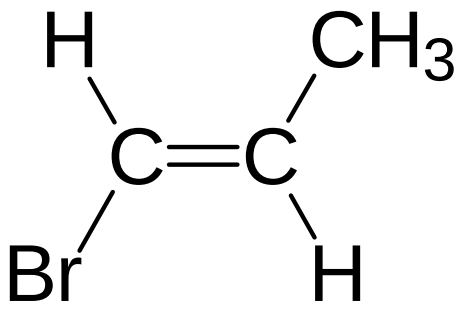
☐ *R* or ☐ *S*



☐ *R* or ☐ *S*

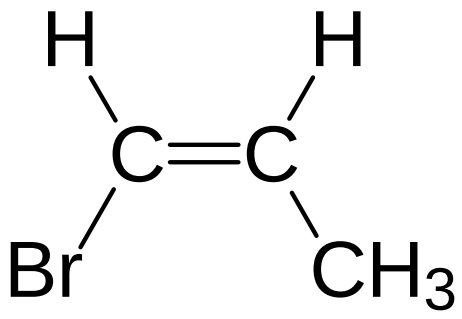
Geometric Isomers

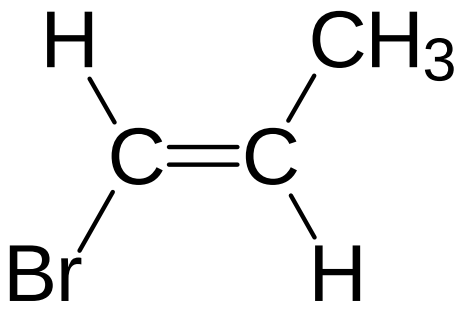




Geometric Isomers

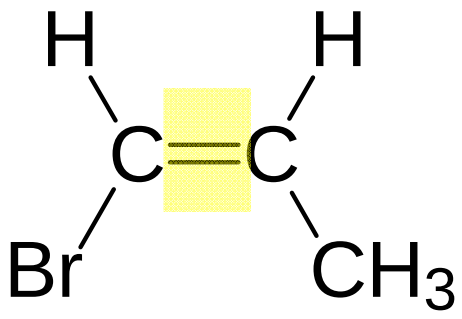
must have a C=C bond

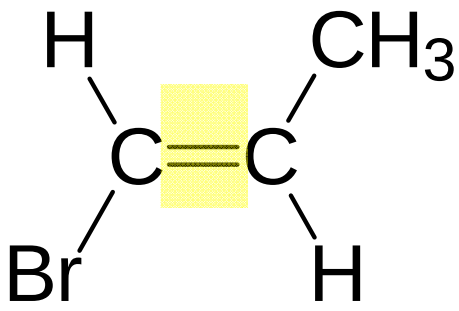




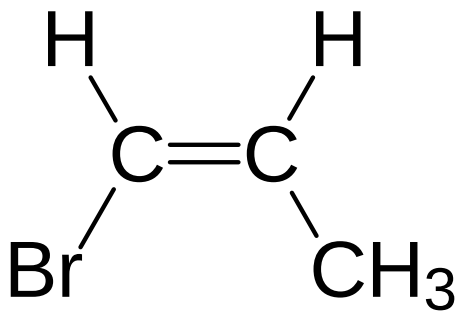
Geometric Isomers

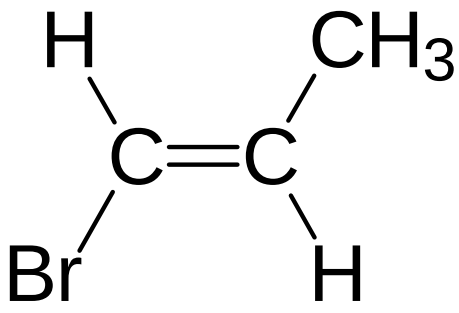
must have a C=C bond





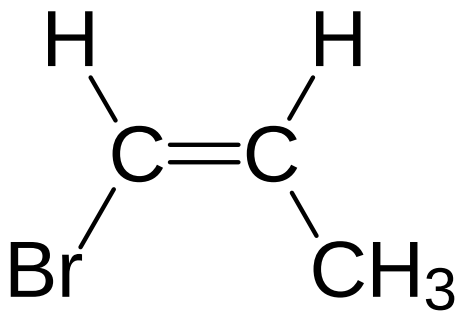
Geometric Isomers

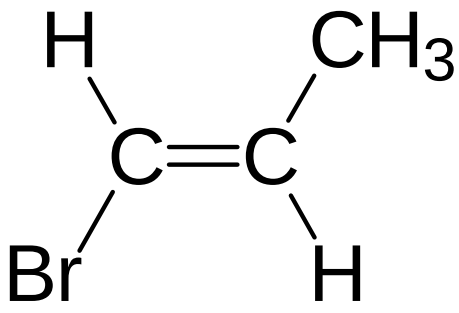




Geometric Isomers

cis or trans ?

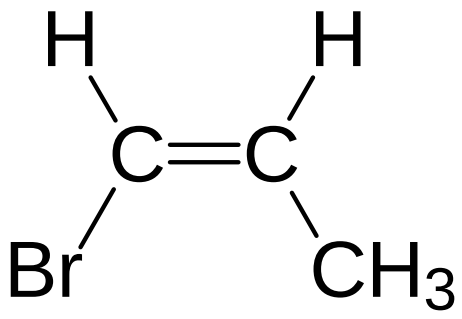


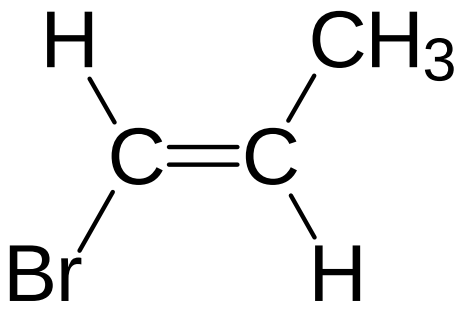


Geometric Isomers

***cis* or *trans* ?**

same atoms on same side

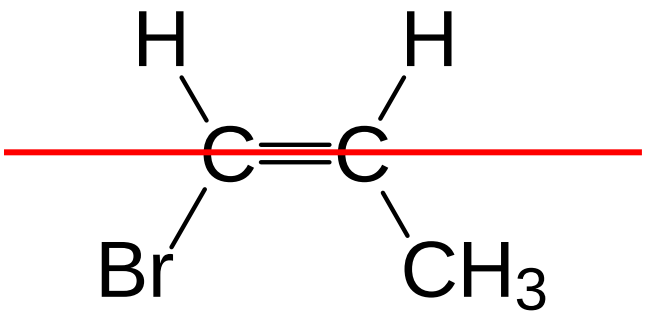


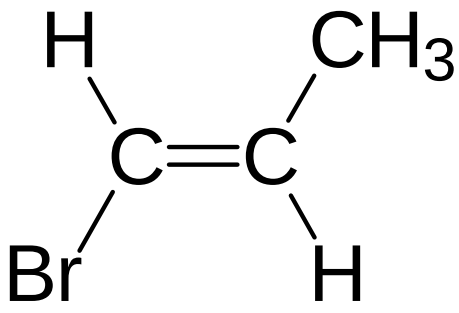


Geometric Isomers

***cis* or *trans* ?**

same atoms on same side

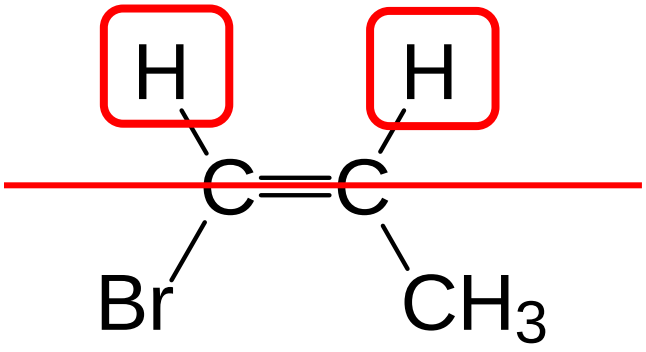


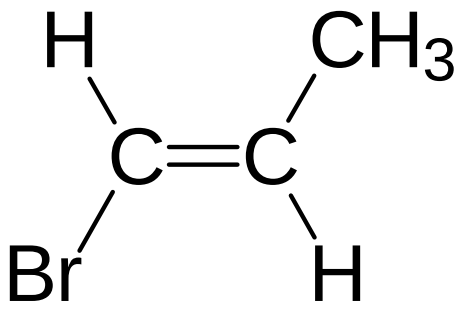


Geometric Isomers

***cis* or *trans* ?**

same atoms on same side

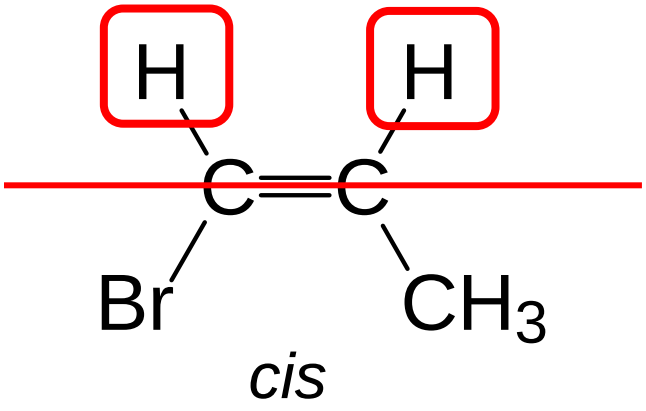




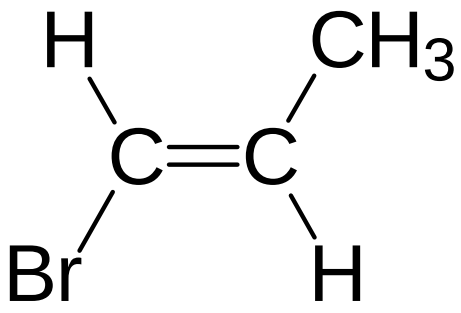
Geometric Isomers

***cis* or *trans* ?**

same atoms on same side



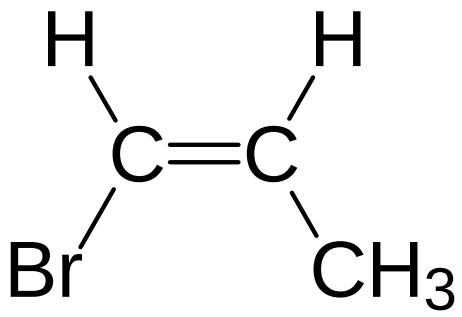
cis



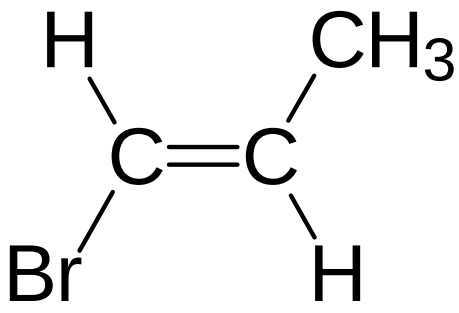
Geometric Isomers

***cis* or *trans* ?**

same atoms on opposite side



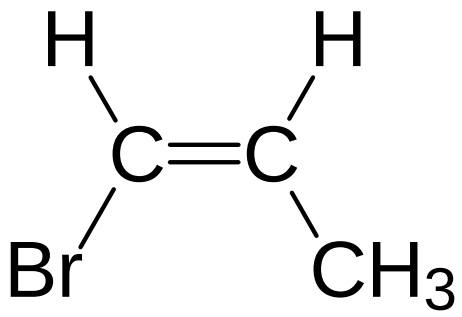
cis



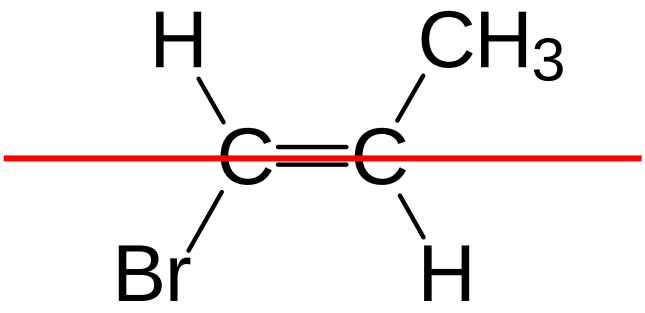
Geometric Isomers

***cis* or *trans* ?**

same atoms on opposite side



cis



Geometric Isomers

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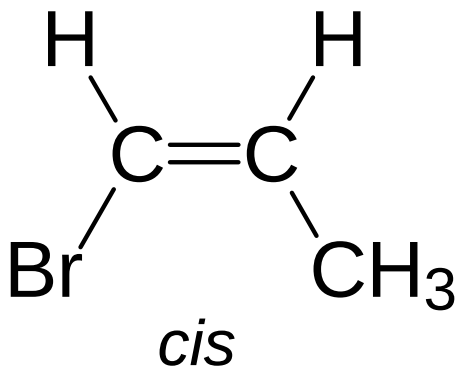
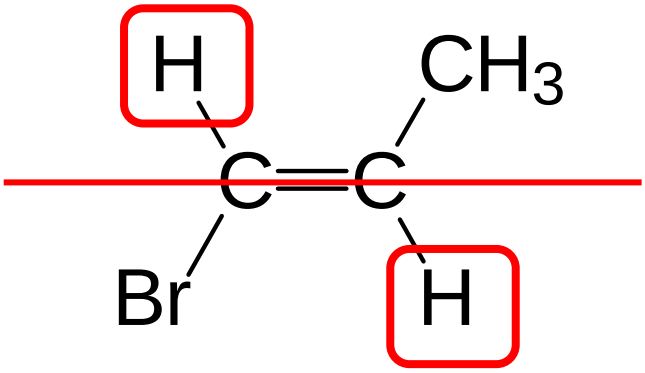


cis



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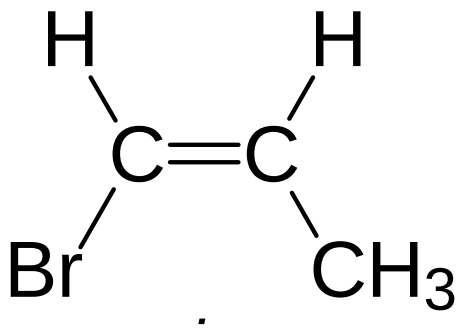
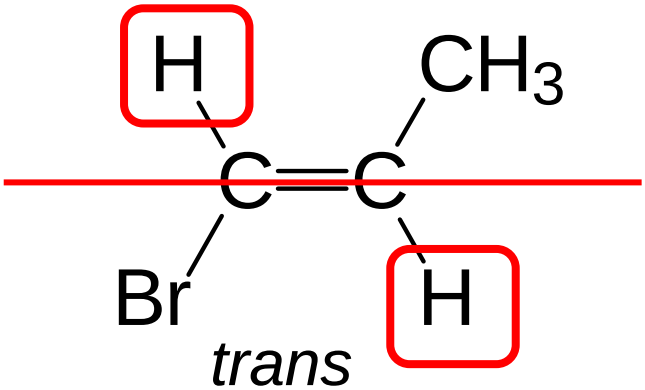


cis



trans

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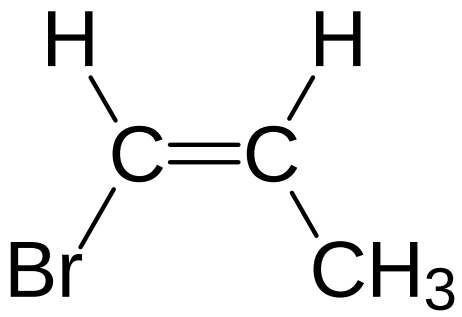
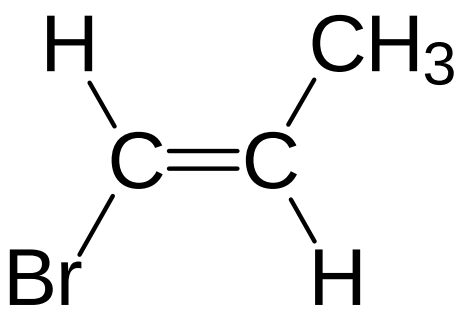


cis



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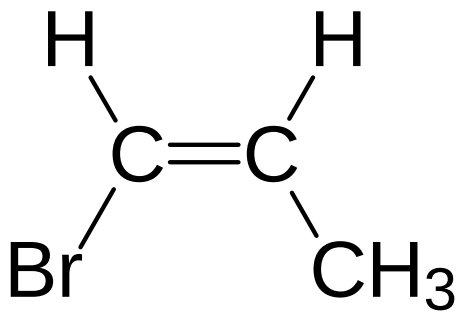
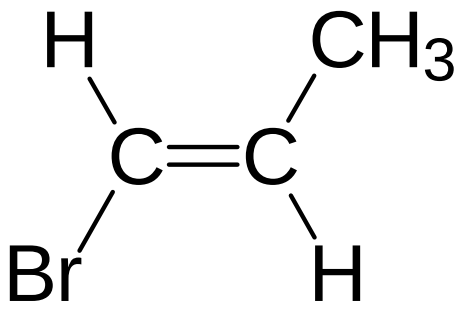


cis

E or Z ?

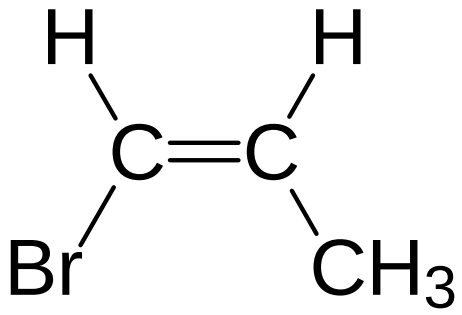


trans

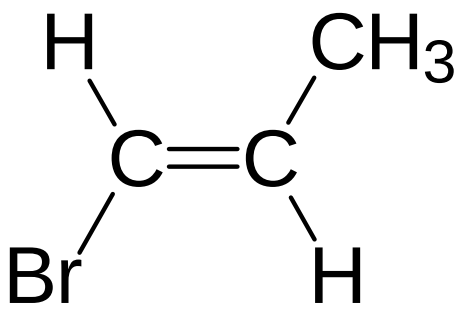
Geometric Isomers

cis or trans ? ***E or Z ?***

highest priority groups on same side



cis



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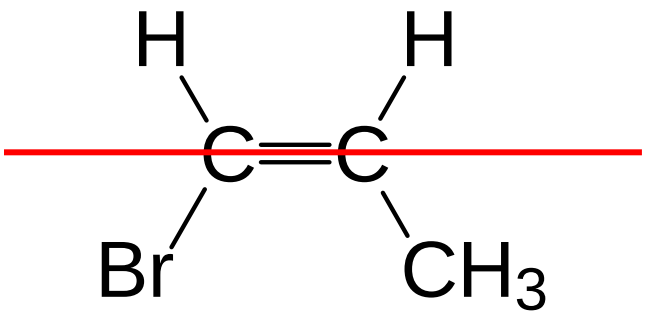

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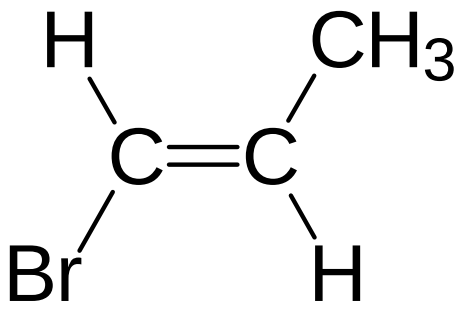

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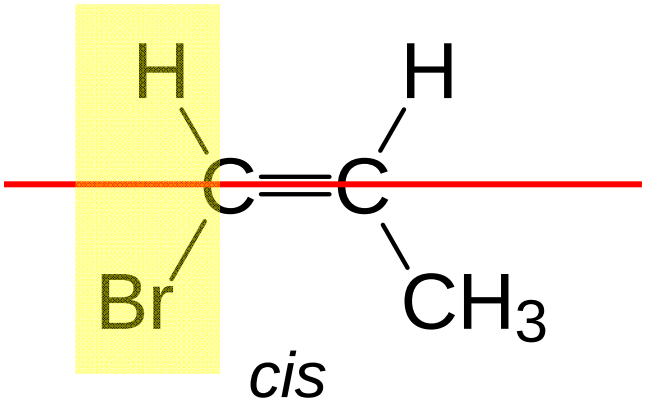

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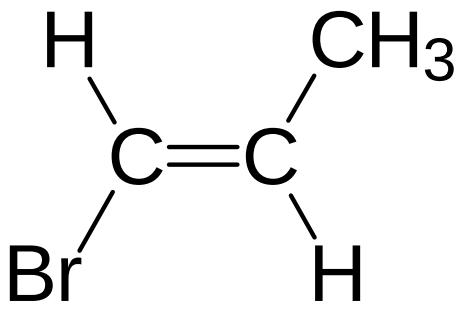

trans

which group is #1 ?

Geometric Isomers

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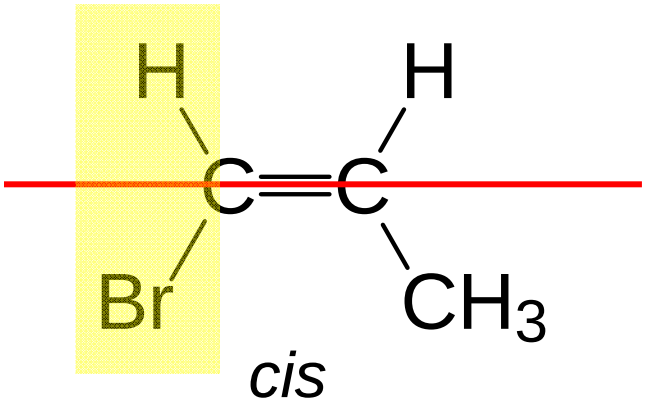
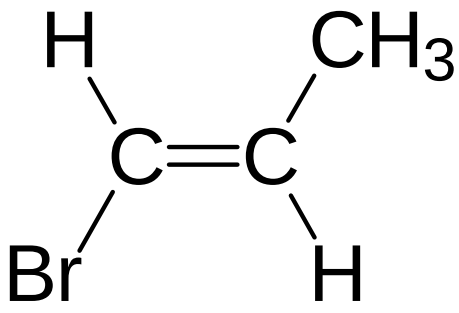


cis



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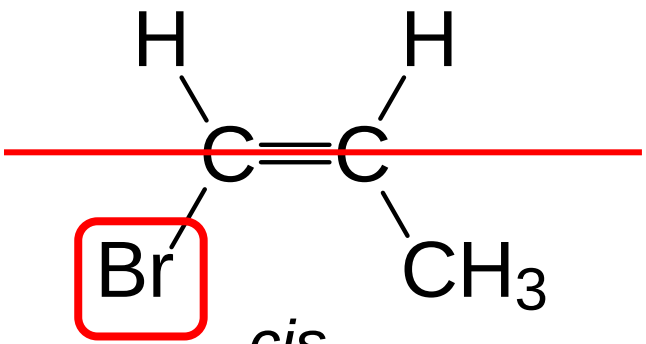

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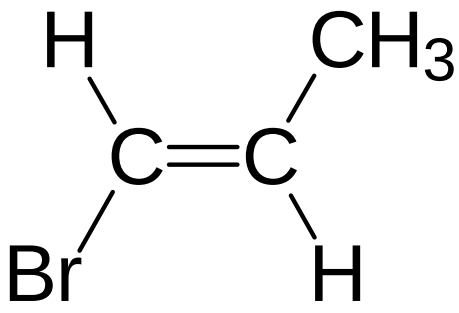

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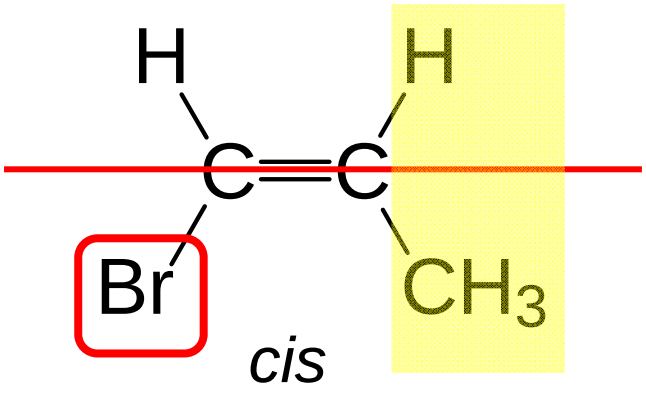

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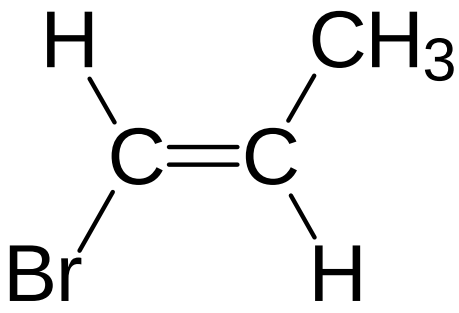

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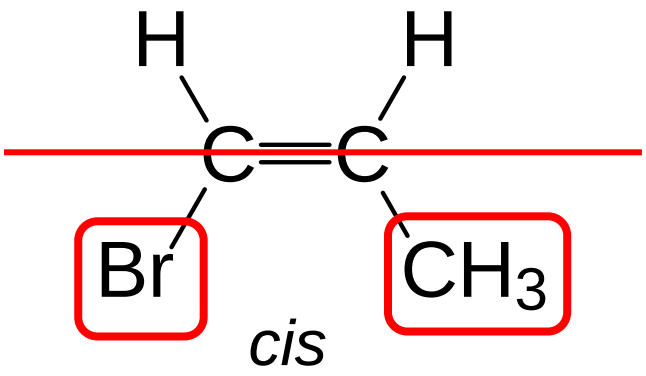
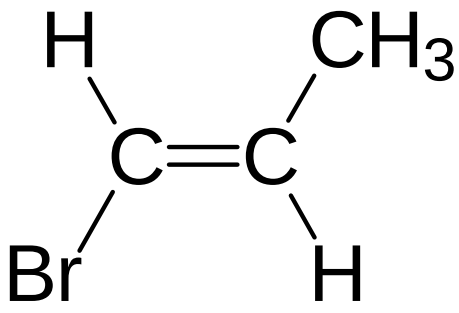


cis



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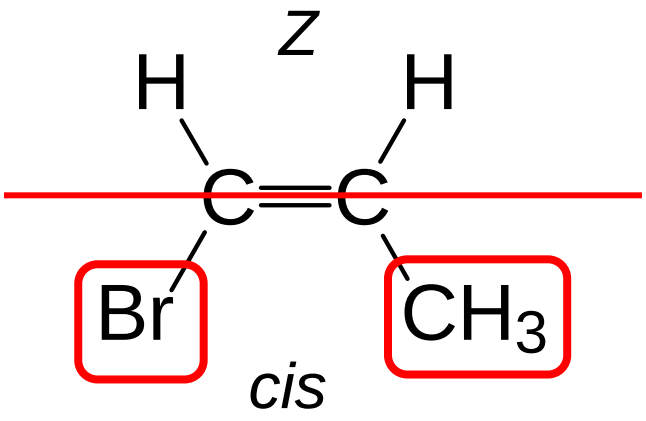
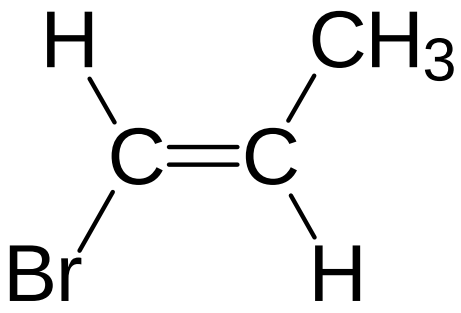


cis



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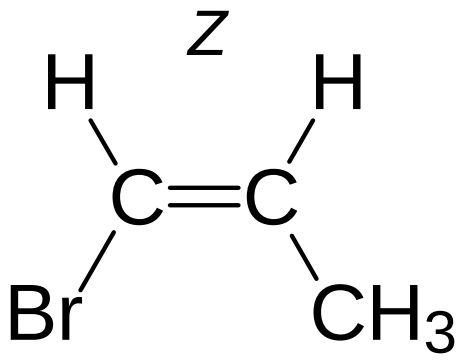

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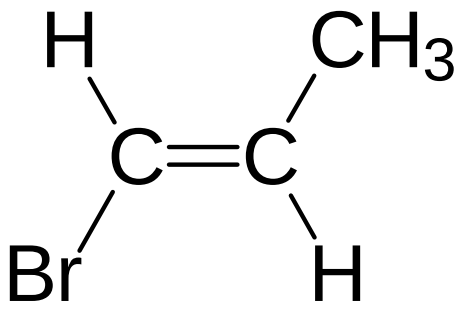
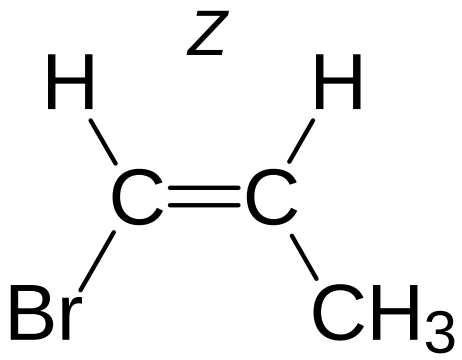


trans

Geometric Isomers

cis or trans ? ***E or Z ?***

highest priority groups on opp. side



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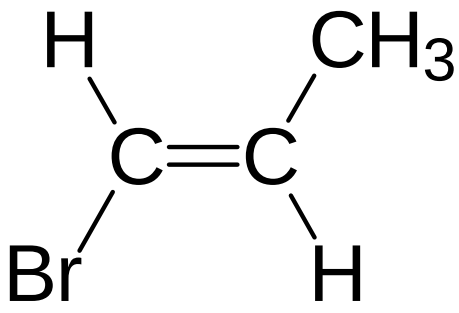

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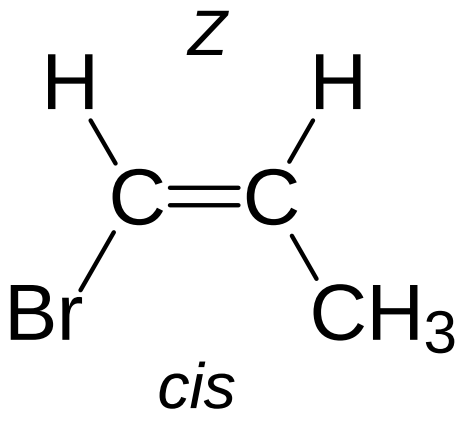
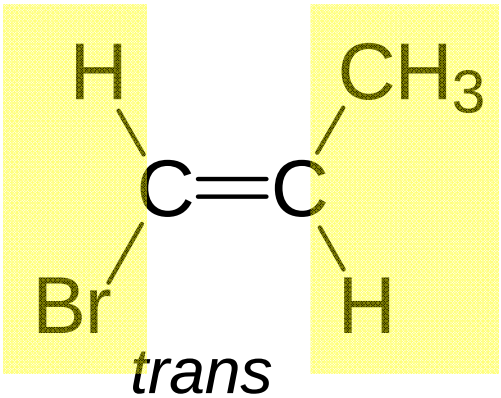


cis



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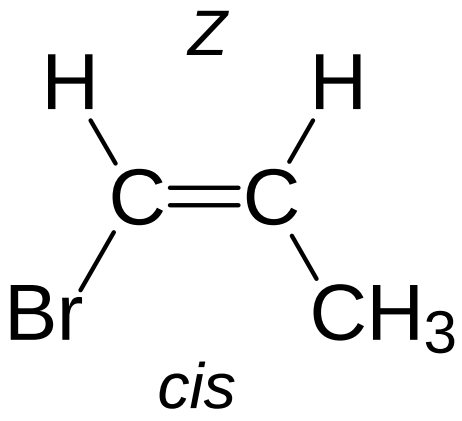

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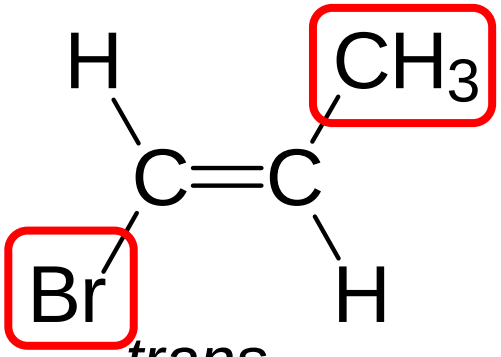

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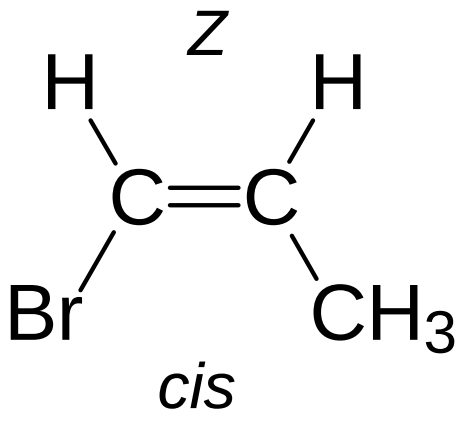

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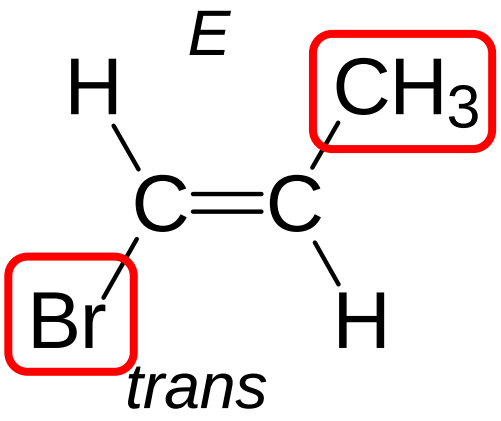

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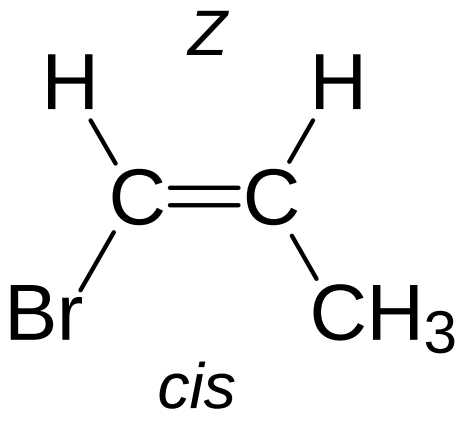

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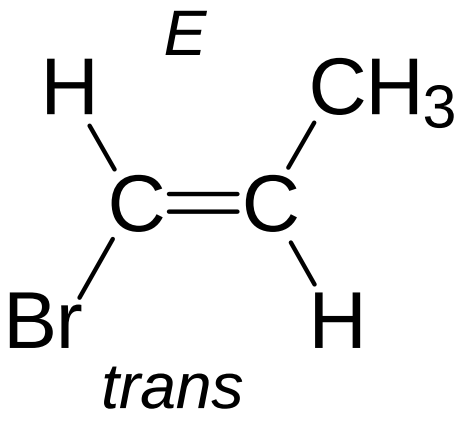

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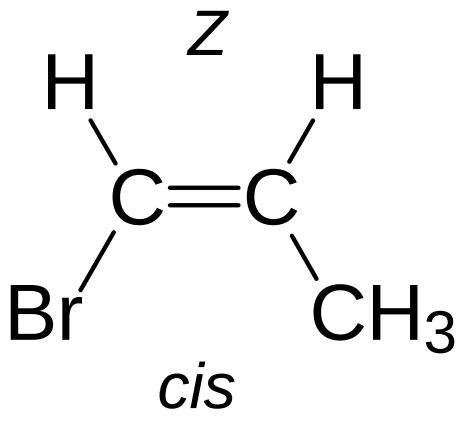

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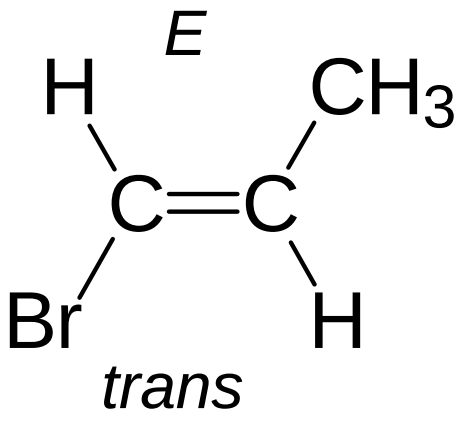

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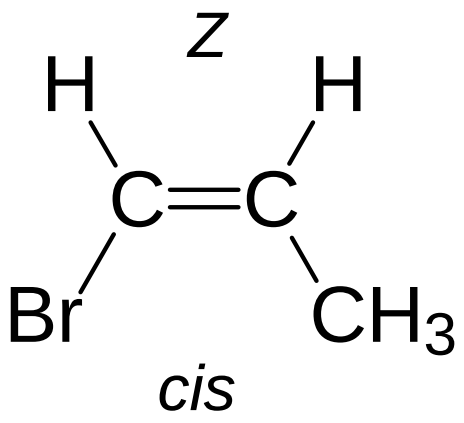

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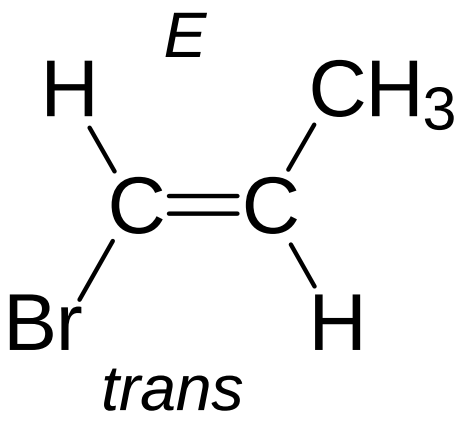

trans

think of "zis" for Z….similar to "cis"

Geometric Isomers

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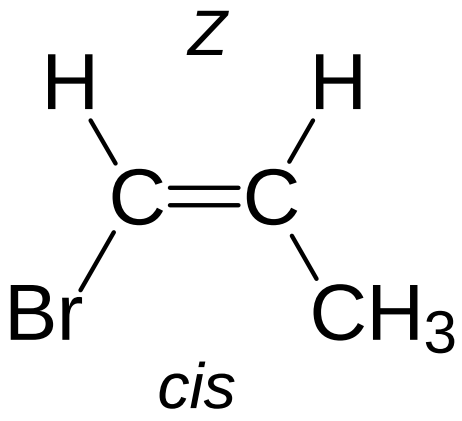

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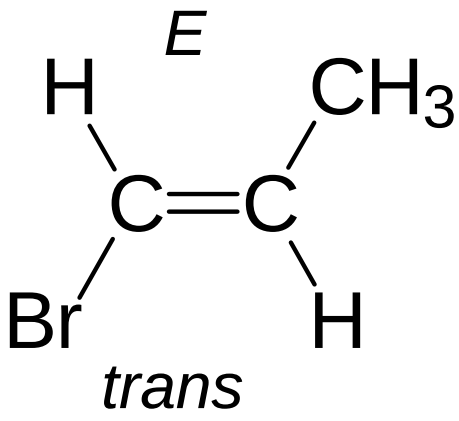

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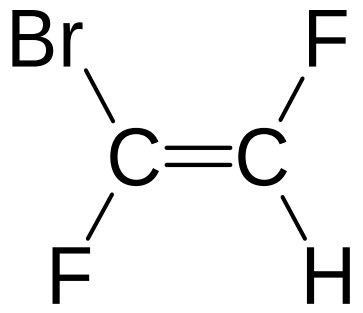

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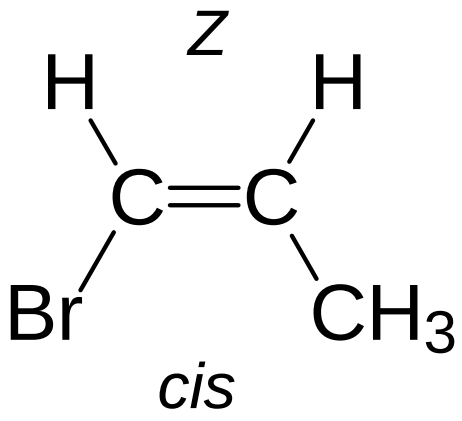

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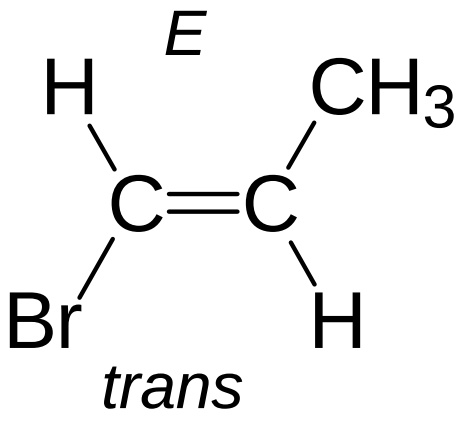

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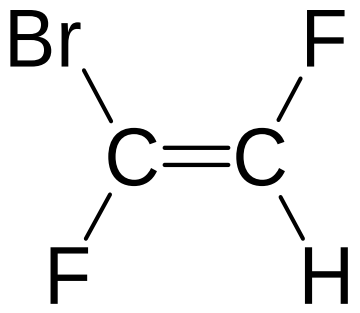

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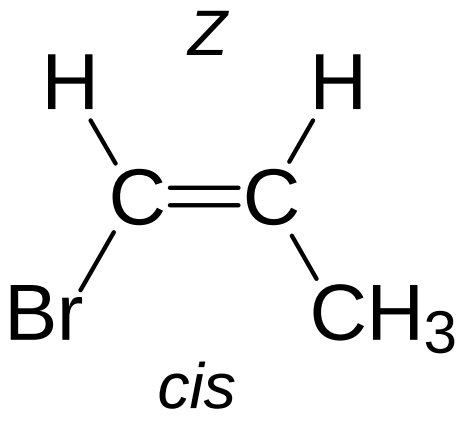

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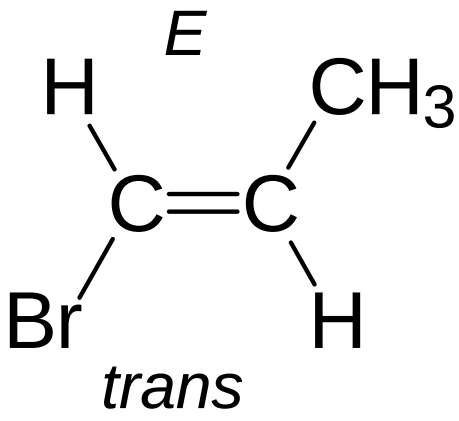

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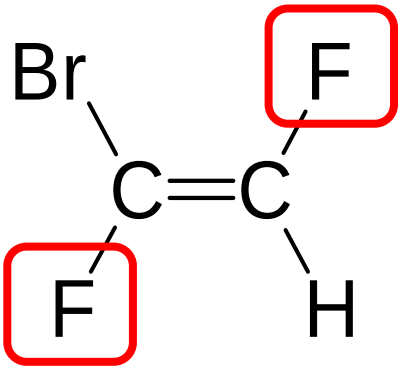

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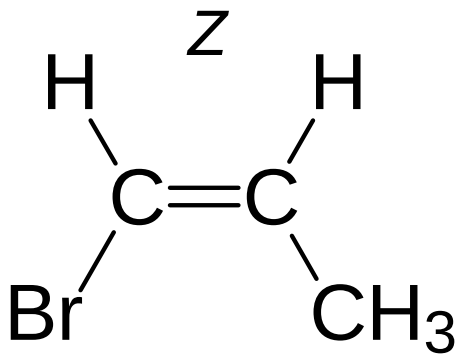

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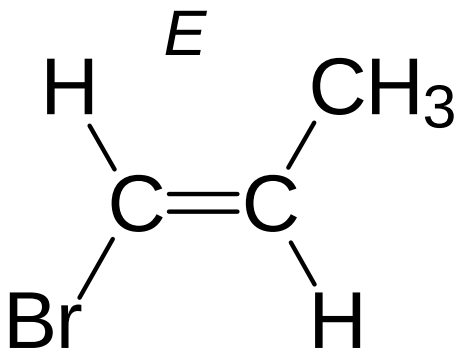

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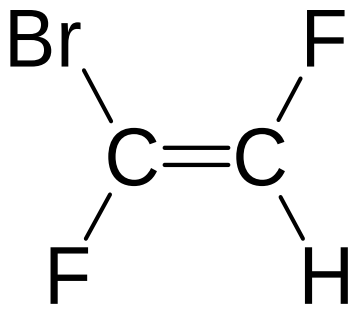

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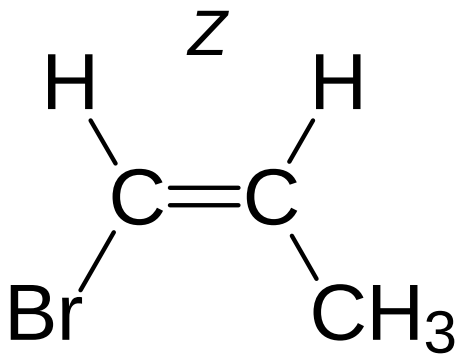
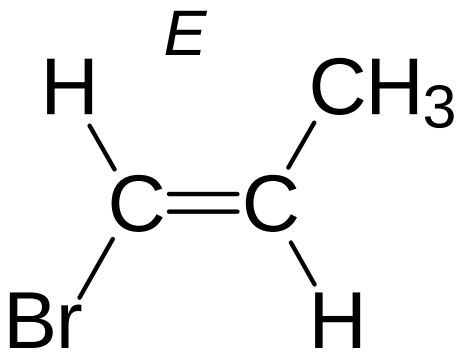


cis

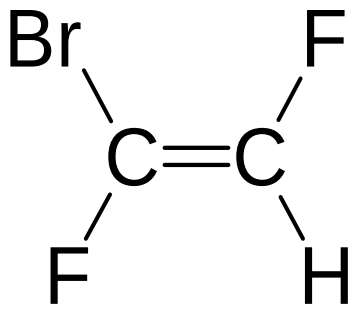
E or Z ?



trans

think of "zis" for Z….similar to "cis"

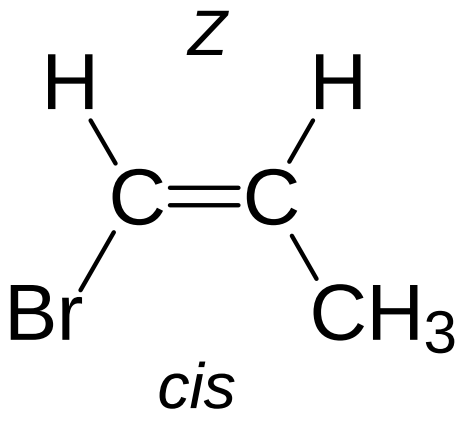
E or Z ?



trans

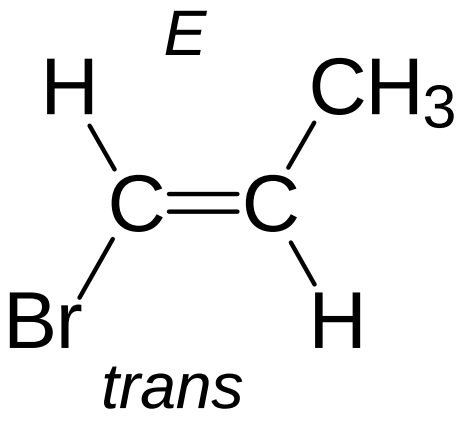
Geometric Isomers

cis or trans ?



cis

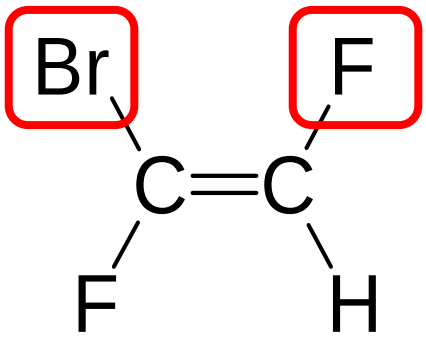
E or Z ?



trans

think of "zis" for Z….similar to "cis"

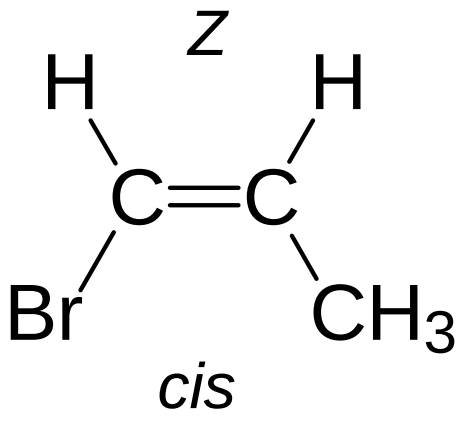
E or Z ?



trans

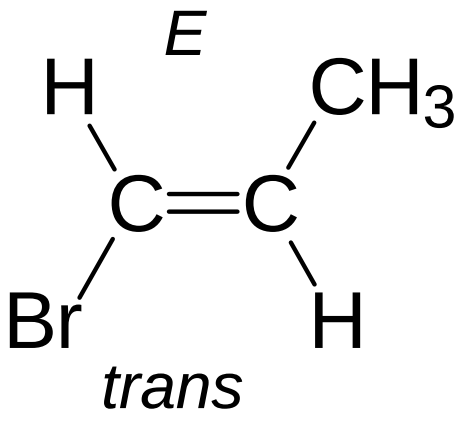
Geometric Isomers

cis or trans ?



cis

E or Z ?



trans

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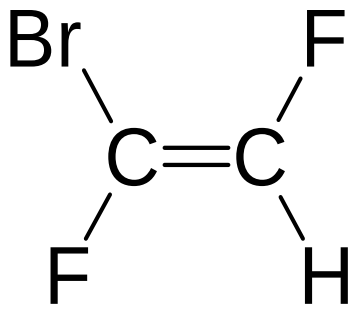
E or Z ?

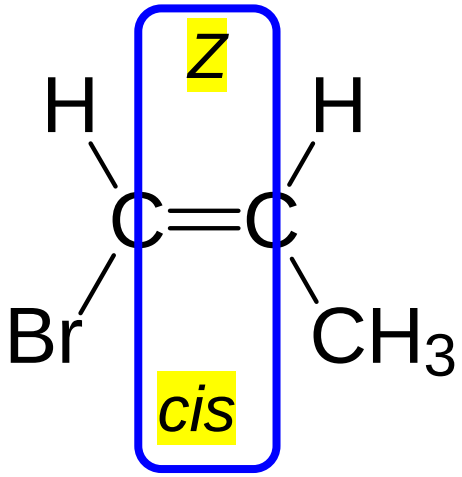


trans

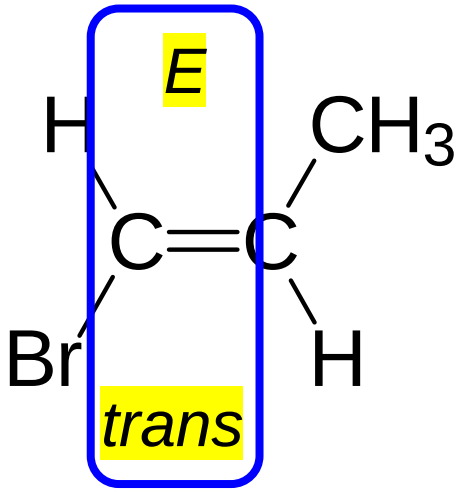
Z

Geometric Isomers

cis or trans ?

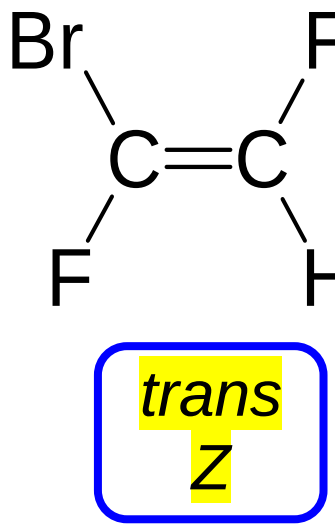


E or Z ?



think of "zis" for Z….similar to "cis"

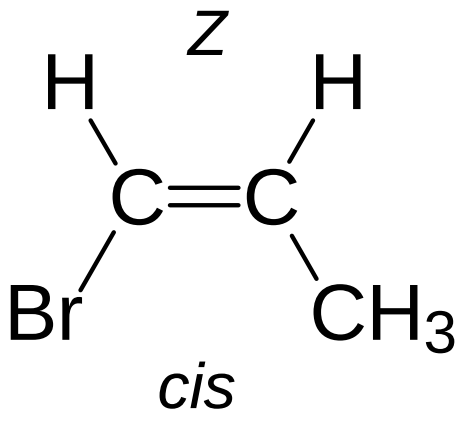
E or Z ?



NOT ALWAYS THE SAME !

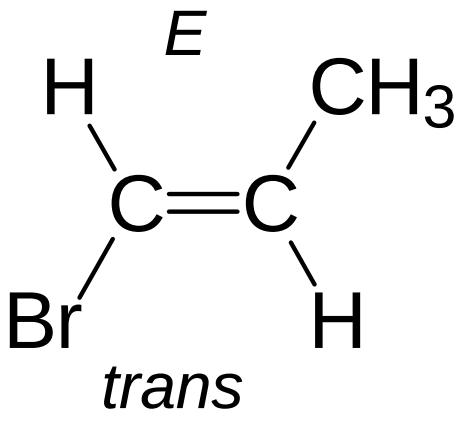
Geometric Isomers

cis or trans ?



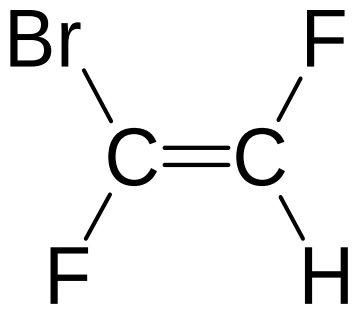
cis

E or Z ?



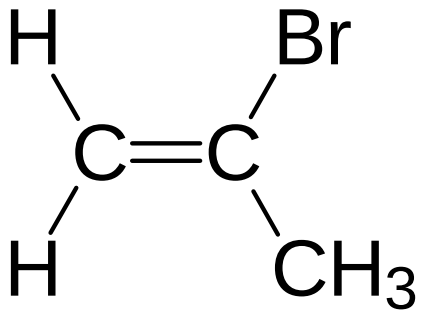
trans

think of "zis" for Z….similar to "cis"



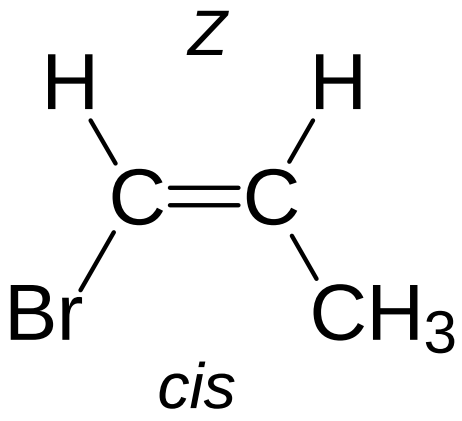
trans
Z

cis or trans ?



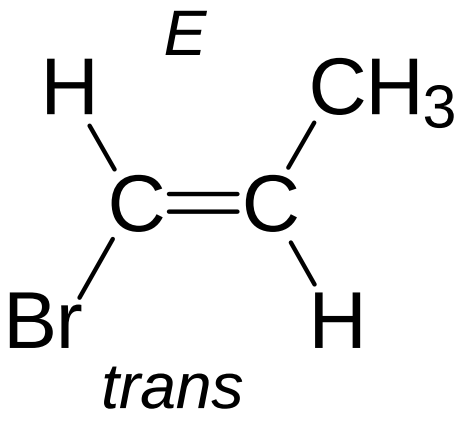
Geometric Isomers

cis or trans ?



cis

E or Z ?



trans

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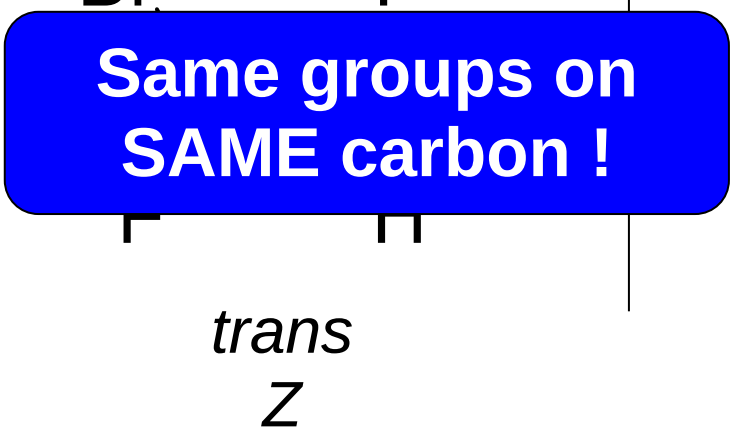
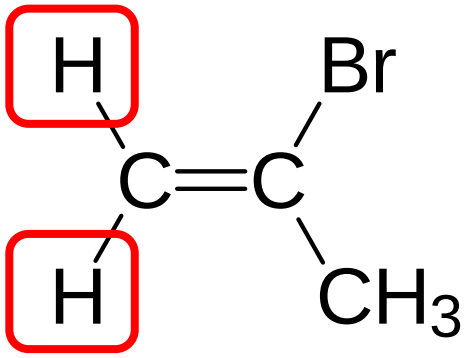


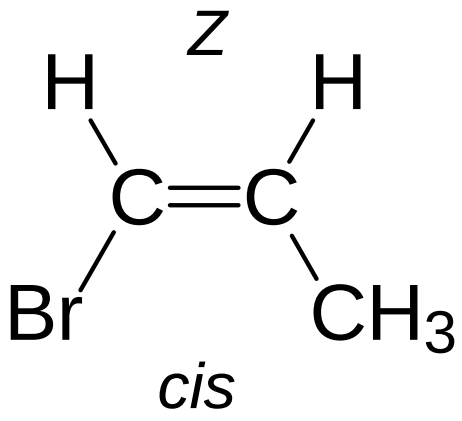
trans
Z

cis or trans ?



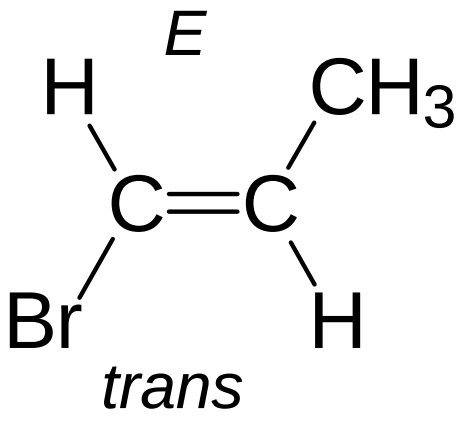
Geometric Isomers

cis or trans ?



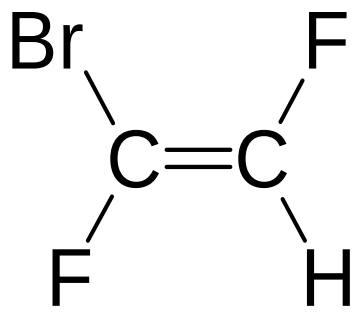
cis

E or Z ?



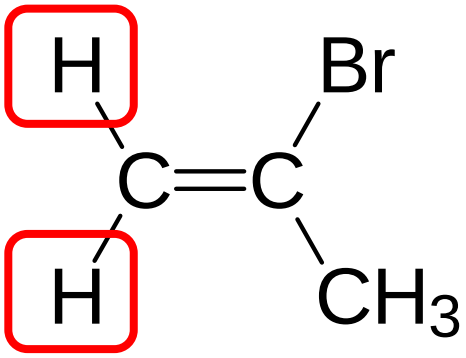
trans

think of "zis" for Z….similar to "cis"



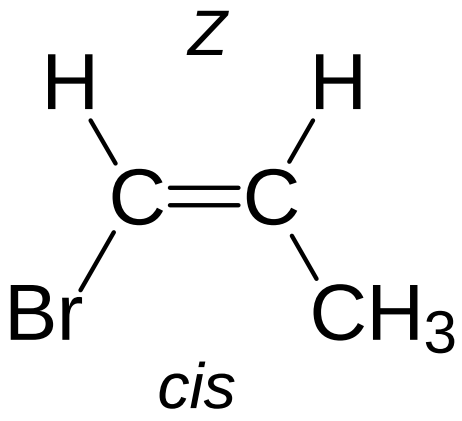
trans
Z

~~cis or trans ?~~



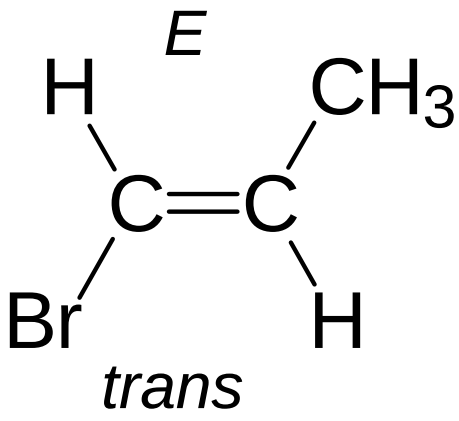
Geometric Isomers

cis or trans ?



cis

E or Z ?



trans

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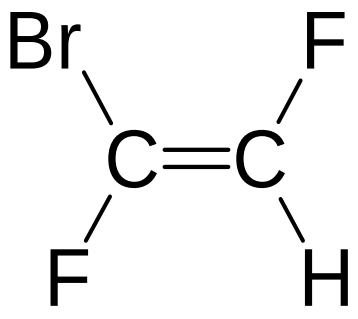
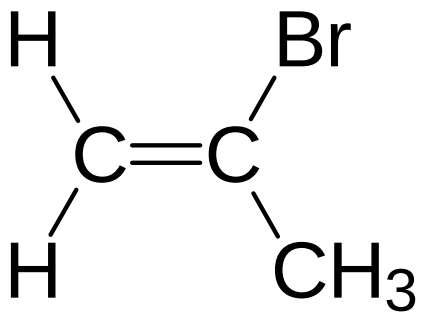


trans
Z

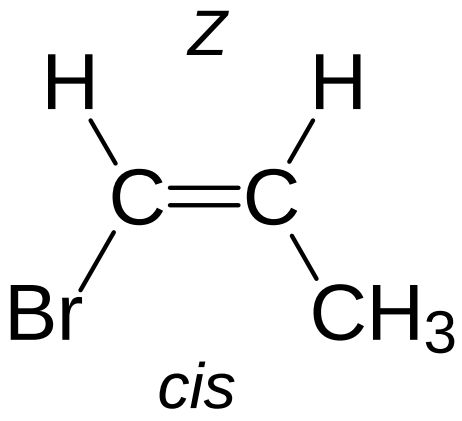
~~cis or trans ?~~



E or Z ?

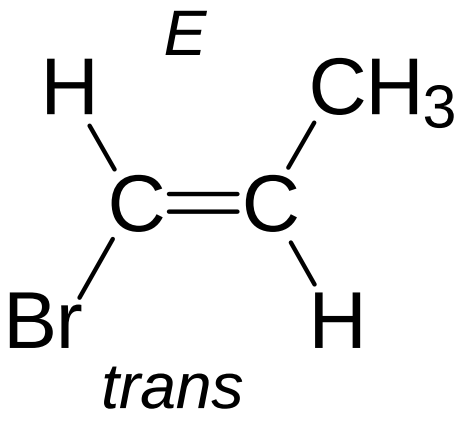
Geometric Isomers

cis or trans ?



cis

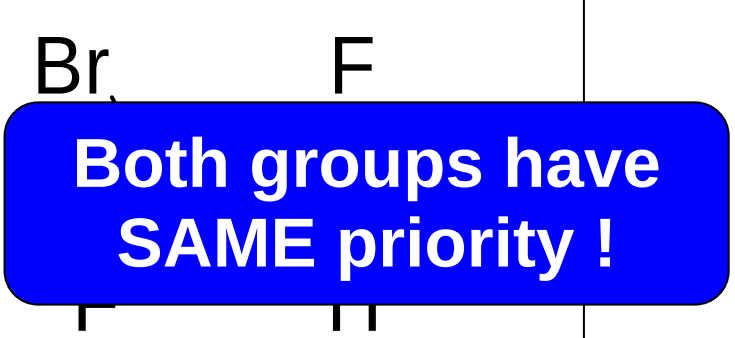
E or Z ?



trans

think of "zis" for Z….similar to "cis"

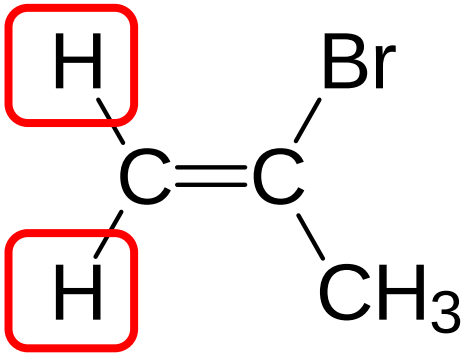
~~cis or trans ?~~



Both groups have SAME priority !

trans

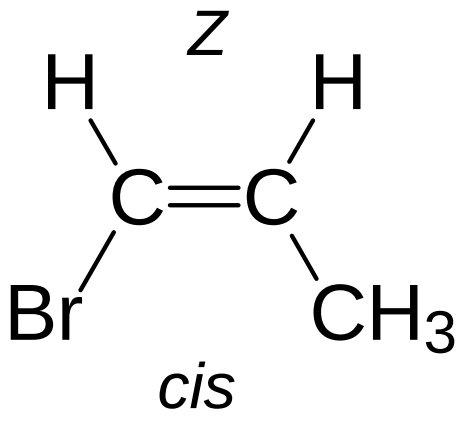
Z



E or Z ?

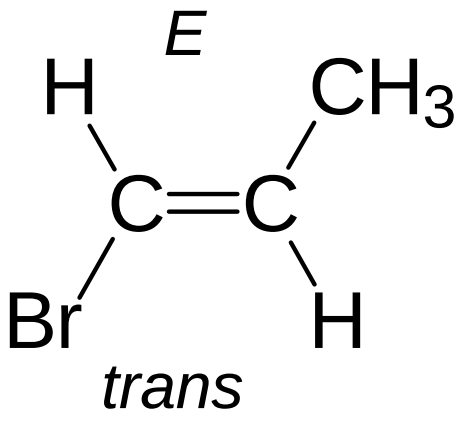
Geometric Isomers

cis or trans ?



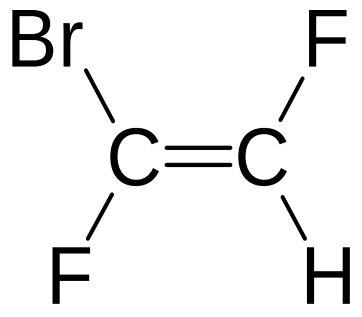
cis

E or Z ?



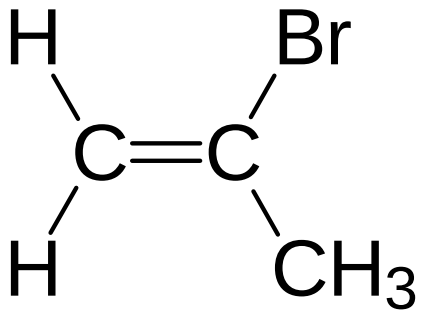
trans

think of "zis" for Z….similar to "cis"



trans
Z

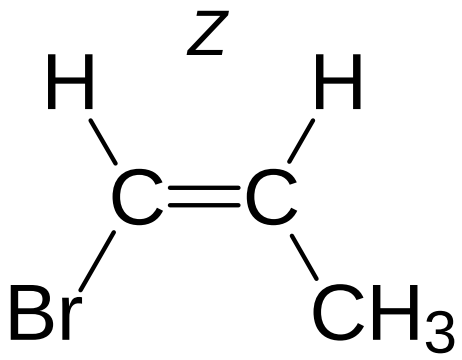
~~***cis or trans ?***~~



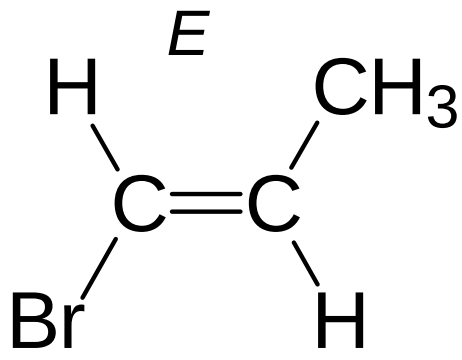
~~***E or Z ?***~~

Geometric Isomers

cis or trans ? ***E or Z ?***



cis

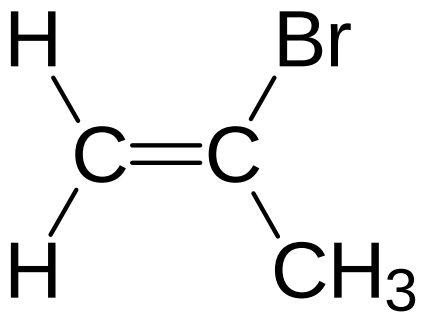


trans

think of "zis" for Z….similar to "cis"

~~***cis or trans ?***~~

Not all compounds having a C=C are geometric isomers.



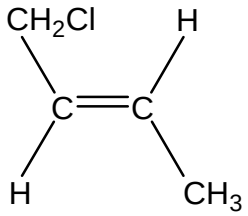
trans

Z

~~***E or Z ?***~~

Part 2 – Geometrical Isomerism

1. *Name the compound drawn below:* ☐ **1-chloro-*cis*-2-butene** ☐ **1-chloro-*trans*-2-butene**



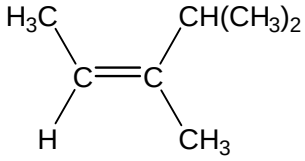
Specify the configuration (E or Z) _____

Is it possible to convert this to the other isomer without breaking any bonds? _____

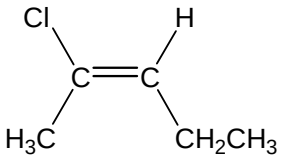
2. *Specify the configuration (E or Z) of the new compound:* _____

Are all trans compounds assigned an E configuration? _____

3. *For each alkene, circle the group (or atom) on each C of the double bond that has the higher priority. Identify whether the geometry is E or Z by checking the appropriate choice.*

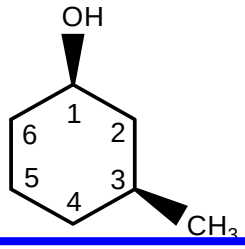


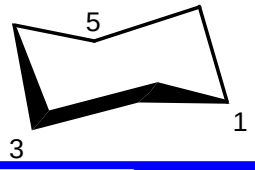
☐ *E* or ☐ *Z*

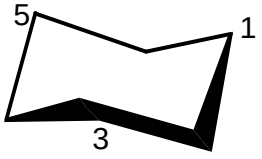


☐ *E* or ☐ *Z*

5. *Construct a model of the **cis*-3-methylcyclohexanol** shown below. Complete the two chair conformations, showing the position of the **hydroxyl** and **methyl** groups **only**. Do **not** include the hydrogens. Clearly label the substituents as axial (**a**) or equatorial (**e**).*







optical isomers

Part 3 – Optical Isomerism

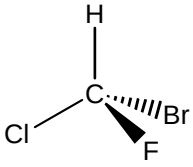
1. **Bromo-chloromethane:** *Are the two molecules of CH_2ClBr superimposable?* _____

Is CH_2ClBr chiral or achiral? _____

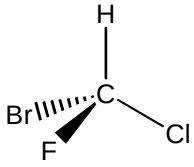
2. **Bromo-chloro-fluoromethane:**

Are the two molecules of CHClBrF superimposable on each other? _____

Assign an R or S configuration to each enantiomer:



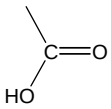
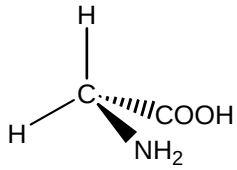
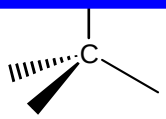
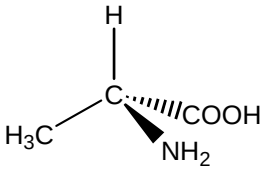
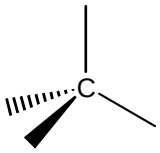
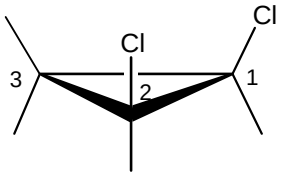
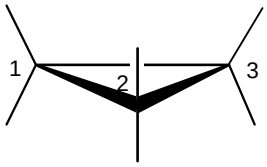
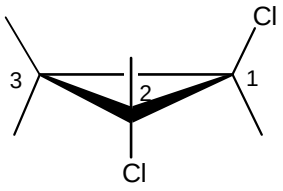
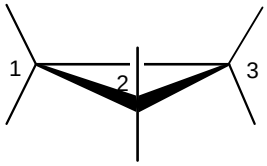
☐ *R* or ☐ *S*



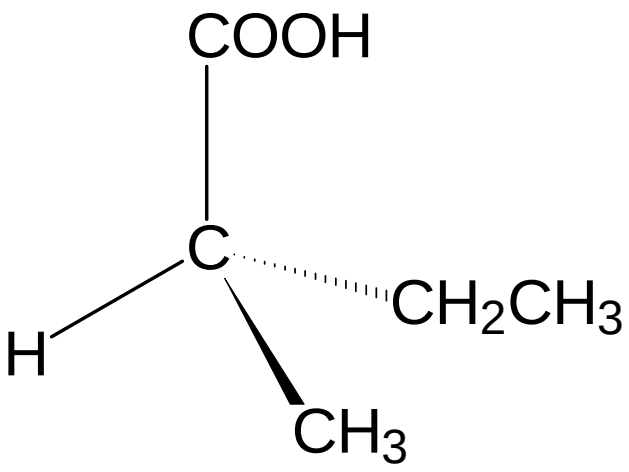
☐ *R* or ☐ *S*

3, 4. Construct models of the following compounds, and then co

optical isomers

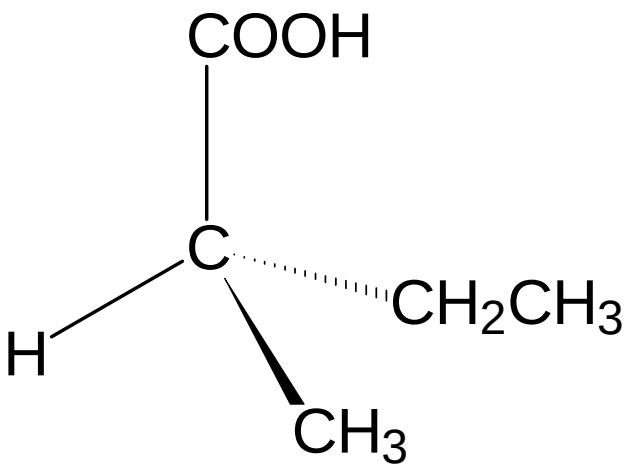
Compound	Sketch *(given)*	Sketch of Mirror Image *(complete:)*	Is Mirror Image Superimposable? *(yes/no)*	Internal Plane of Symmetry? *(yes/no)*	Number of Chiral Centres
3.1 Glycine, H_2NCH_2COOH COOH means: 	 ☐ R or ☐ S *(check one, if applicable)*	 ☐ R or ☐ S *(check one, if applicable)*			
3.2 Alanine, $CH_3NH_2CHCOOH$	 ☐ R or ☐ S *(check one, if applicable)*	 ☐ R or ☐ S *(check one, if applicable)*			
4.1 *cis*-1,2-dichloro-cyclopropane	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*			
4.2 *trans*-1,2-dichloro-cyclopropane	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*			

Optical Isomers



Optical Isomers

must contain a chiral carbon atom



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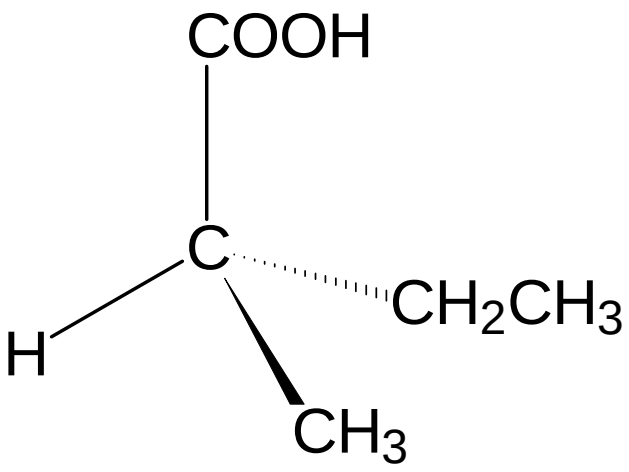
must contain a chiral carbon atom

4 different groups on 1 C



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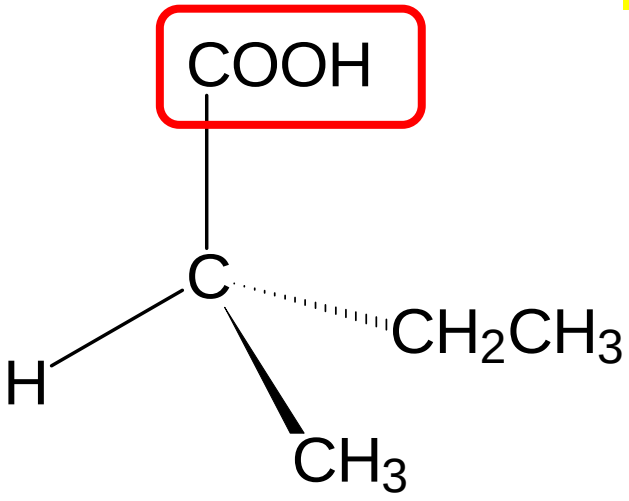

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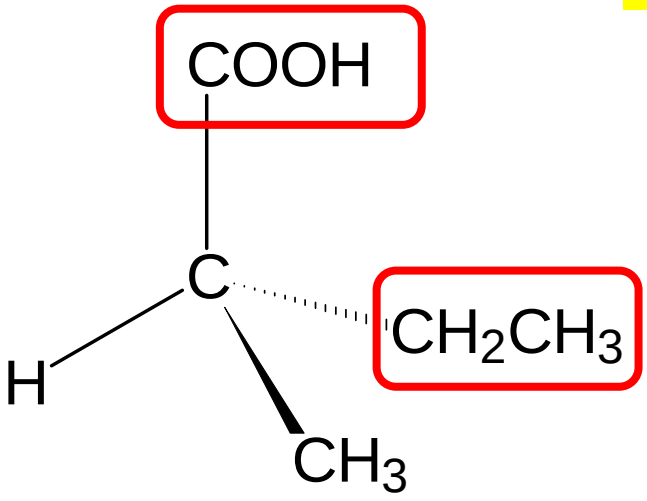

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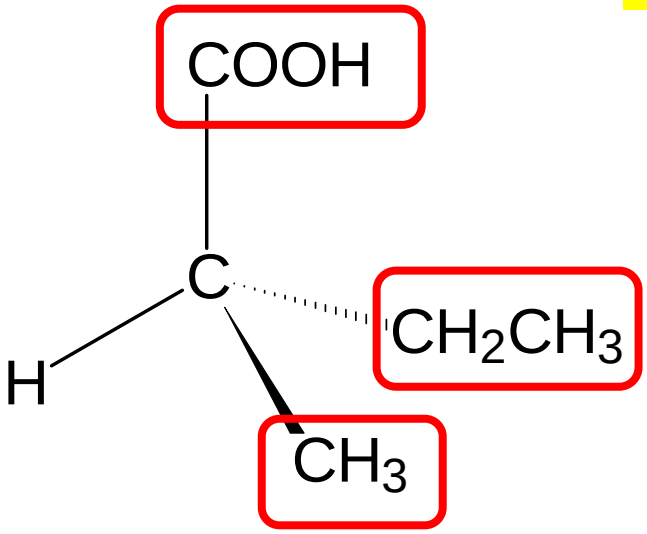

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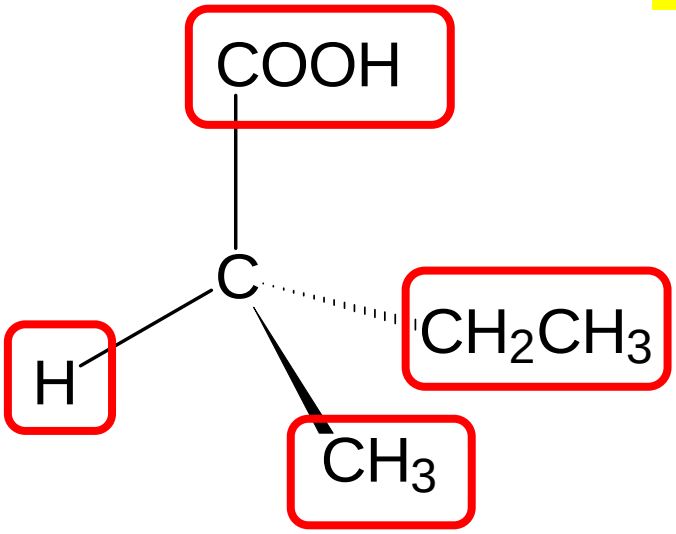

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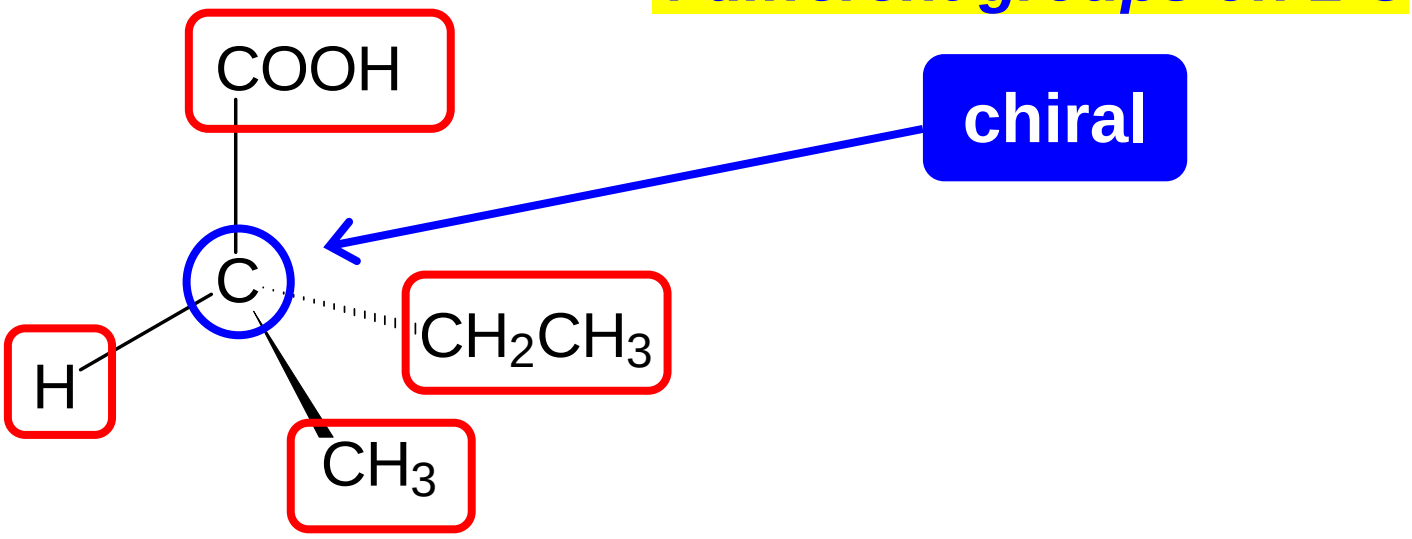

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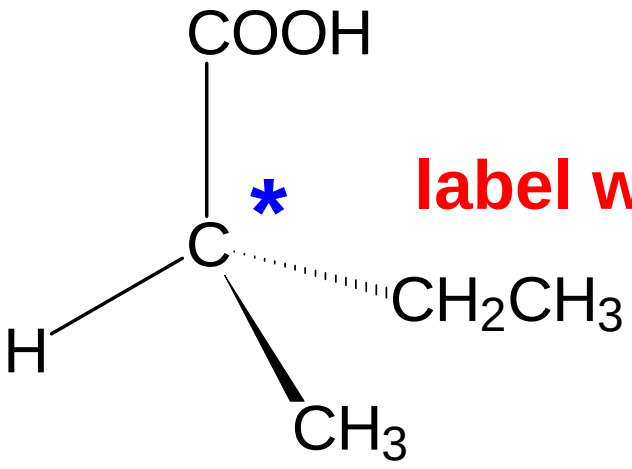

label with asterisk

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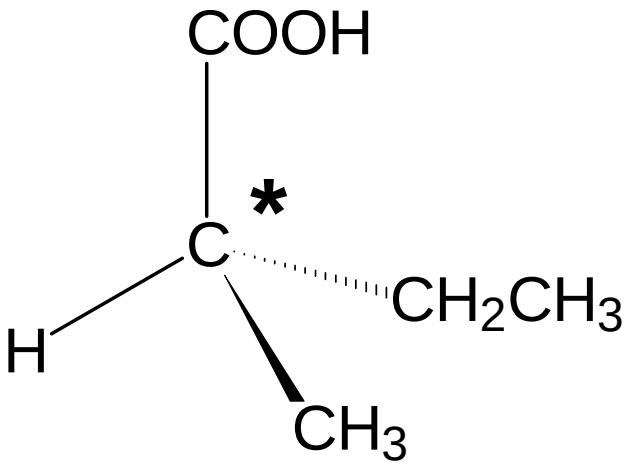
"stereogenic centre"



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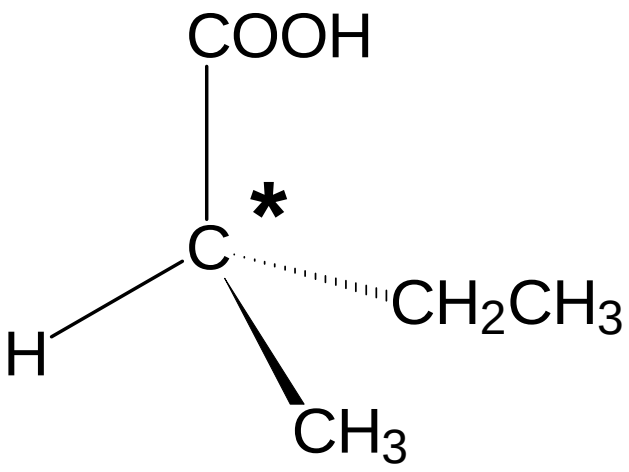

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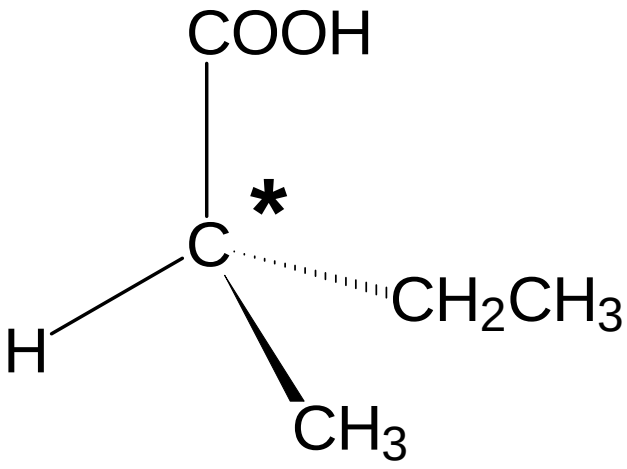

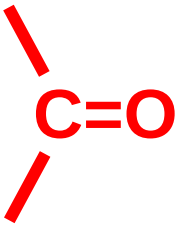

not chiral… *"achiral"* b/c only 3 groups

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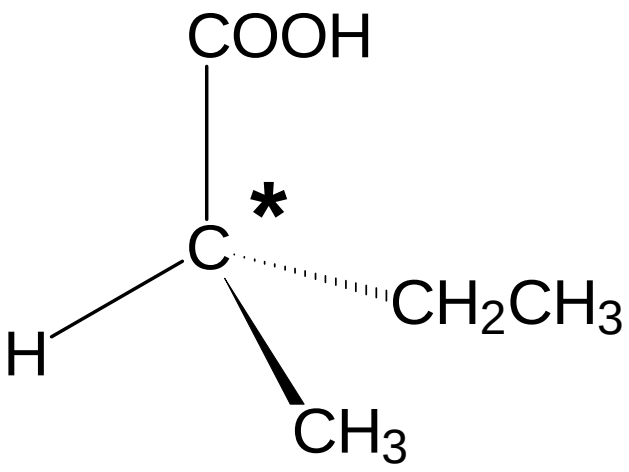

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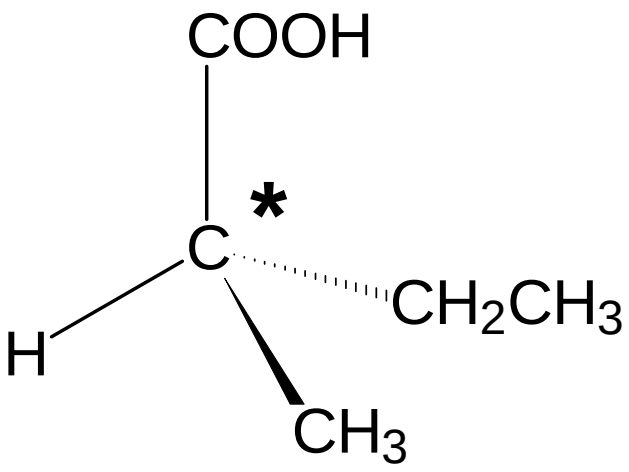

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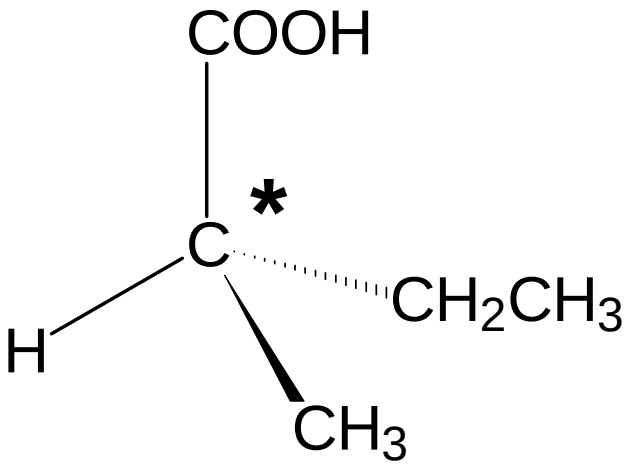
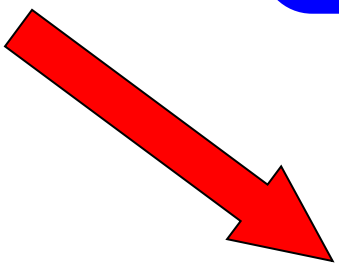
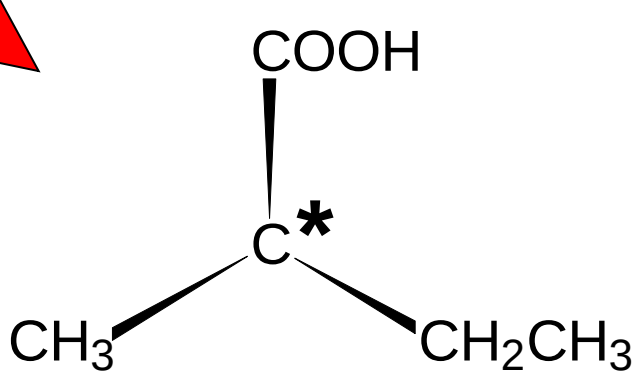


rotate lowest priority group into page





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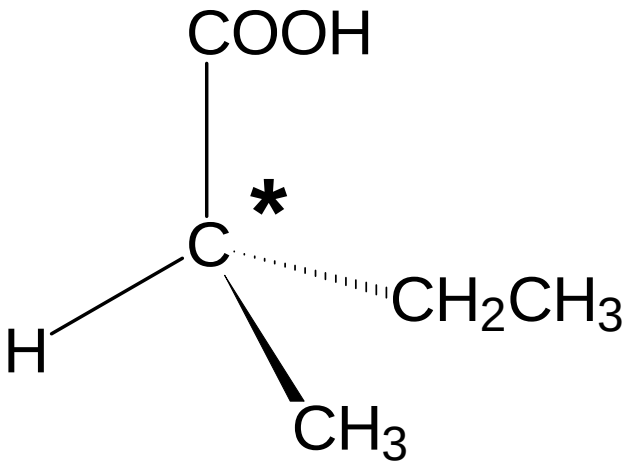

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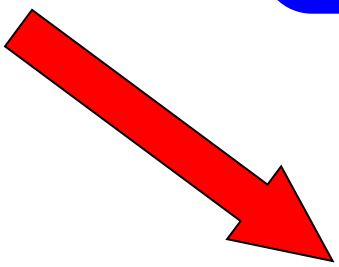

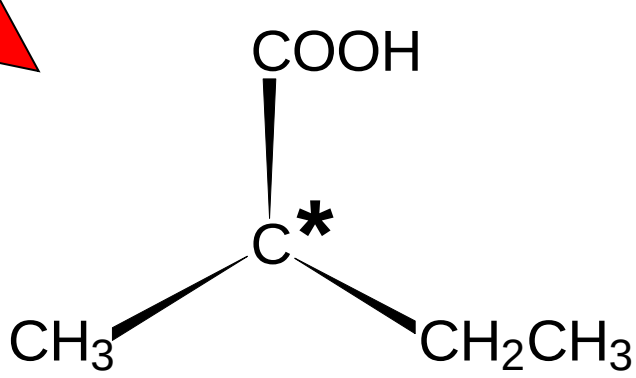

steering-wheel analogy

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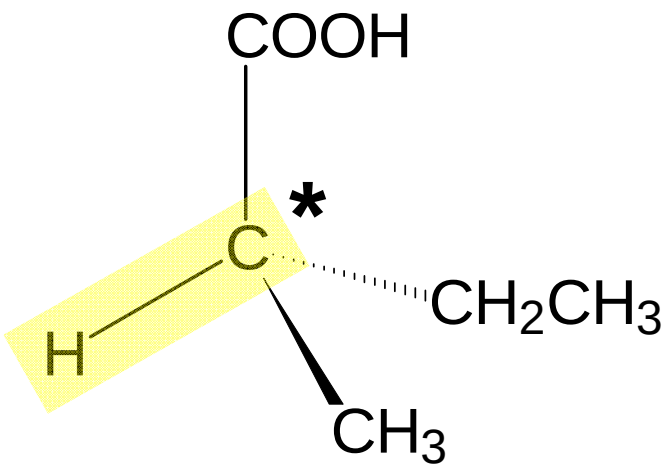

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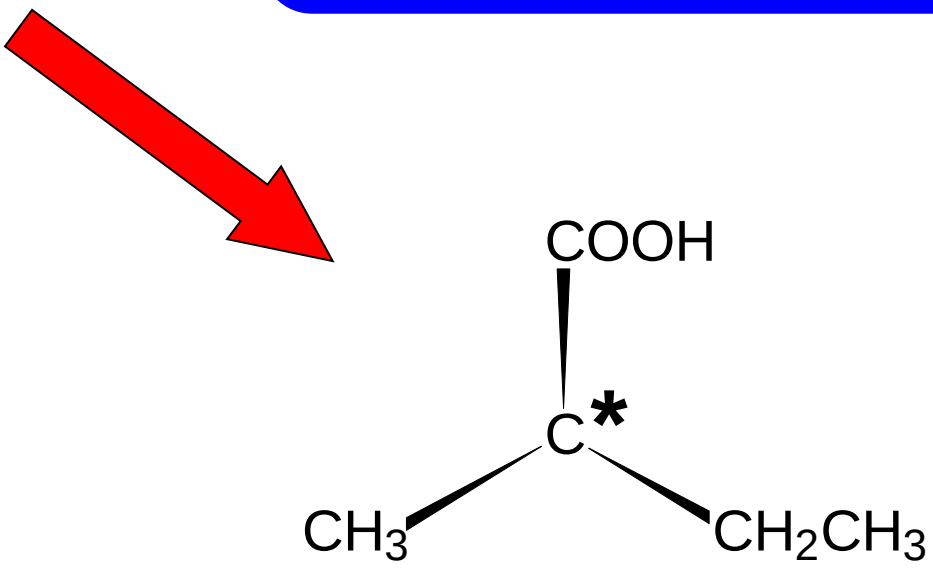

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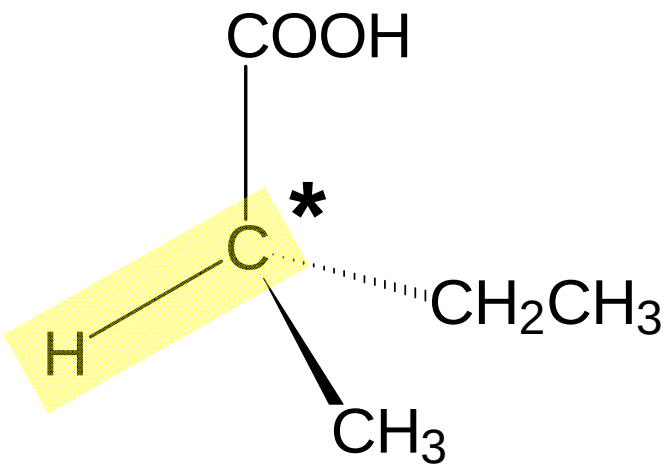

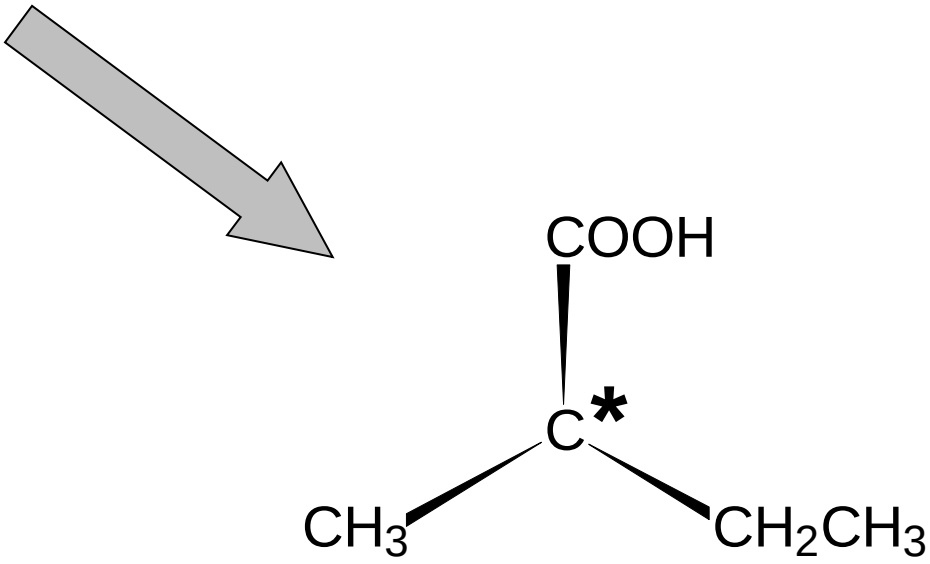

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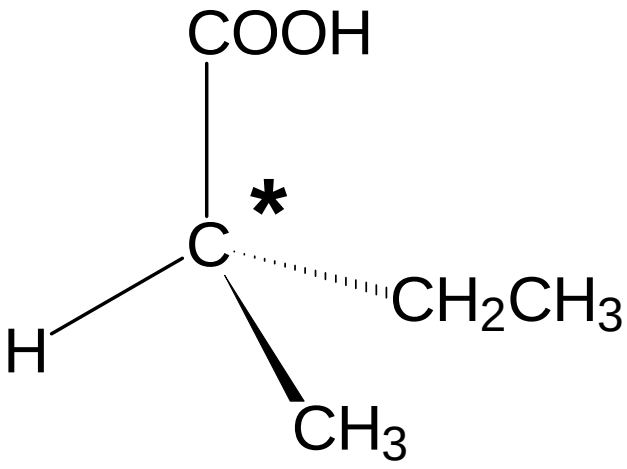

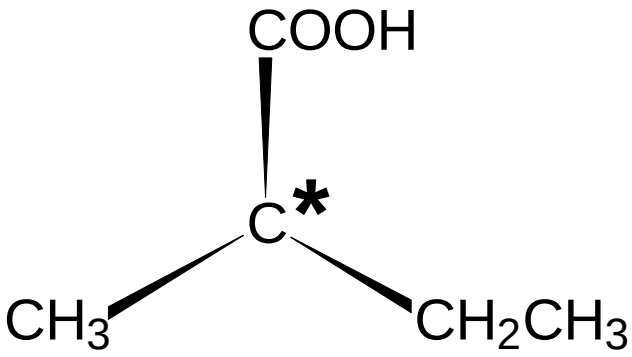

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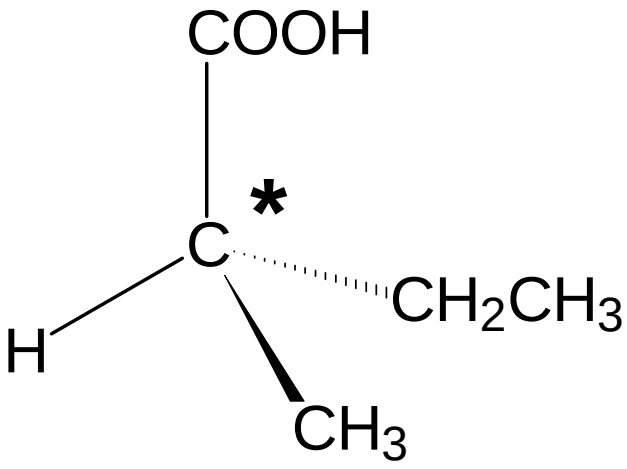

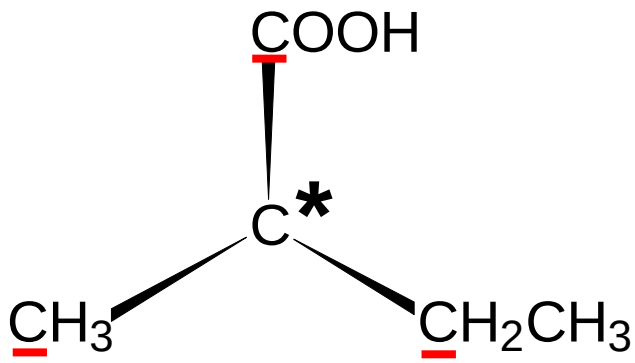

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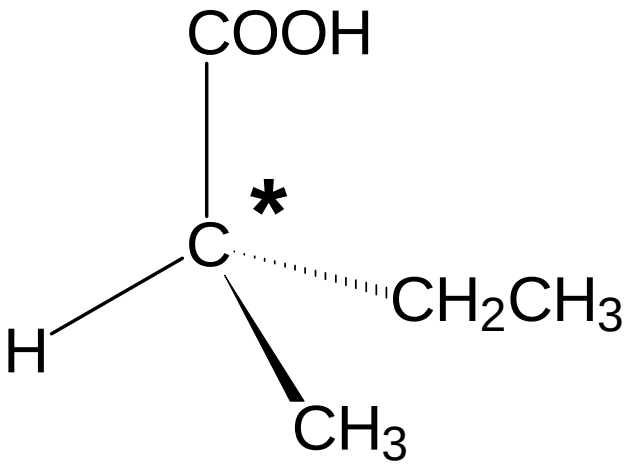
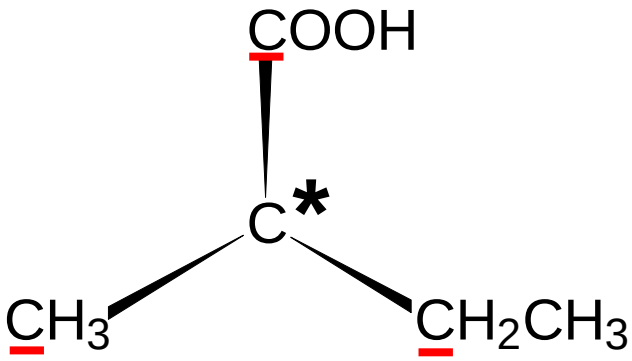


If first atom of connectivity is the same, move on to next atom.



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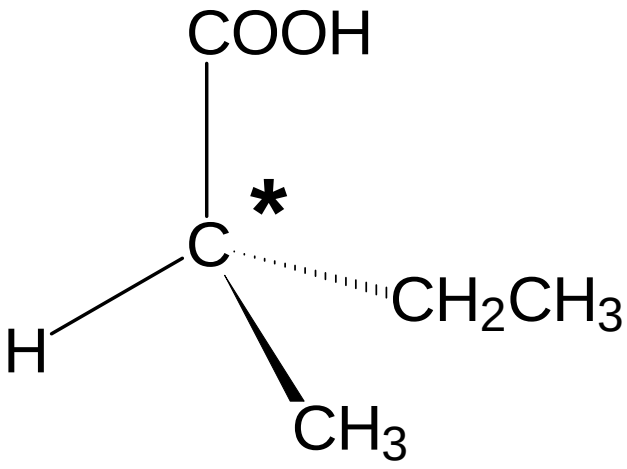

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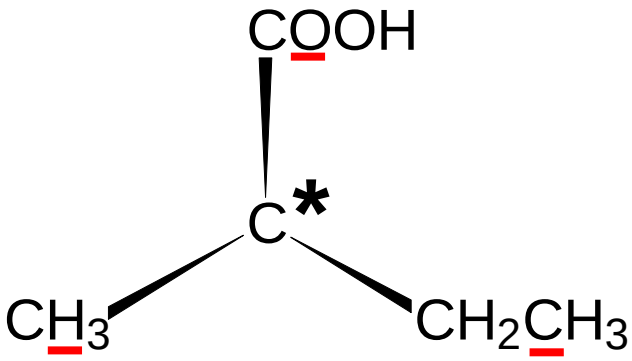

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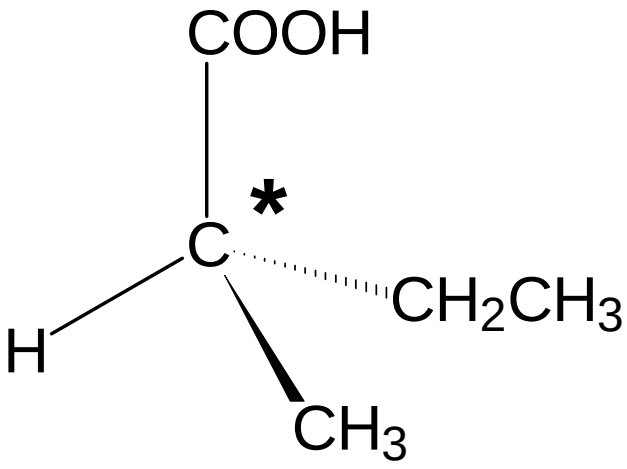

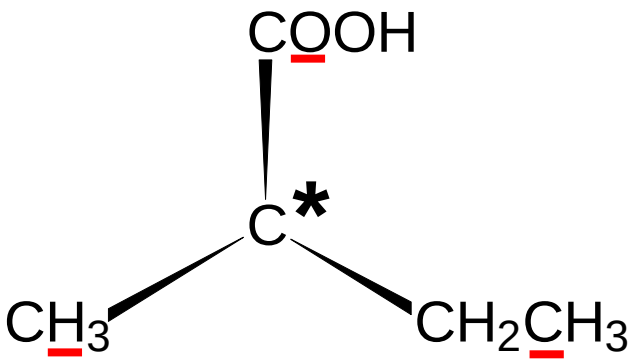

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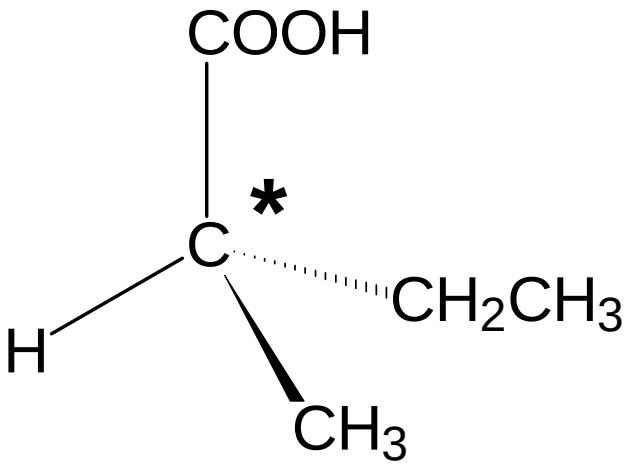

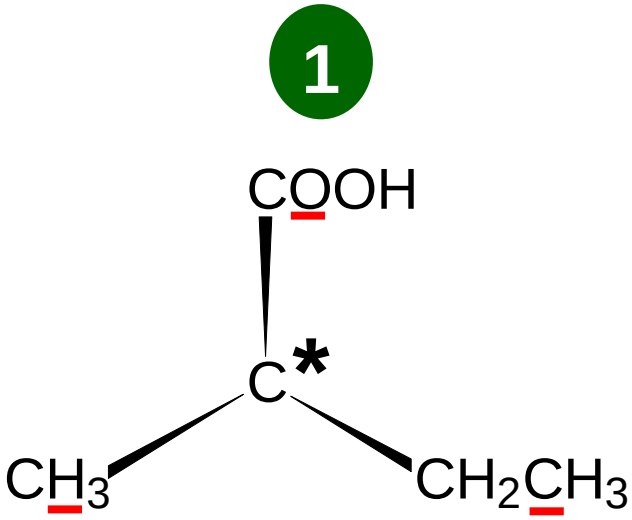

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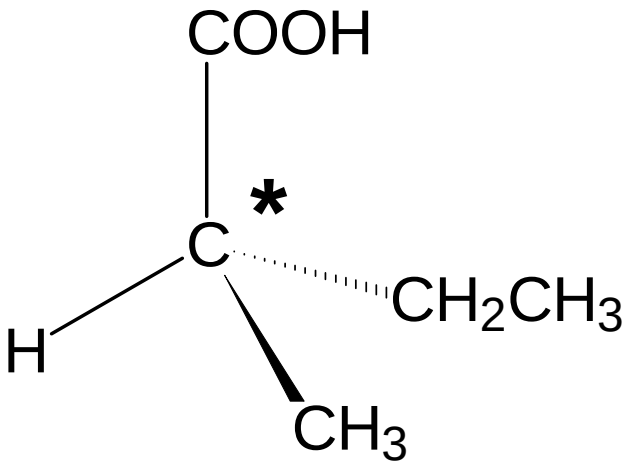

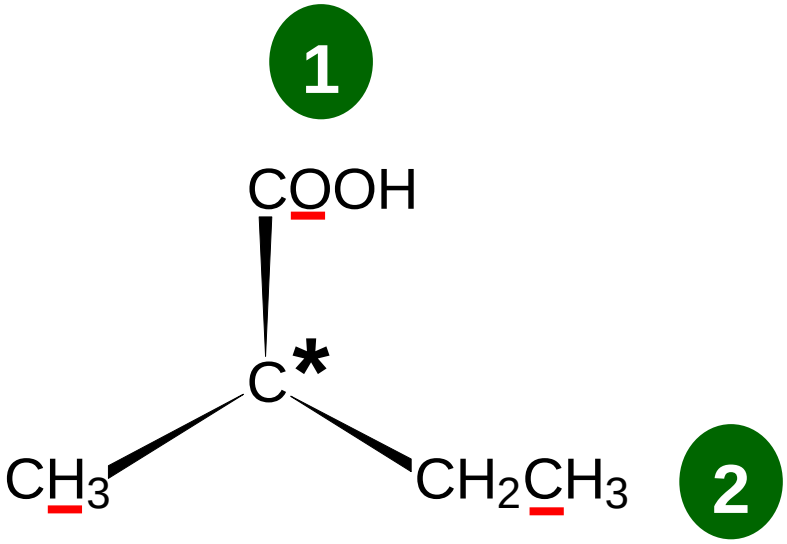

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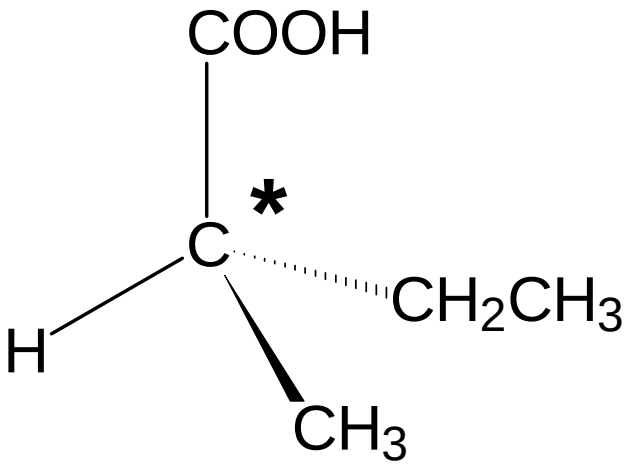

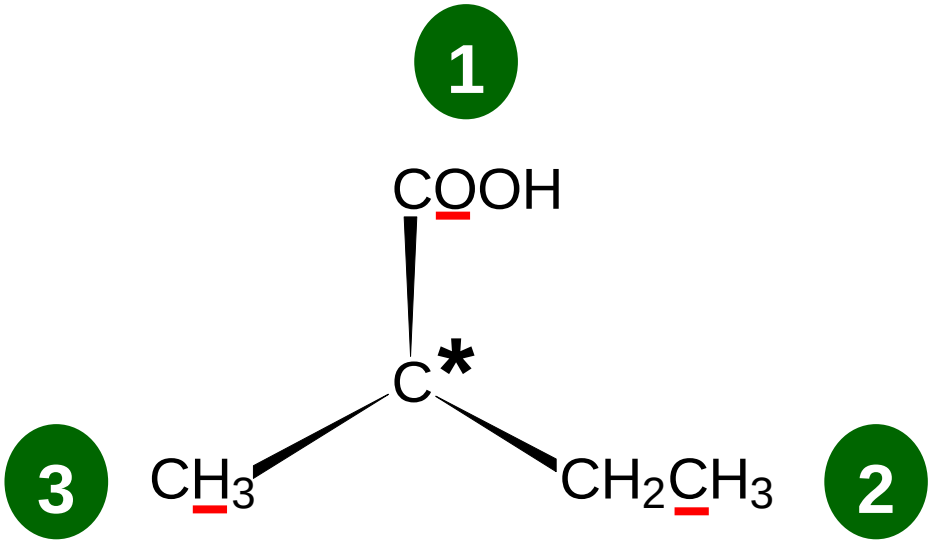

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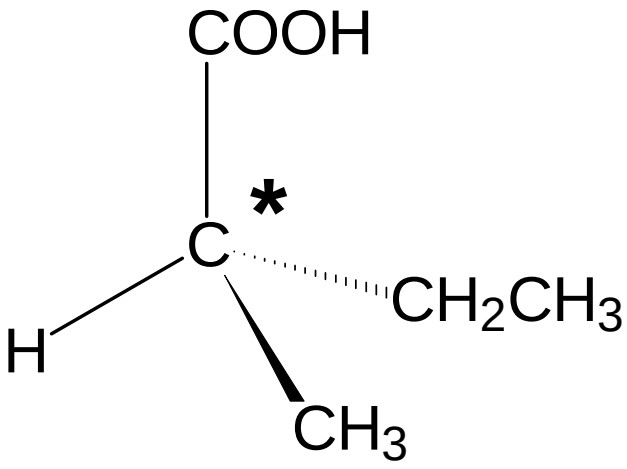

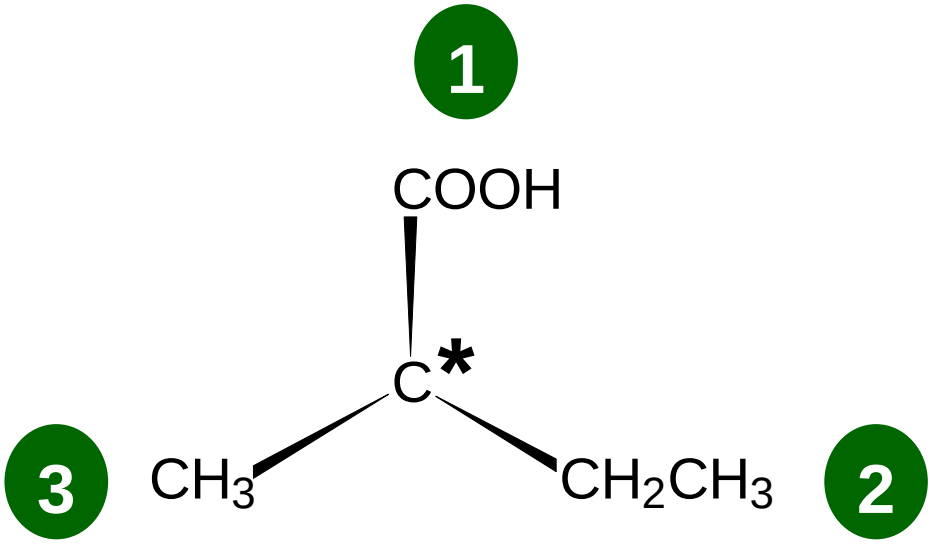

assess rotation from highest to lowest

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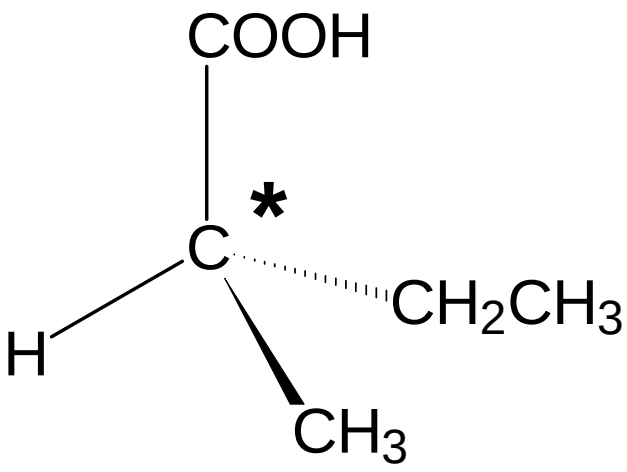

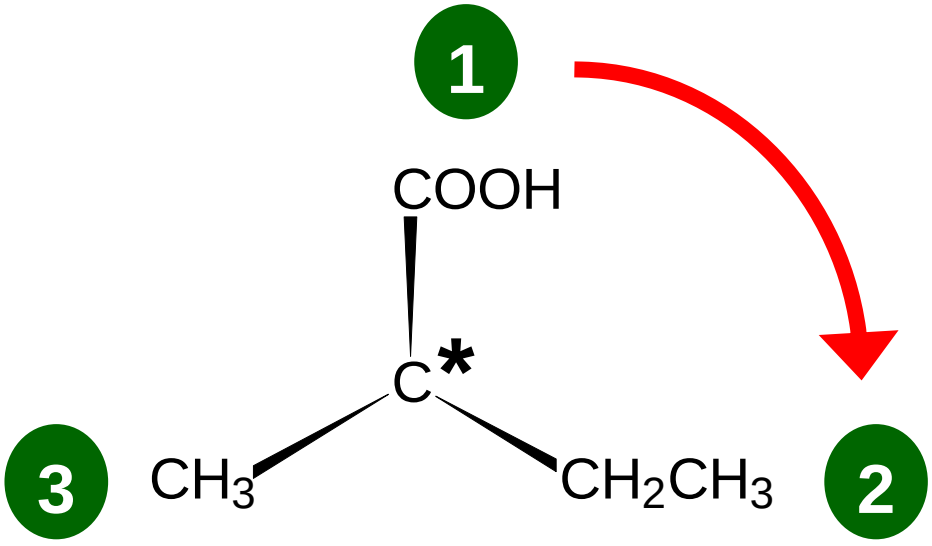

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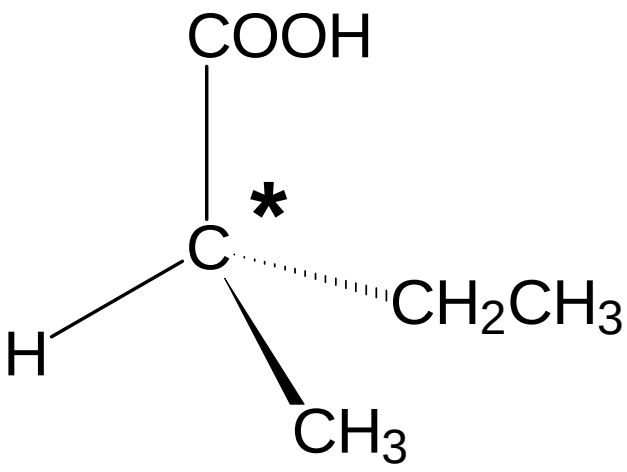

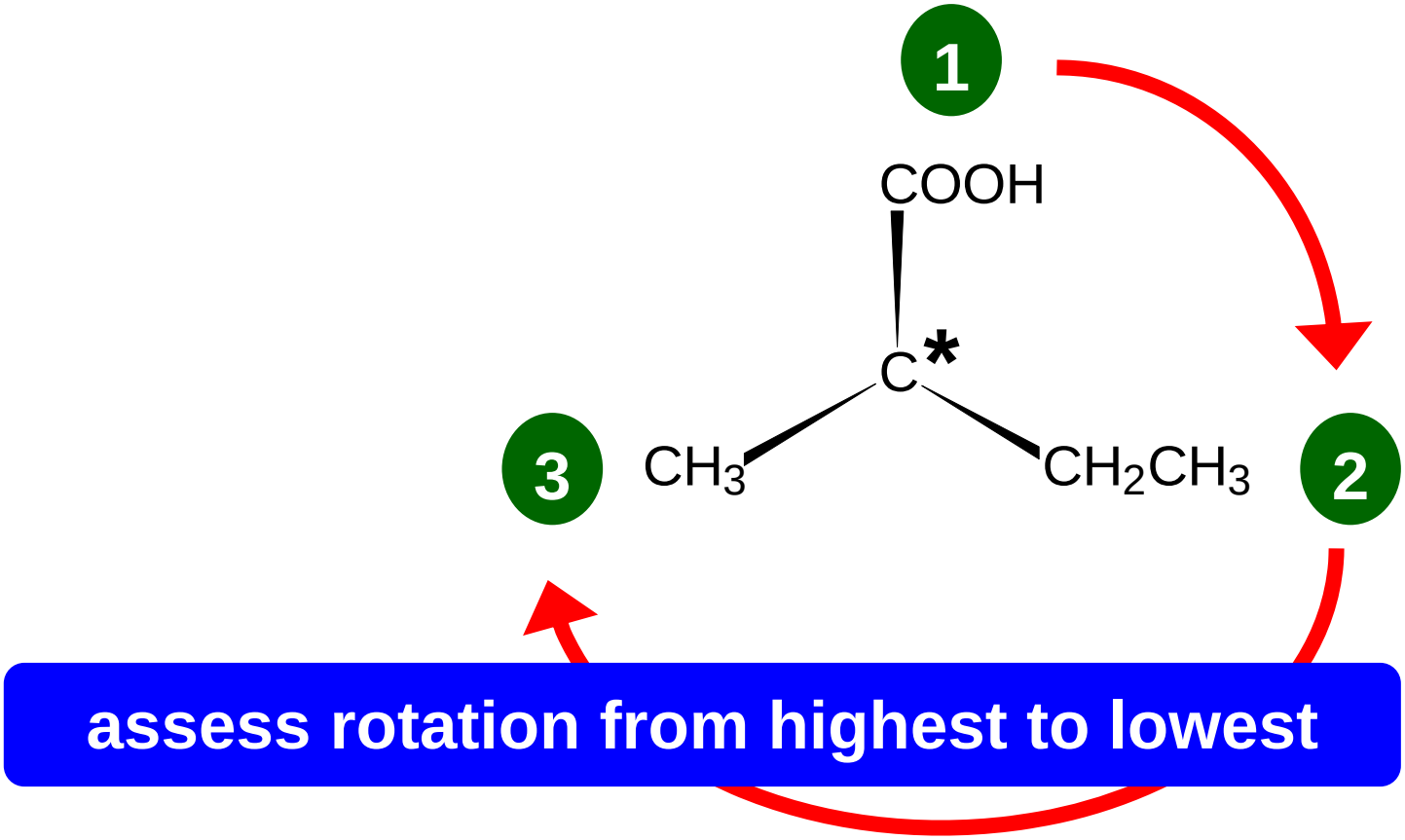

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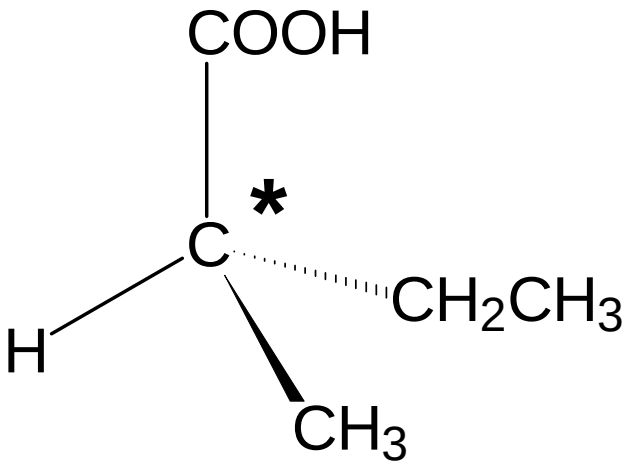
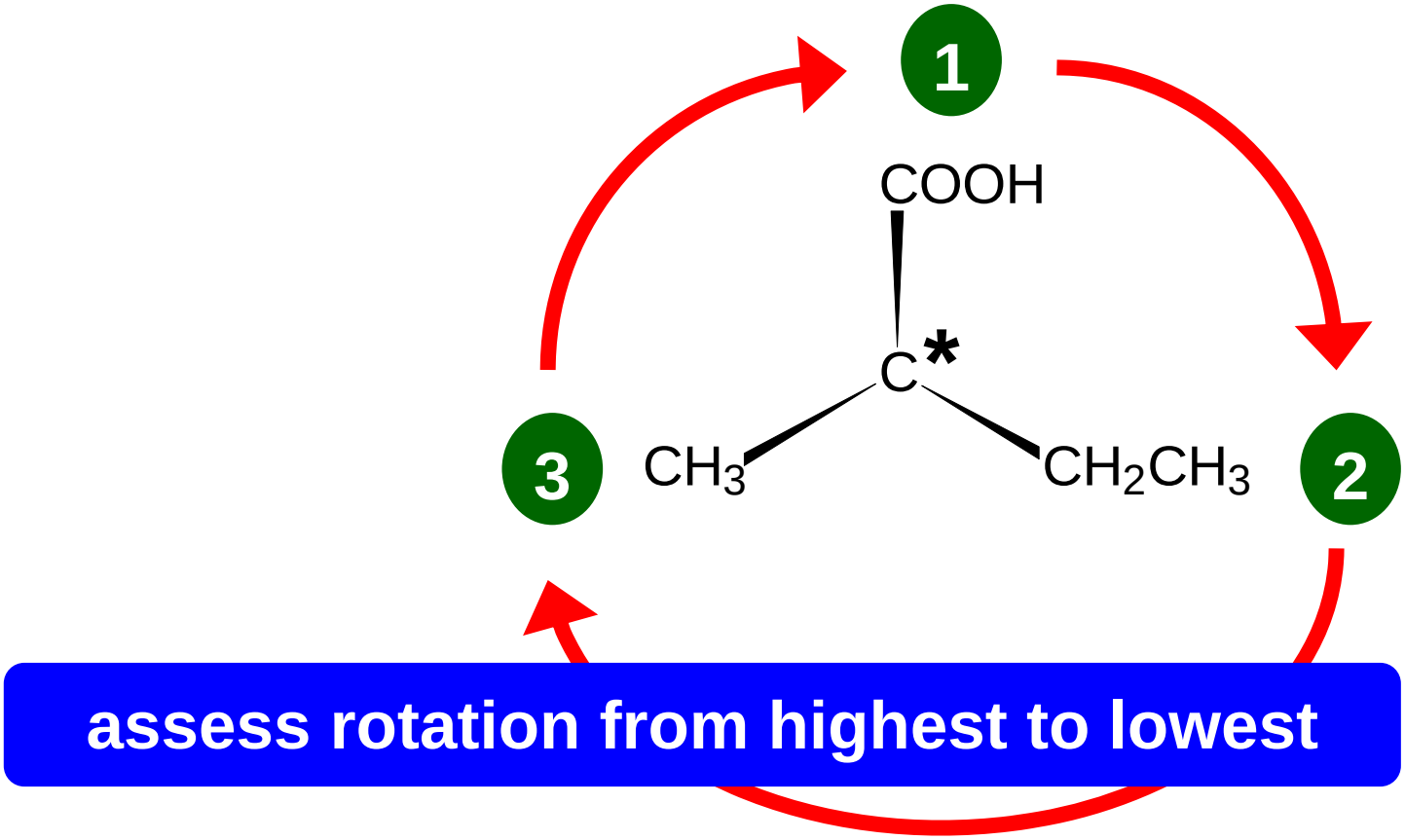




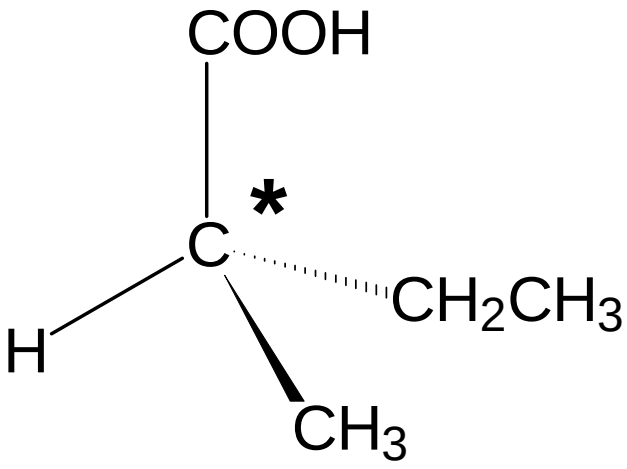
Optical Isomers

must contain a chiral carbon atom

4 different groups on 1 C

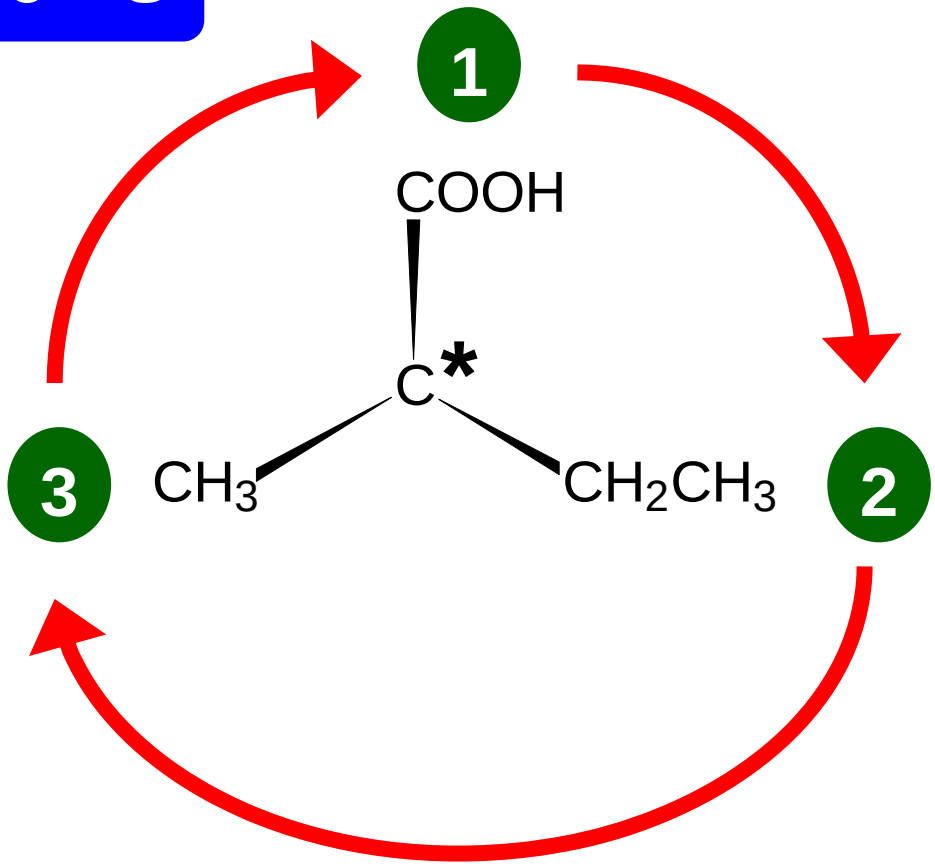
"stereogenic centre"

Is the chirality R or S ?



counterclockwise = *S*

clockwise = *R*



Optical Isomers

must contain a chiral carbon atom

4 different groups on 1 C

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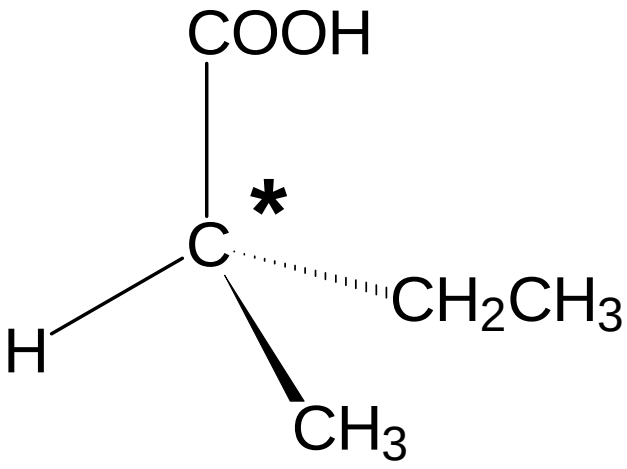
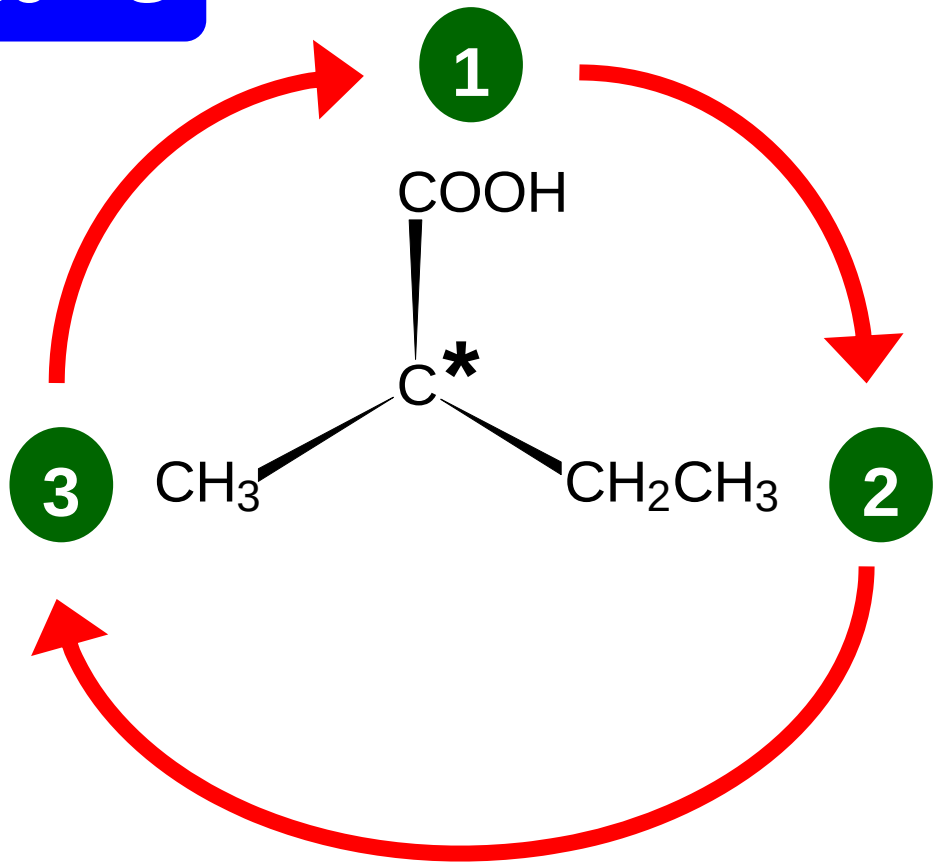
Is the chirality R or S ?



counterclockwise = *S*

clockwise = *R*

R



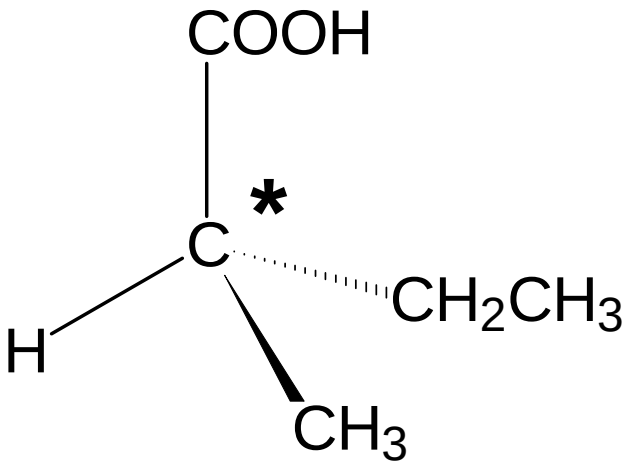
Optical Isomers

must contain a chiral carbon atom

4 different groups on 1 C

"stereogenic centre"

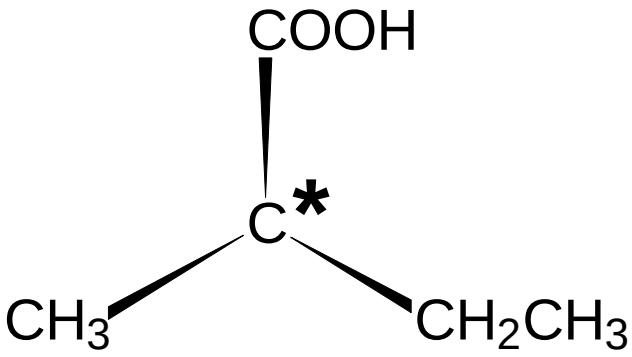
Is the chirality R or S ?



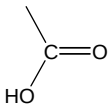
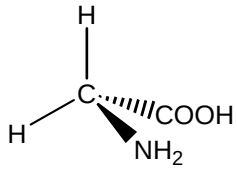
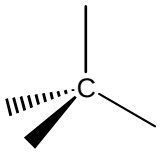
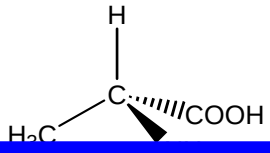
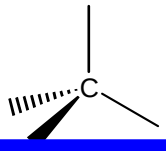
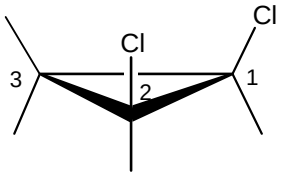
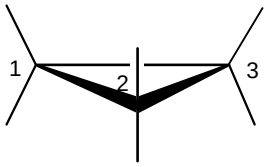
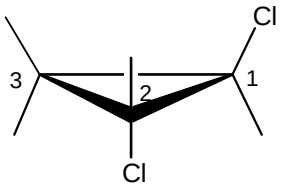
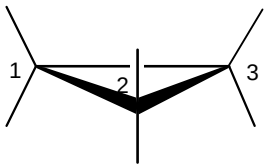
counterclockwise = *S*

clockwise = *R*

R

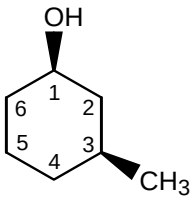


3, 4. Construct models of the following compounds, and then c

Compound	Sketch *(given)*	Sketch of Mirror Image *(complete:)*	Is Mirror Image Superimposable? *(yes/no)*	Internal Plane of Symmetry? *(yes/no)*	Number of Chiral Centres
3.1 Glycine, H_2NCH_2COOH COOH means: 	 ☐ R or ☐ S *(check one, if applicable)*	 ☐ R or ☐ S *(check one, if applicable)*			
3.2 Alanine, $CH_3NH_2CHCOOH$	 *if applicable)*	 *if applicable)*			
4.1 *cis*-1,2-dichloro-cyclopropane	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*			
4.2 *trans*-1,2-dichloro-cyclopropane	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*	 ☐ R or ☐ S *(check one, if applicable, looking at carbon 1)*			

cyclic optical isomers

5. ***cis*-3-methylcyclohexanol:**



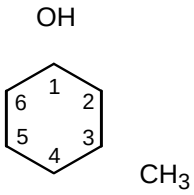
How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

cyclic optical isomers

Use the dashed-lin

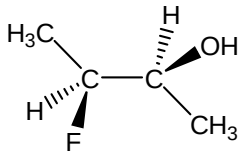


*What is the R/S configuration at carbon 1?*_____

4 3 2 1

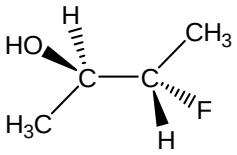
6. **3-fluorobutan-2-ol: CH_3CHF-$CH(OH)CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



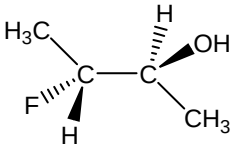
2S,3S

(a)



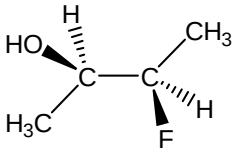
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

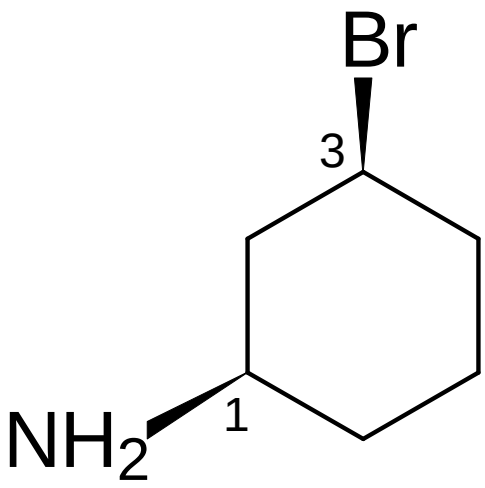
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

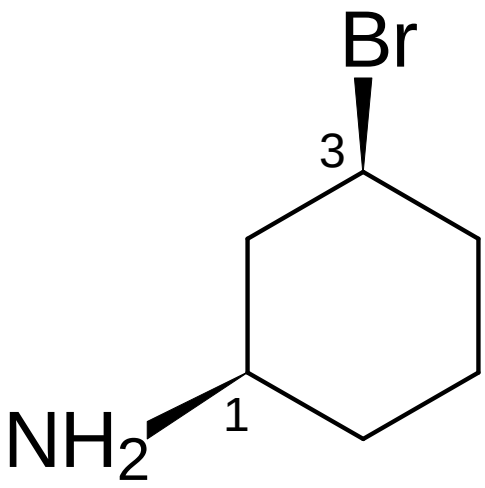
How many stereoisomers are possible for CH_3CHF-$CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

Cyclic Optical Isomers

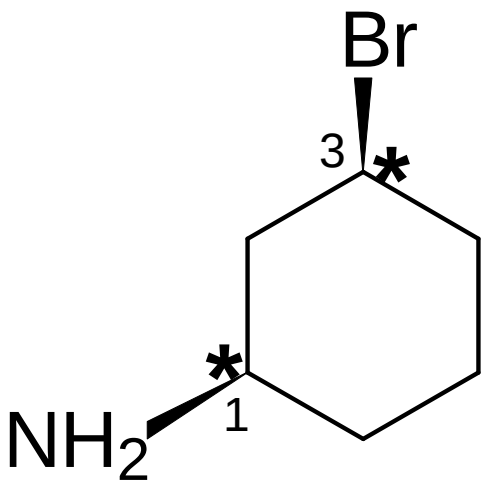


Cyclic Optical Isomers



C1 and C3 are both chiral.

Cyclic Optical Isomers



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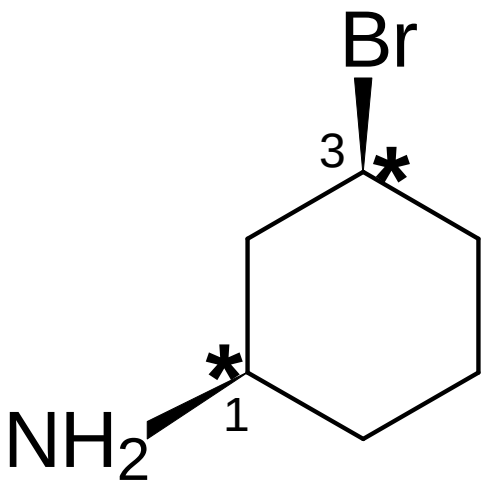
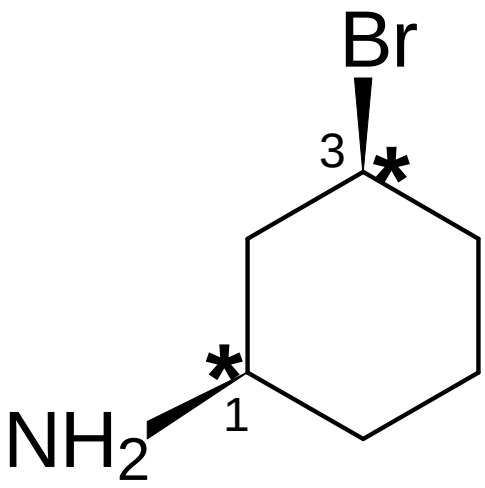
Cyclic Optical Isomers



C1 and C3 are both chiral.

Assign chirality (R or S)

Cyclic Optical Isomers



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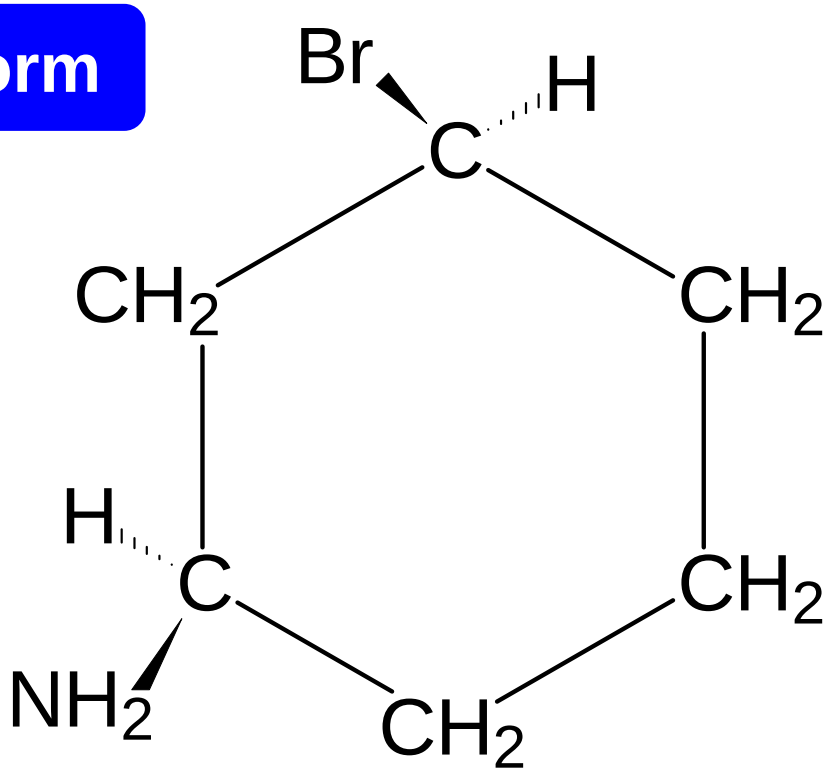
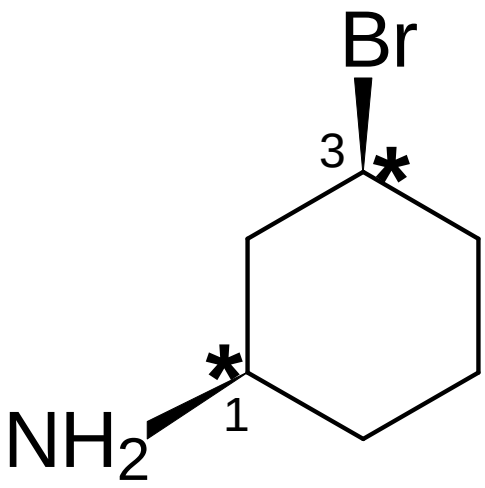
expanded form



Cyclic Optical Isomers



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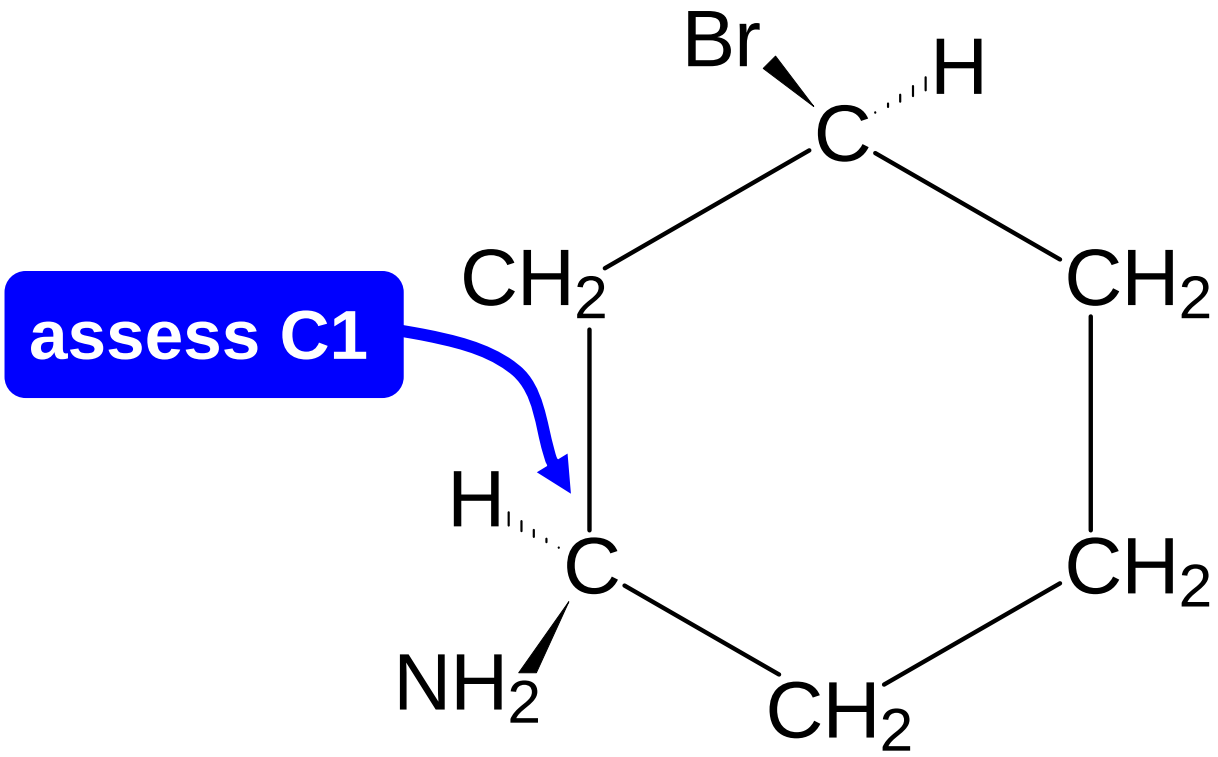
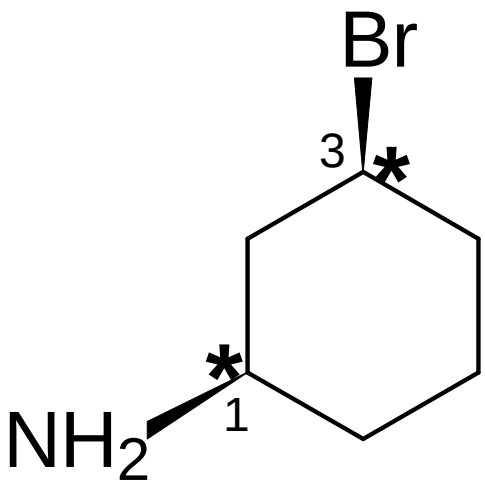


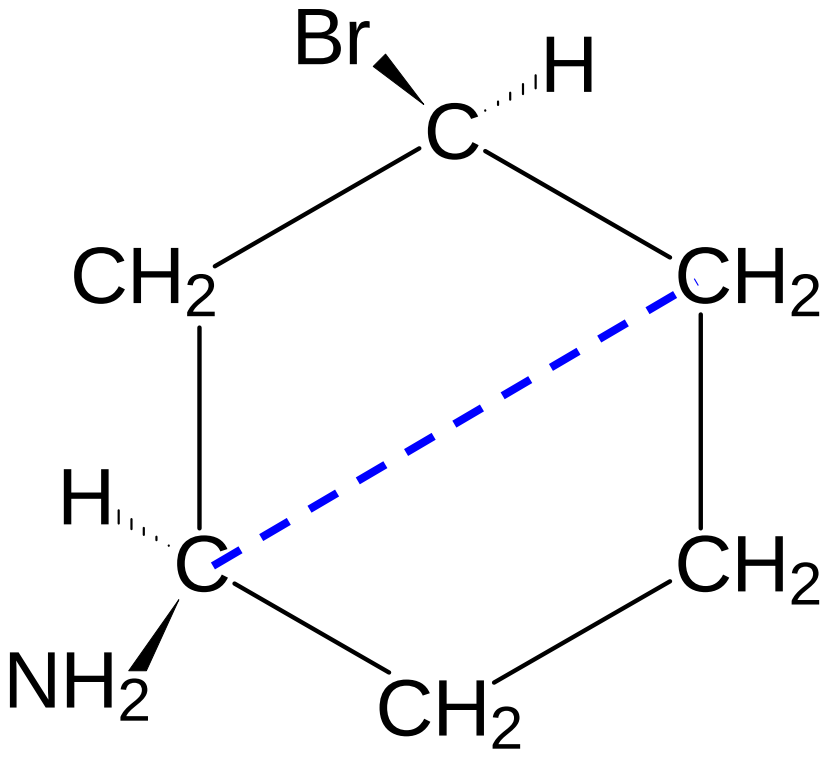
Cyclic Optical Isomers



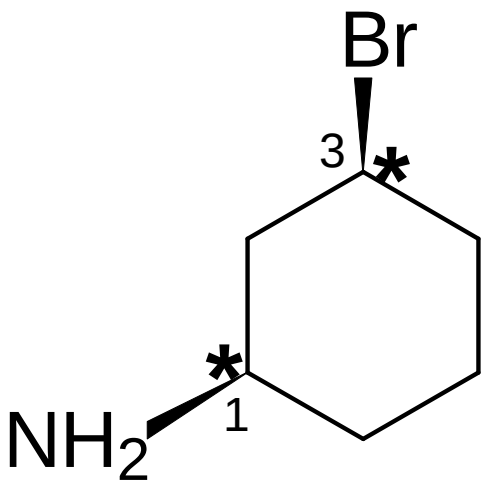
C1 and C3 are both chiral.

Assign chirality (R or S)

cut ring in half from C1



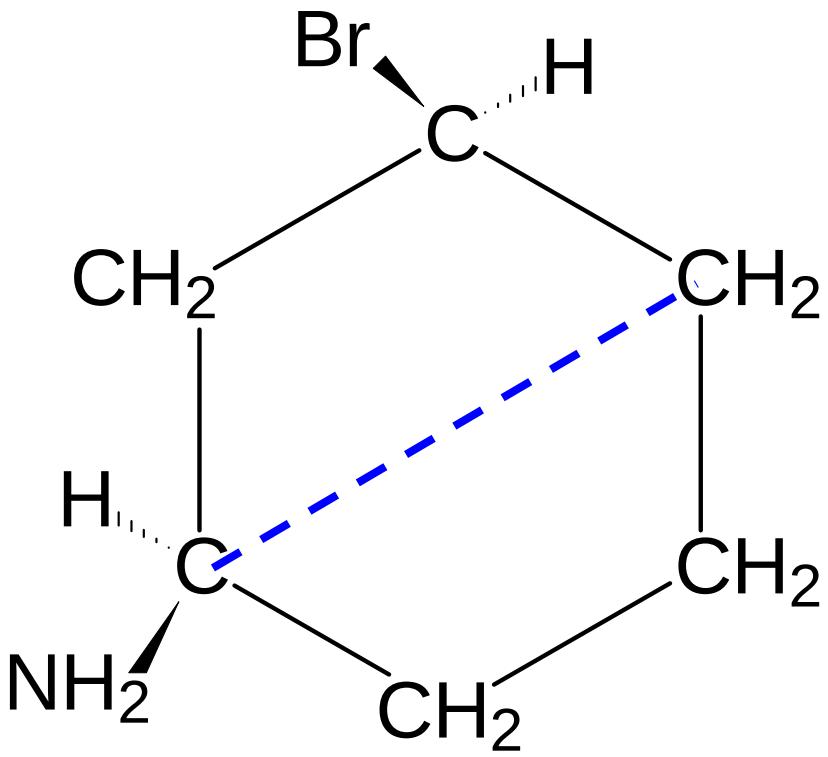
Cyclic Optical Isomers



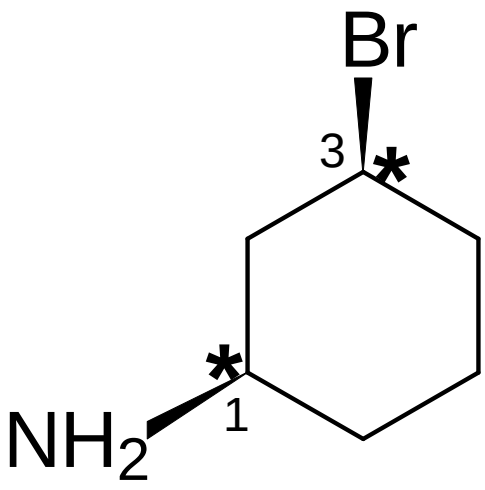
C1 and C3 are both chiral.

Assign chirality (R or S)

assign priorities to the 4 groups



Cyclic Optical Isomers



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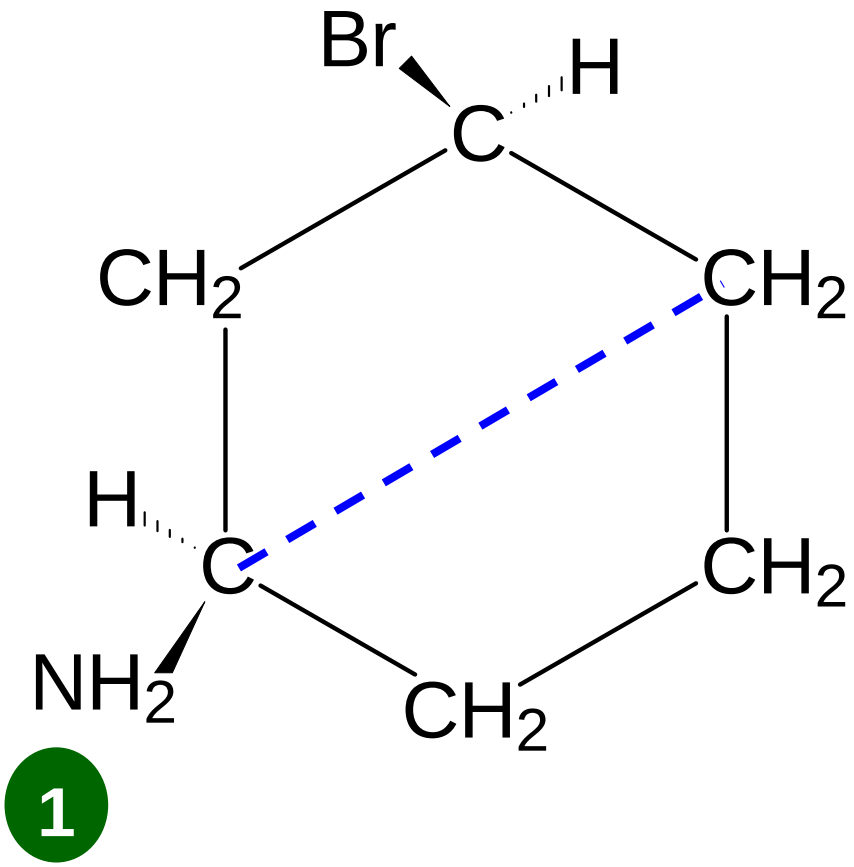
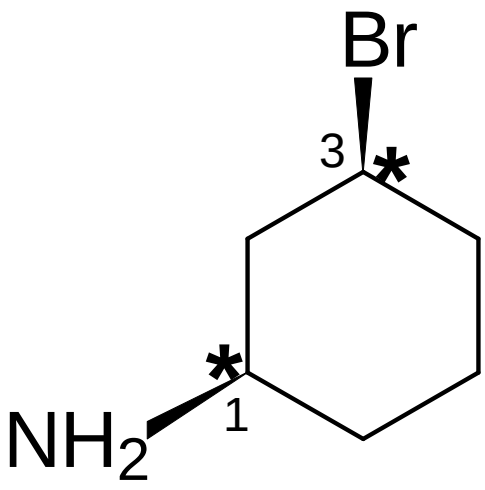


Cyclic Optical Isomers



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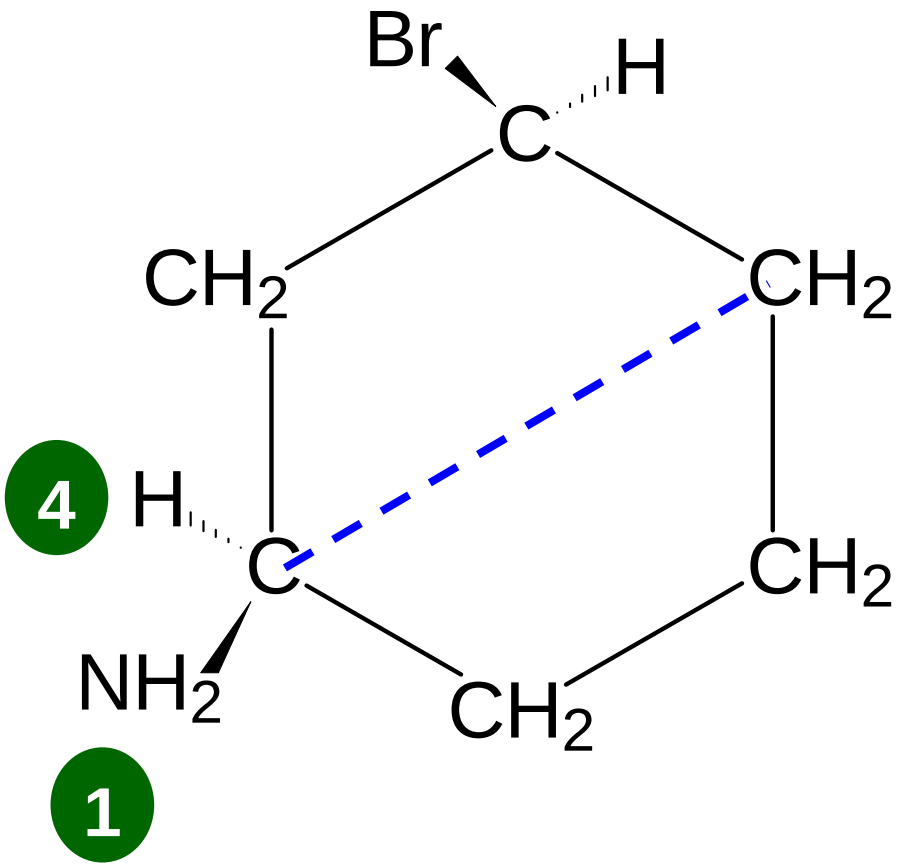
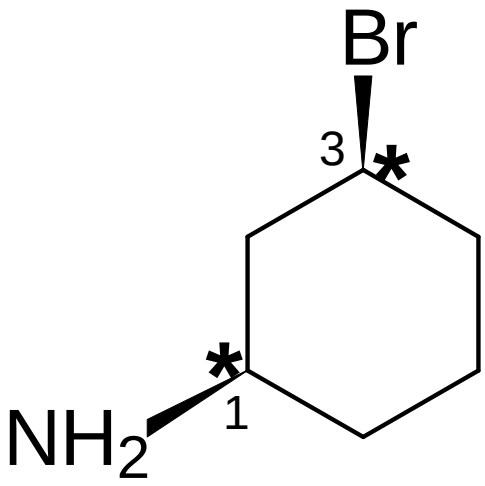


Cyclic Optical Isomers



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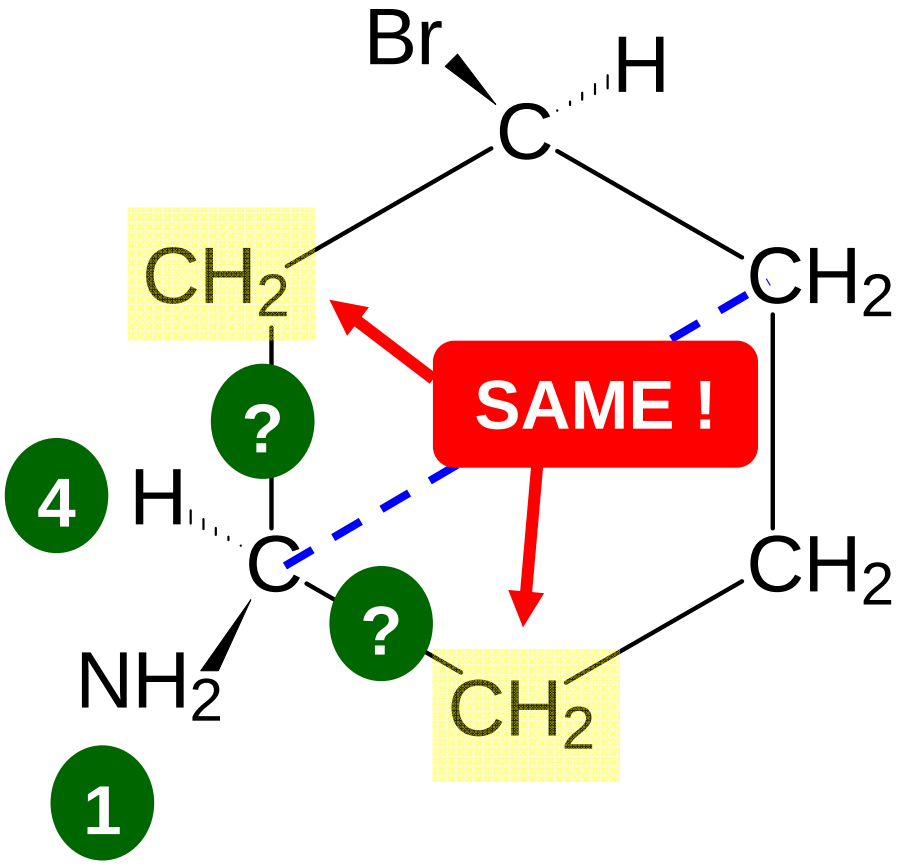
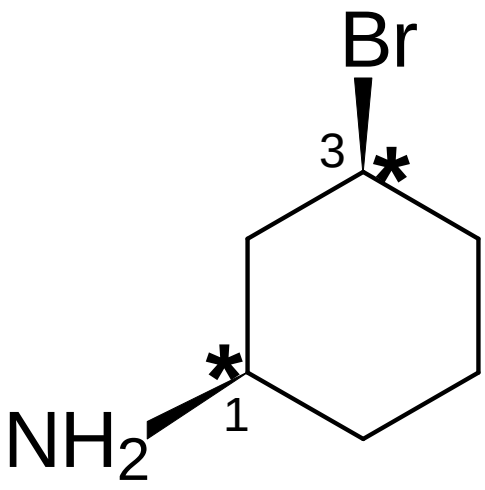


Cyclic Optical Isomers



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Assign chirality (R or S)

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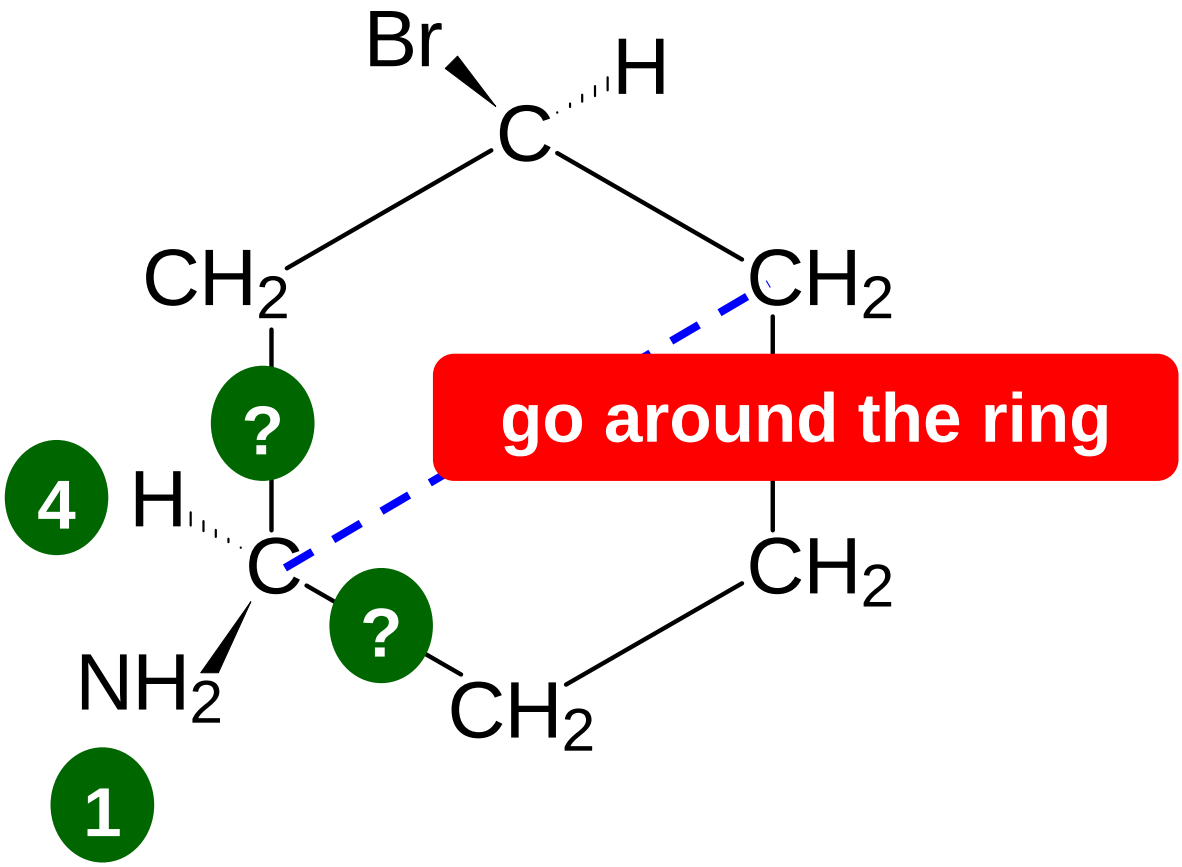
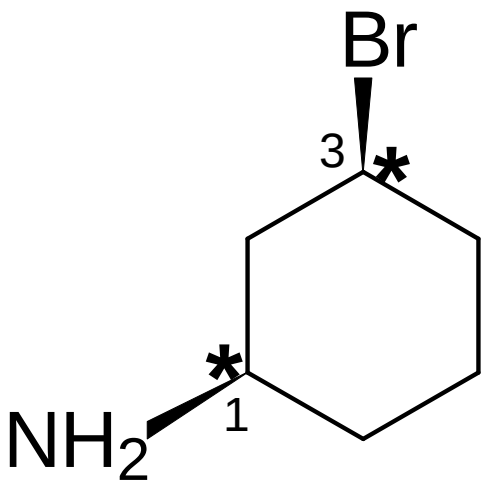


go around the ring

Cyclic Optical Isomers



C1 and C3 are both chiral.

Assign chirality (R or S)

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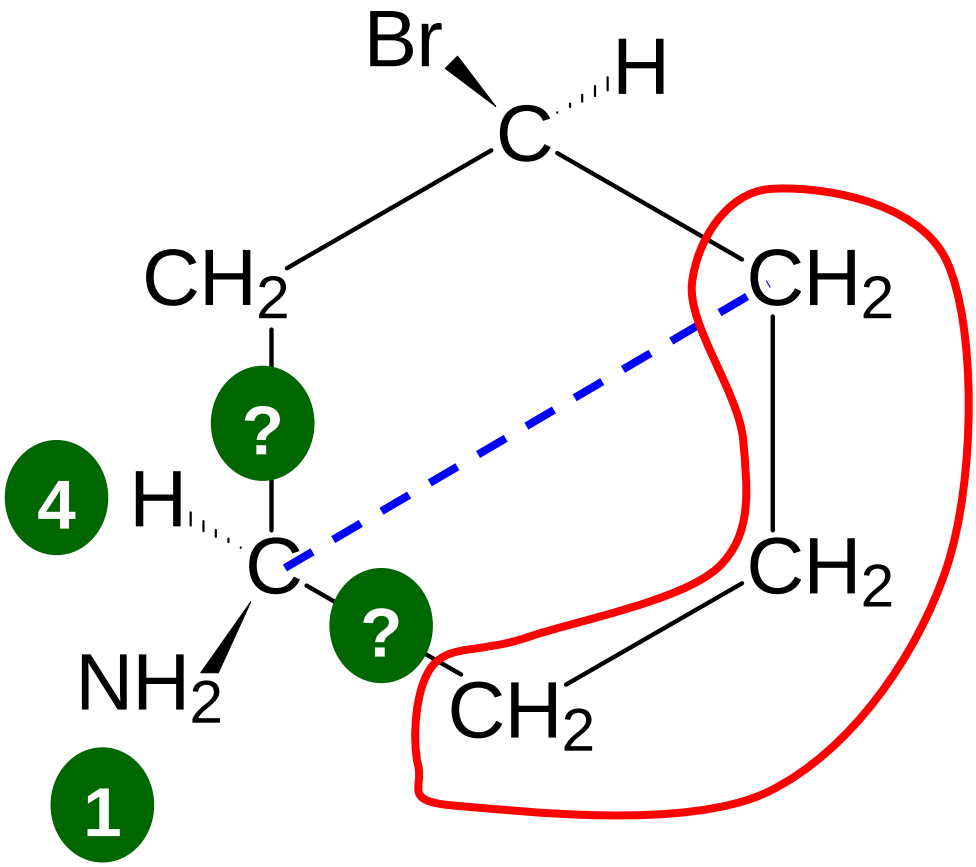
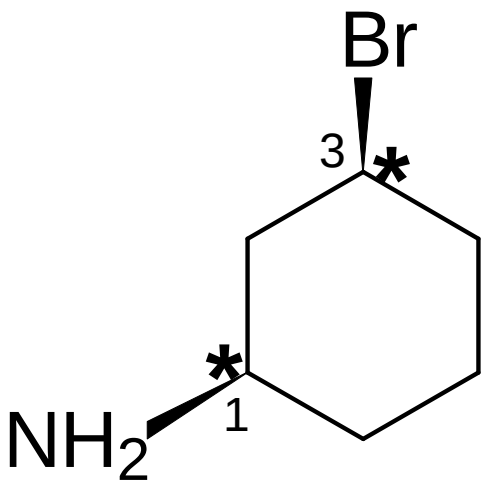


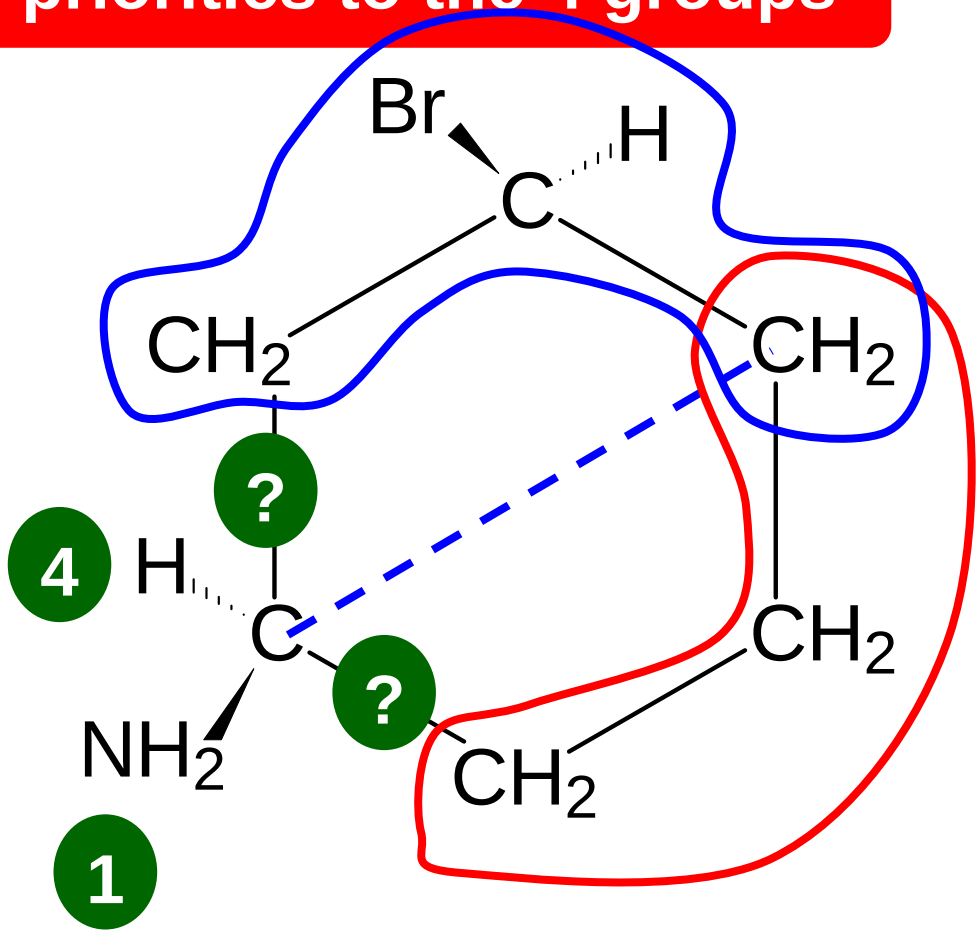
Cyclic Optical Isomers



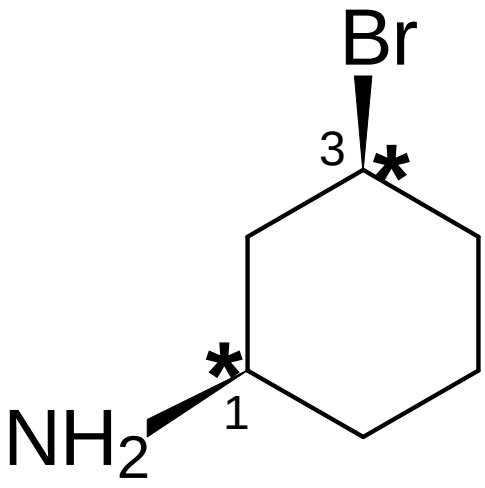
C1 and C3 are both chiral.

Assign chirality (R or S)

assign priorities to the 4 groups



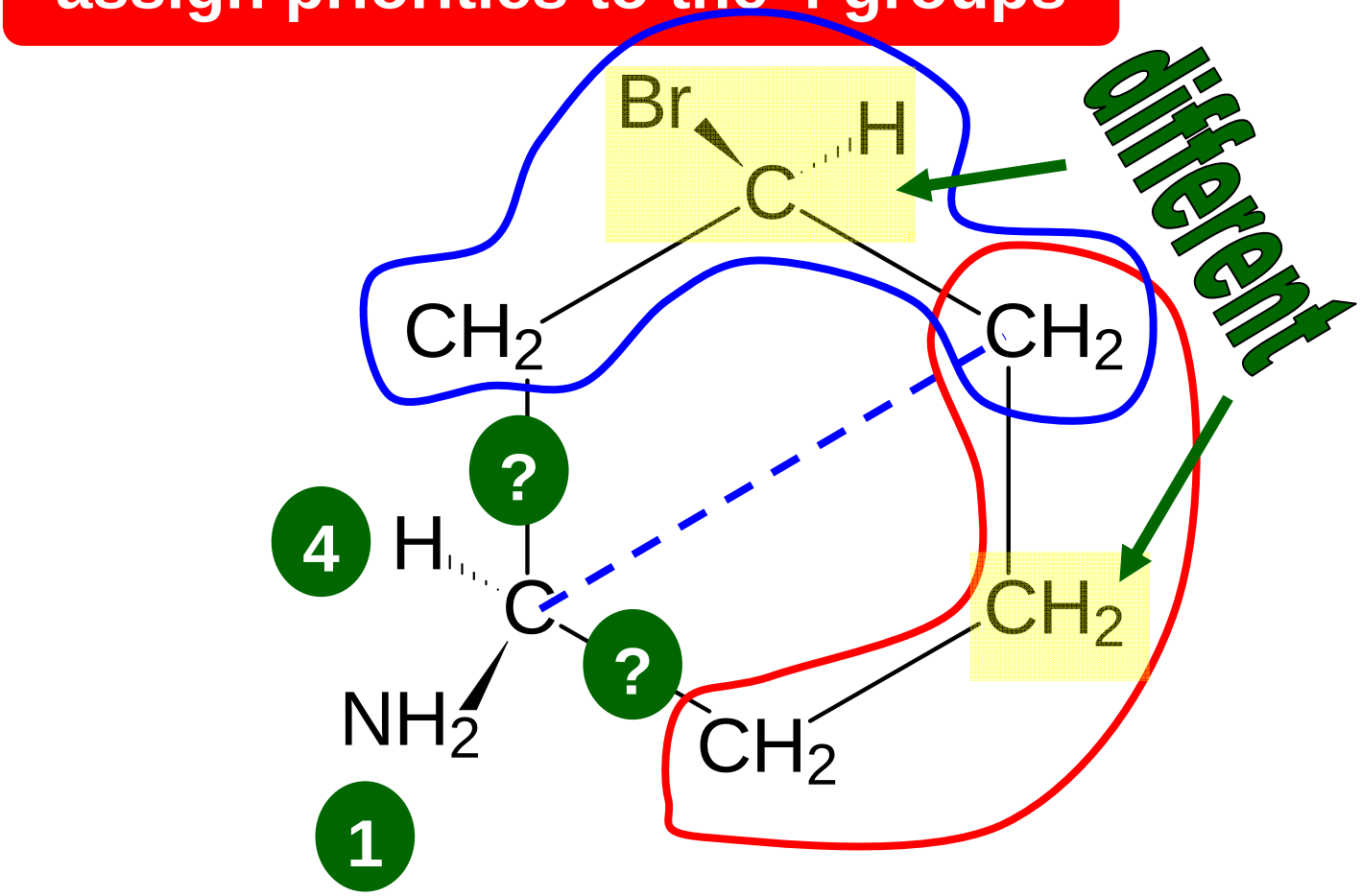
Cyclic Optical Isomers



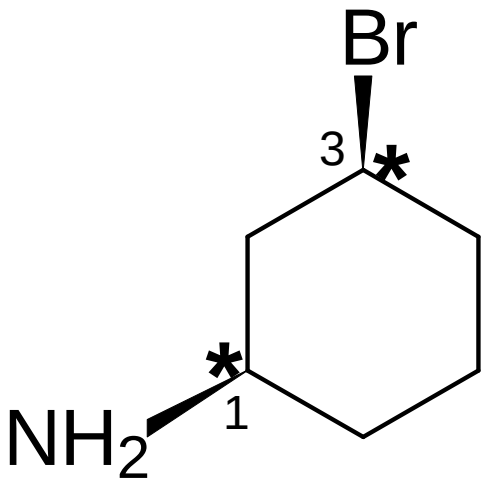
C1 and C3 are both chiral.

Assign chirality (R or S)

assign priorities to the 4 groups



Cyclic Optical Isomers



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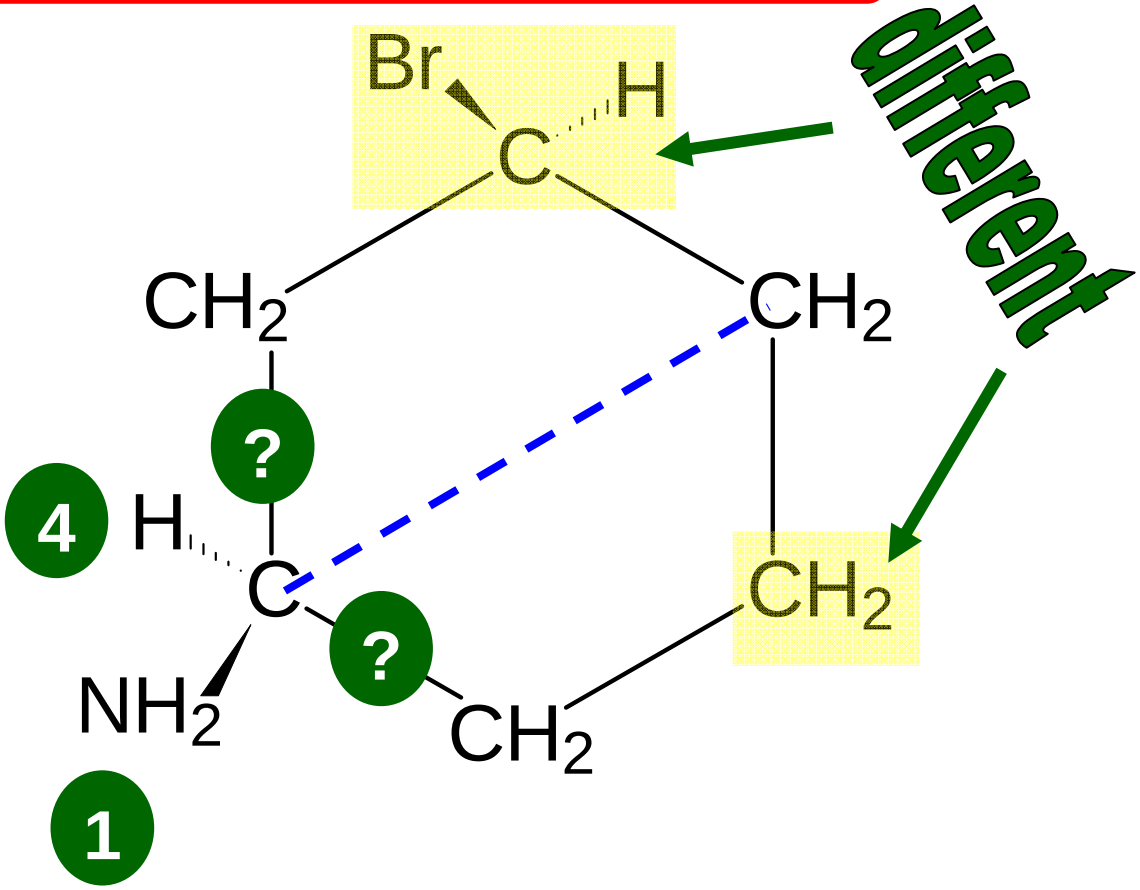
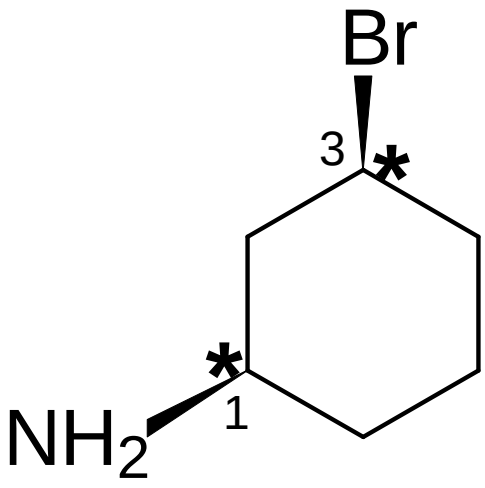


Cyclic Optical Isomers



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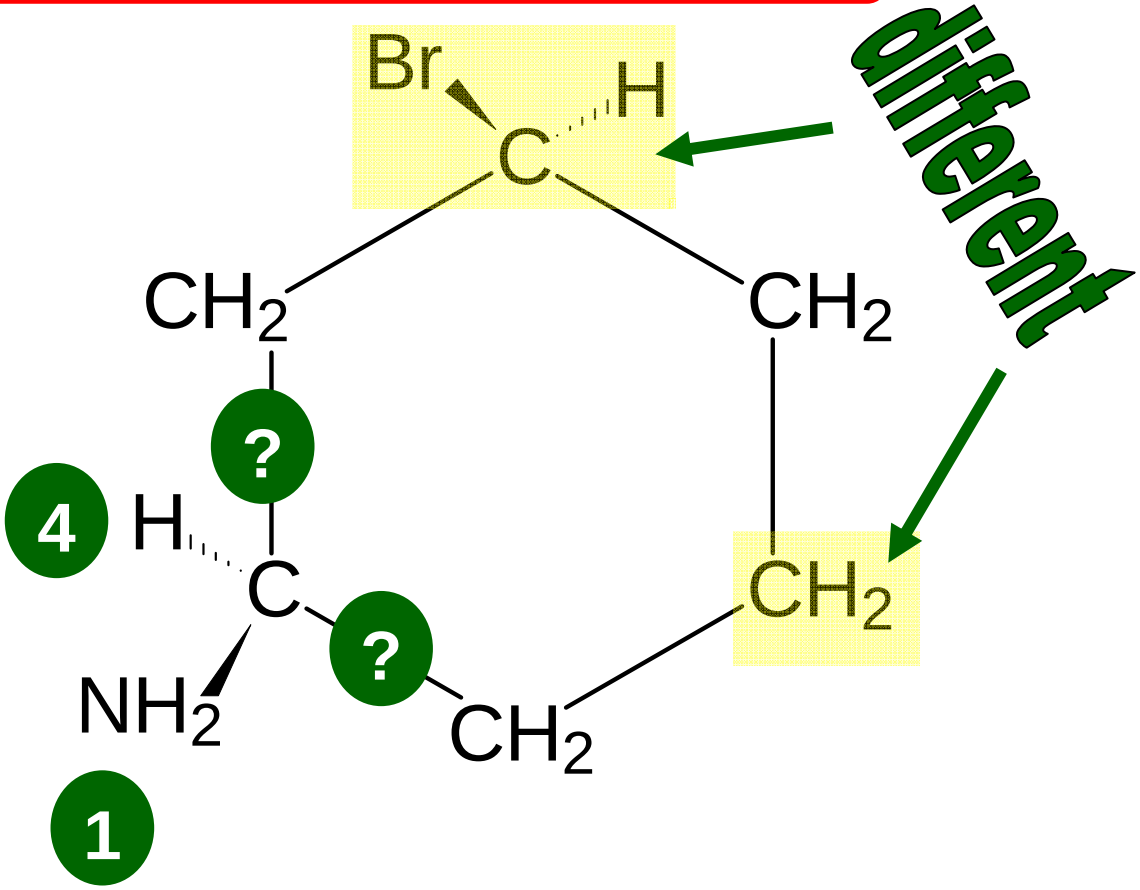
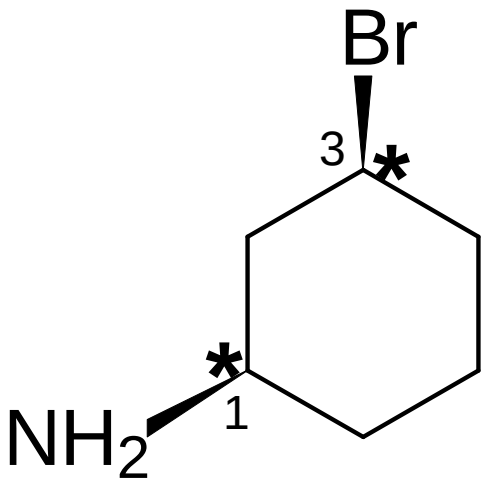


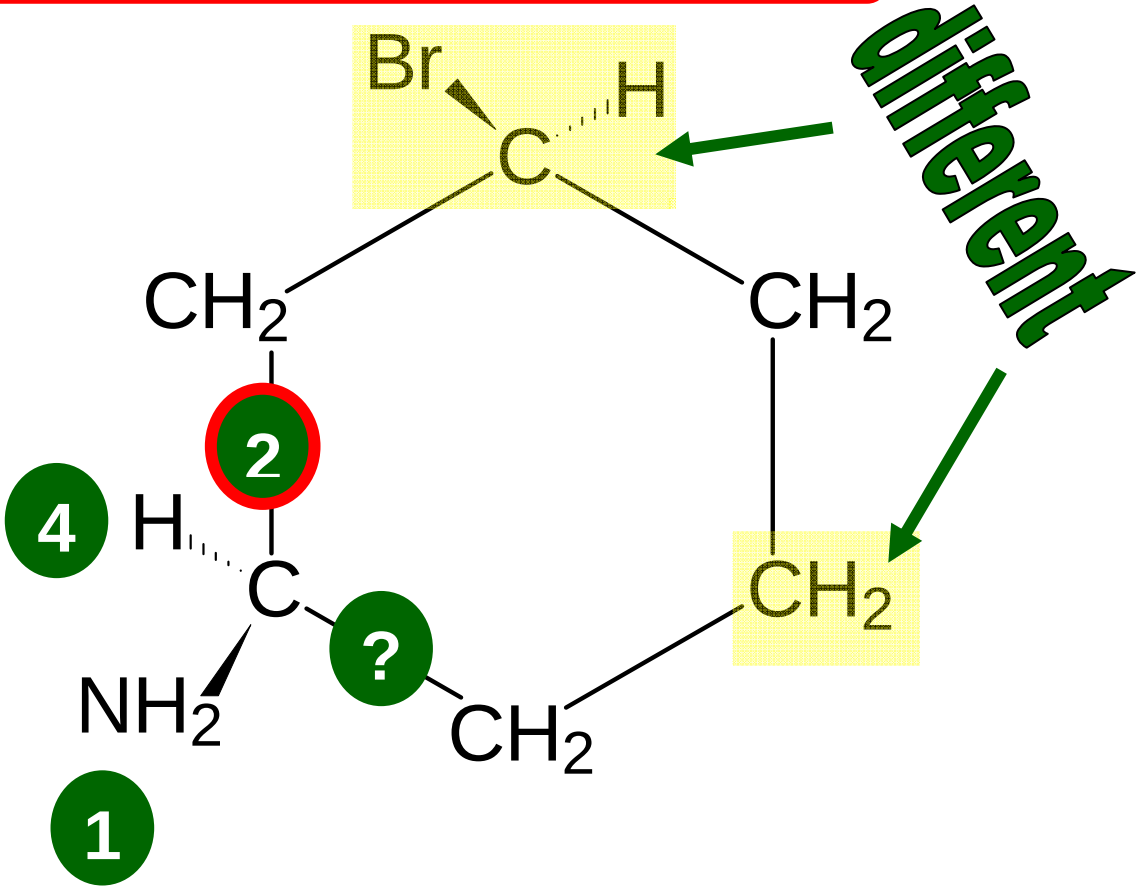
Cyclic Optical Isomers



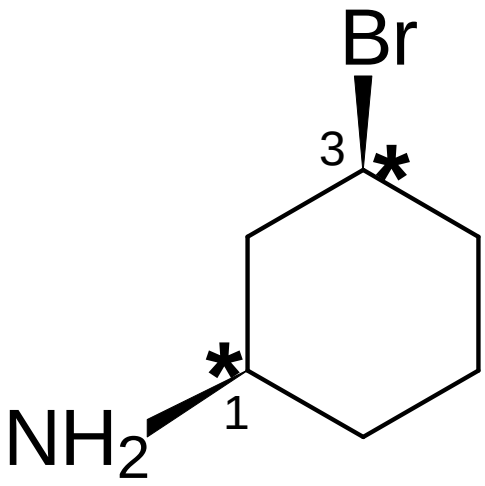
C1 and C3 are both chiral.

Assign chirality (R or S)

assign priorities to the 4 groups



Cyclic Optical Isomers



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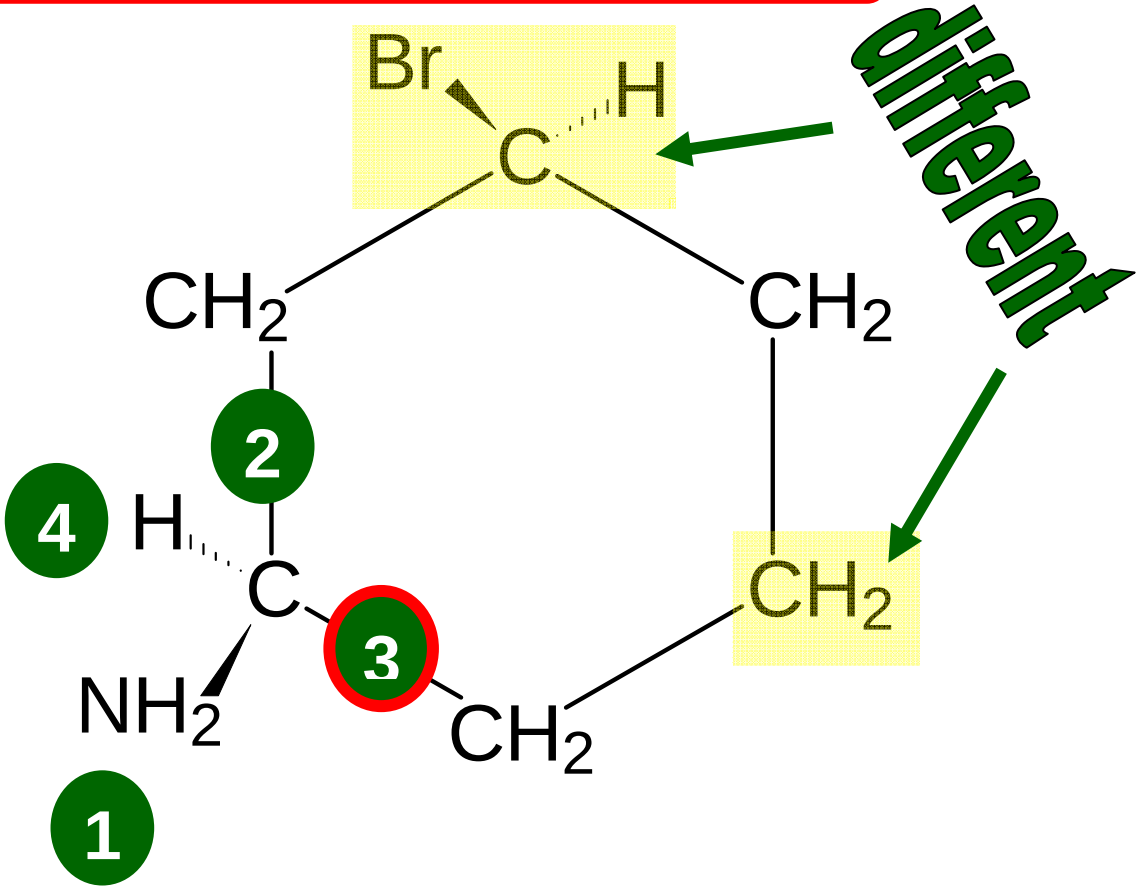
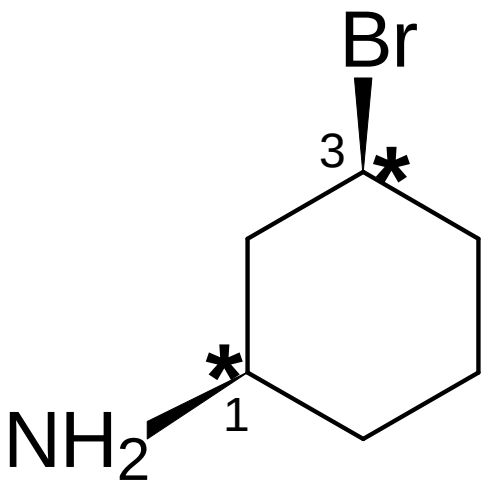


Cyclic Optical Isomers



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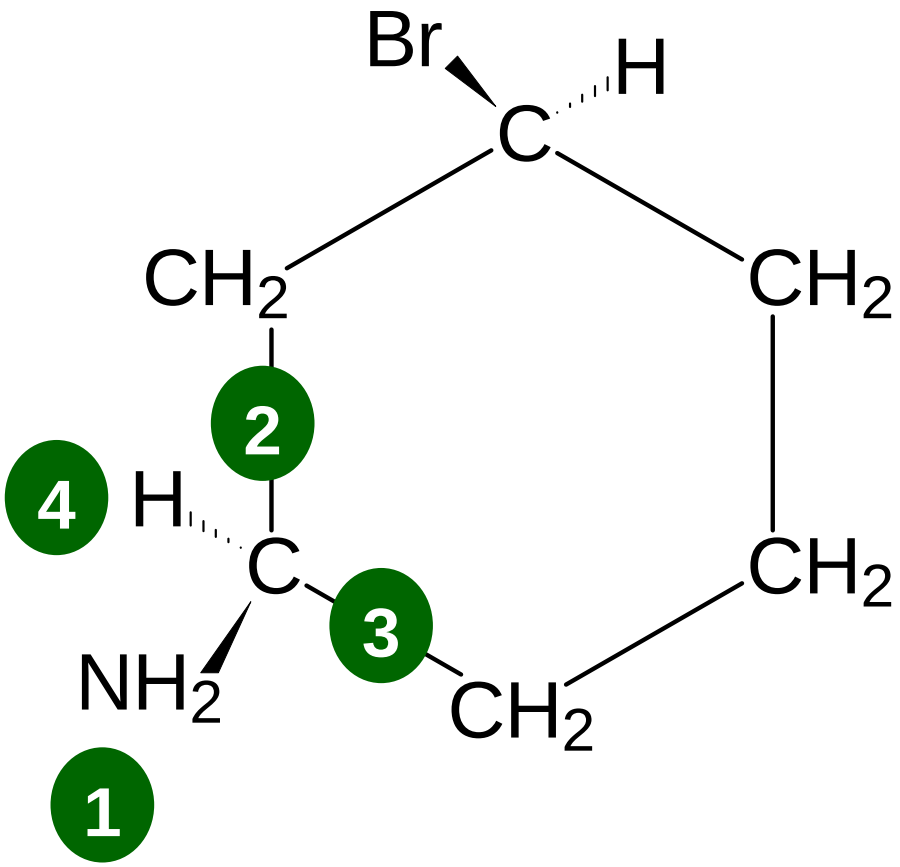
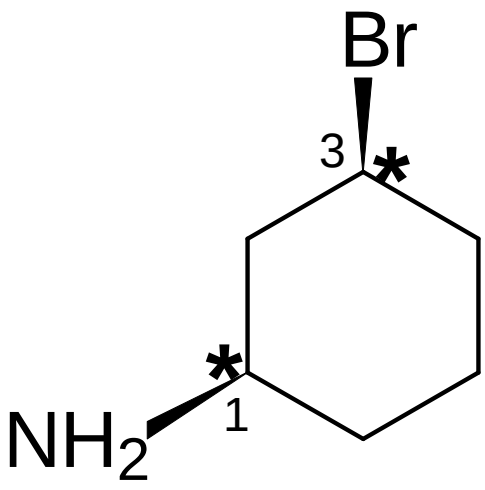


Cyclic Optical Isomers



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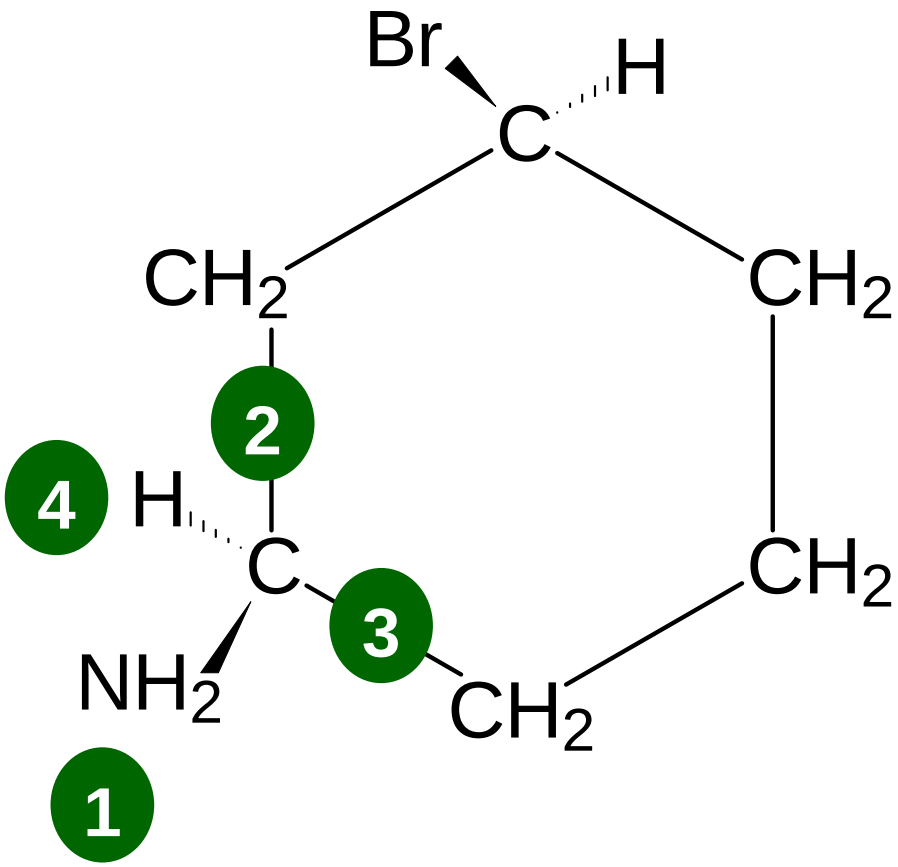
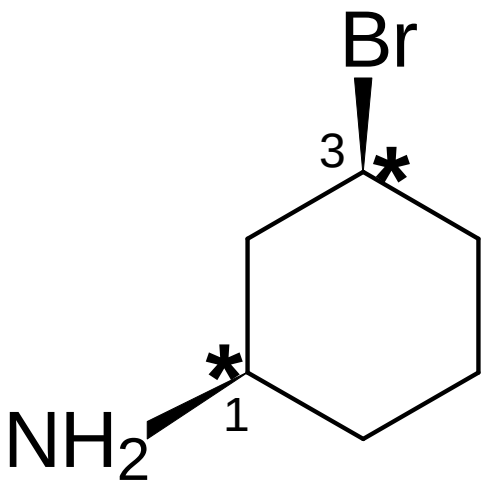
place lowest priority group behind page



Cyclic Optical Isomers



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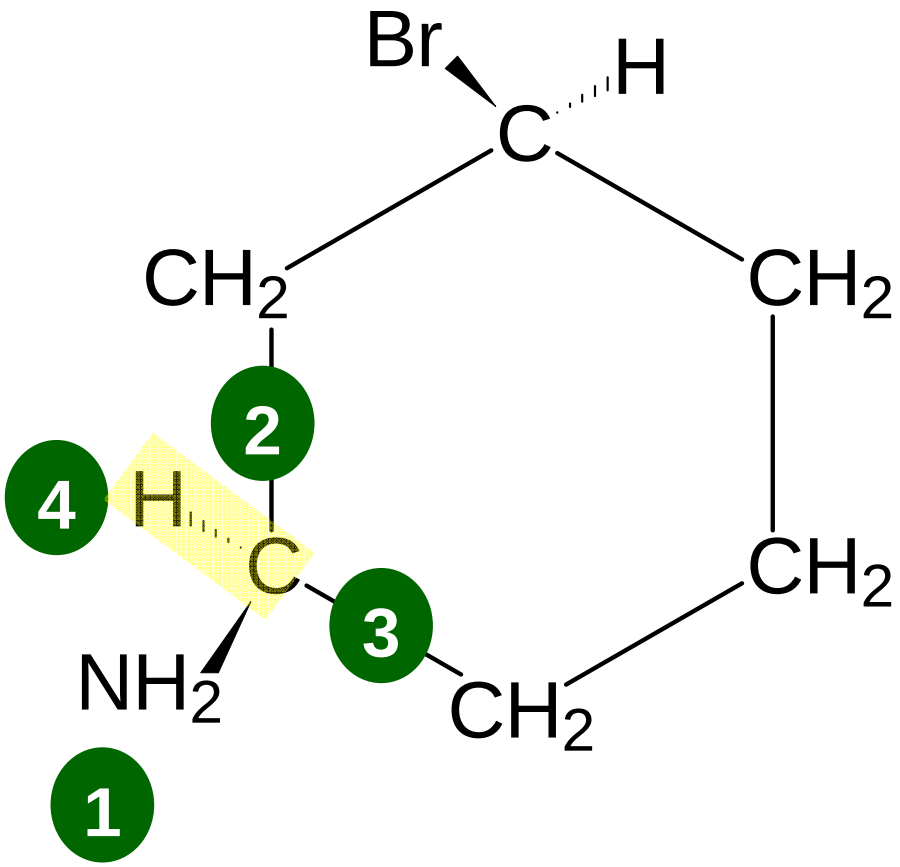
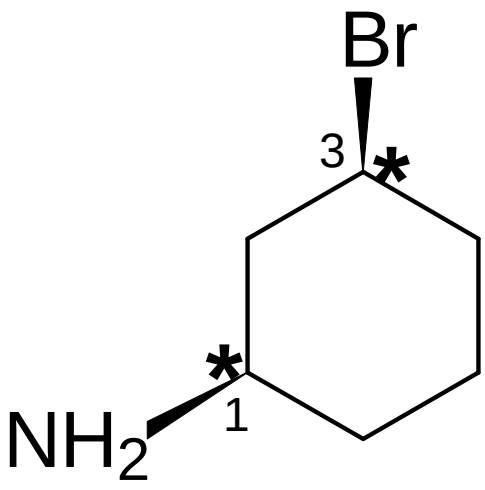


Cyclic Optical Isomers



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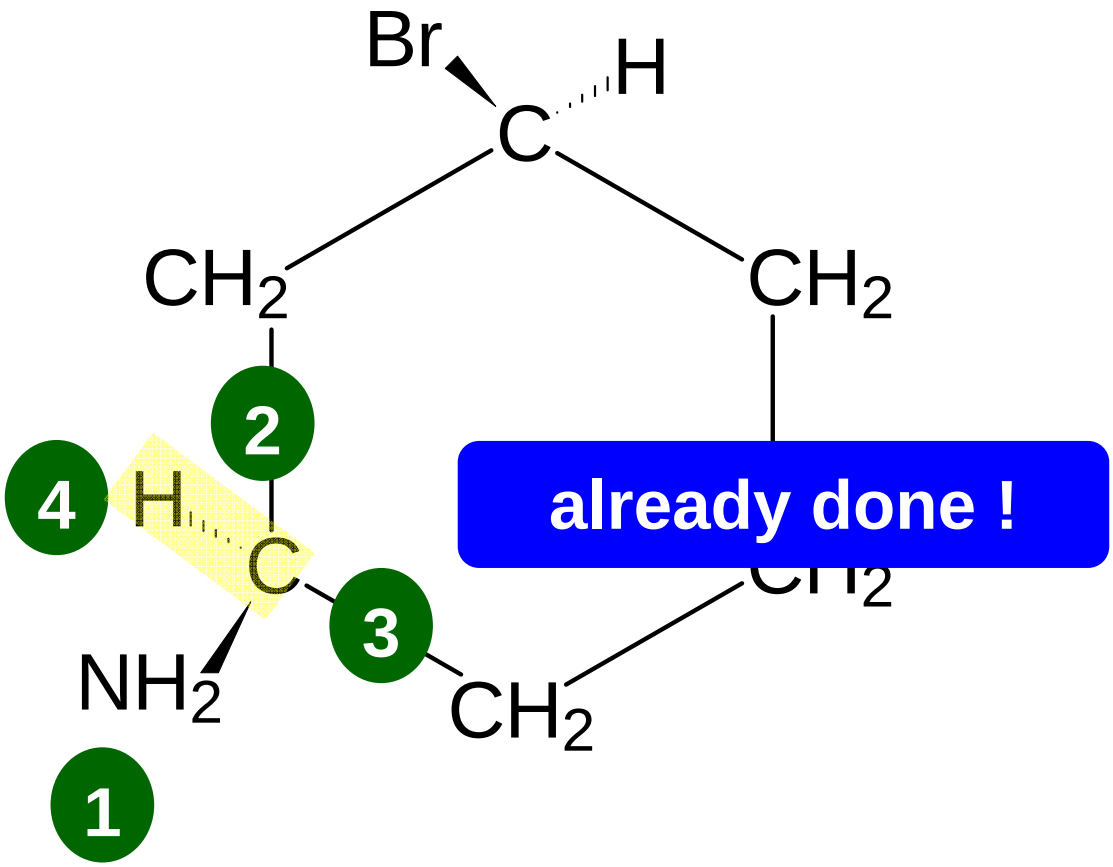
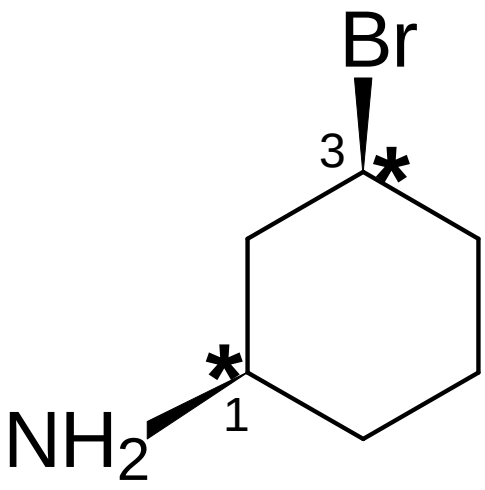


already done !

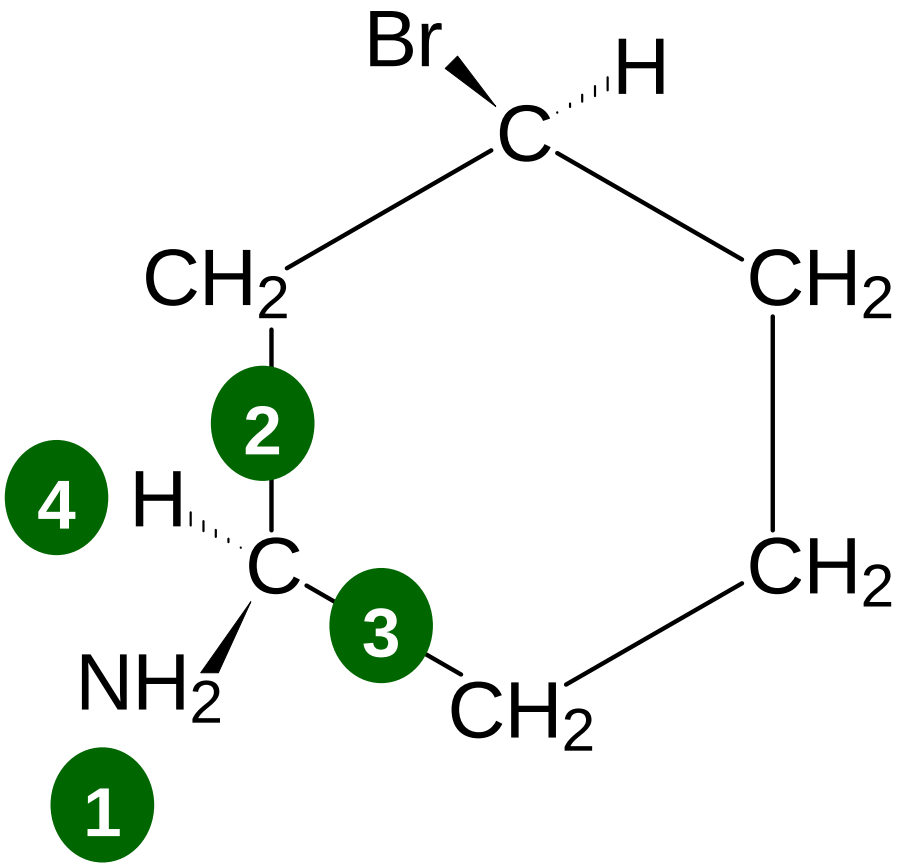
Cyclic Optical Isomers



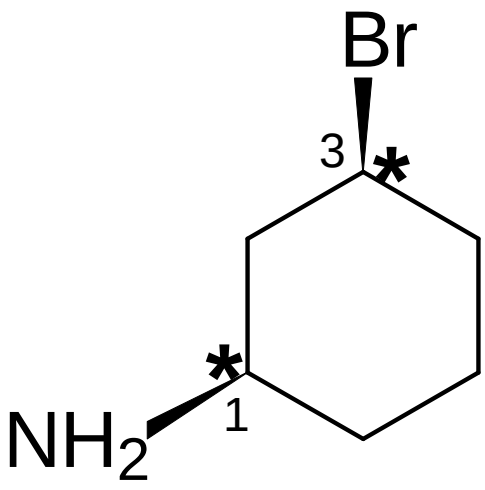
C1 and C3 are both chiral.

Assign chirality (R or S)

assess rotation from 1 to 3



Cyclic Optical Isomers



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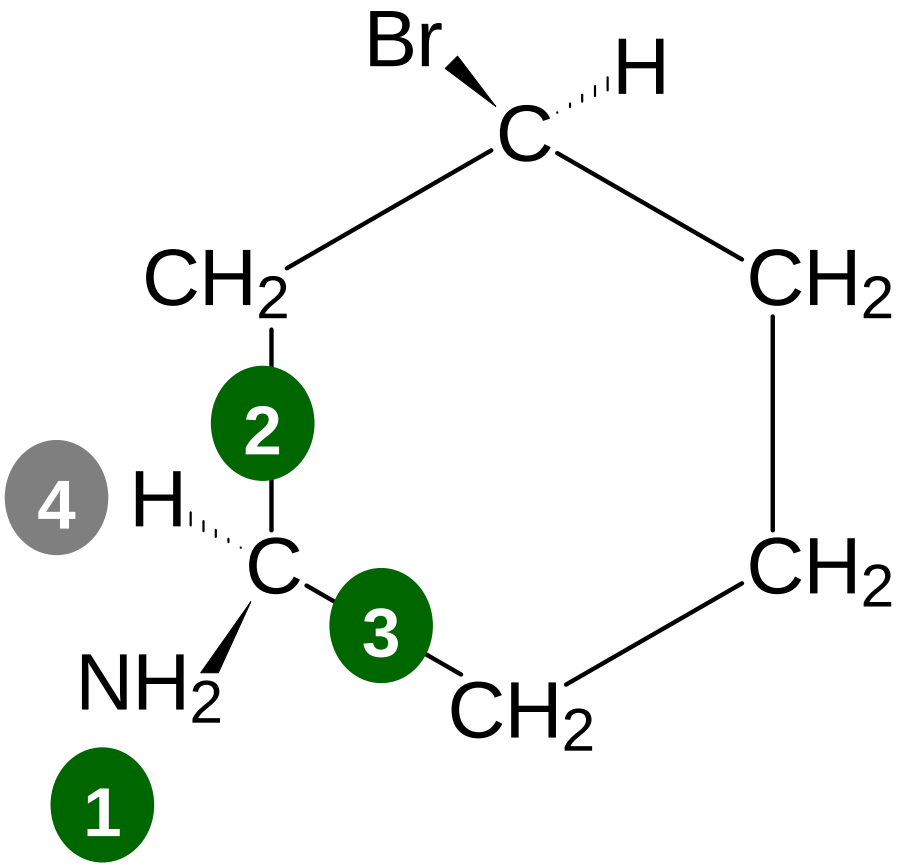
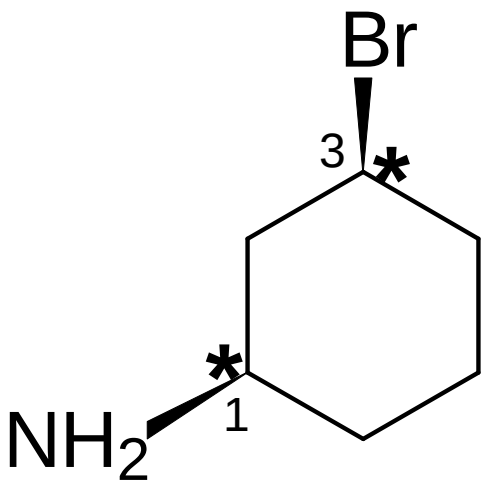


Cyclic Optical Isomers



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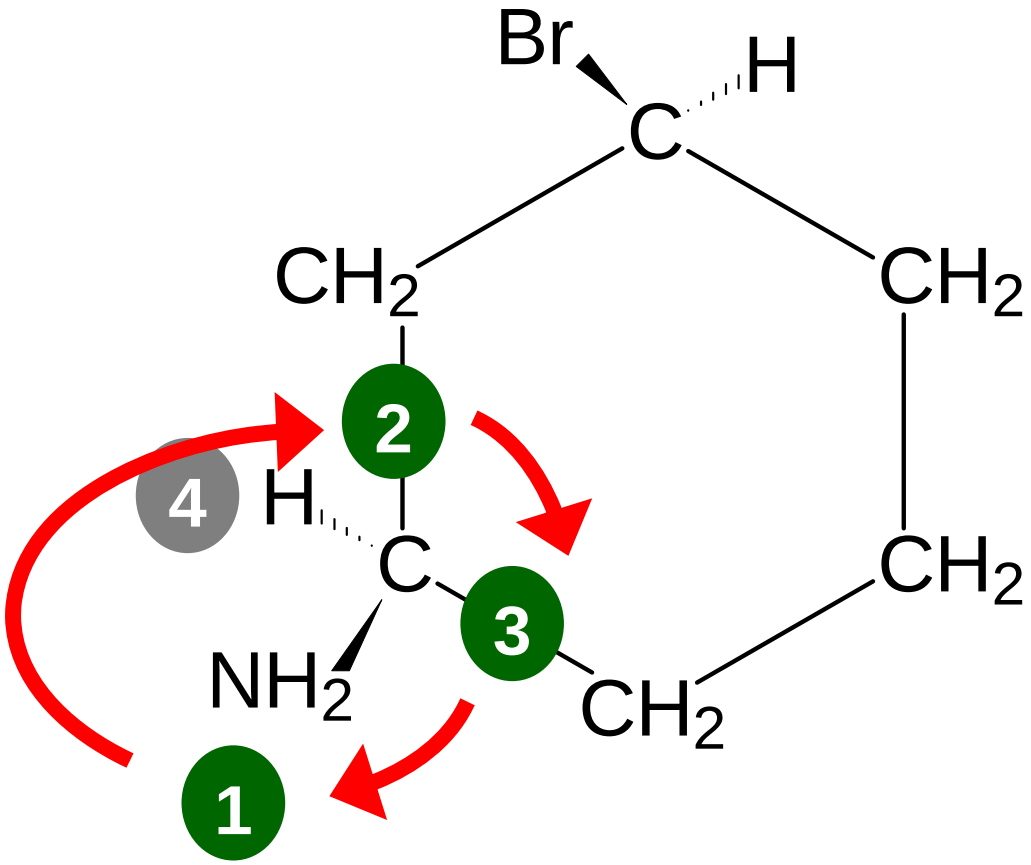
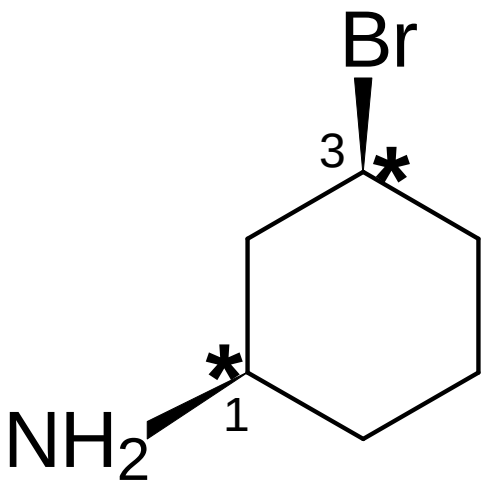


Cyclic Optical Isomers



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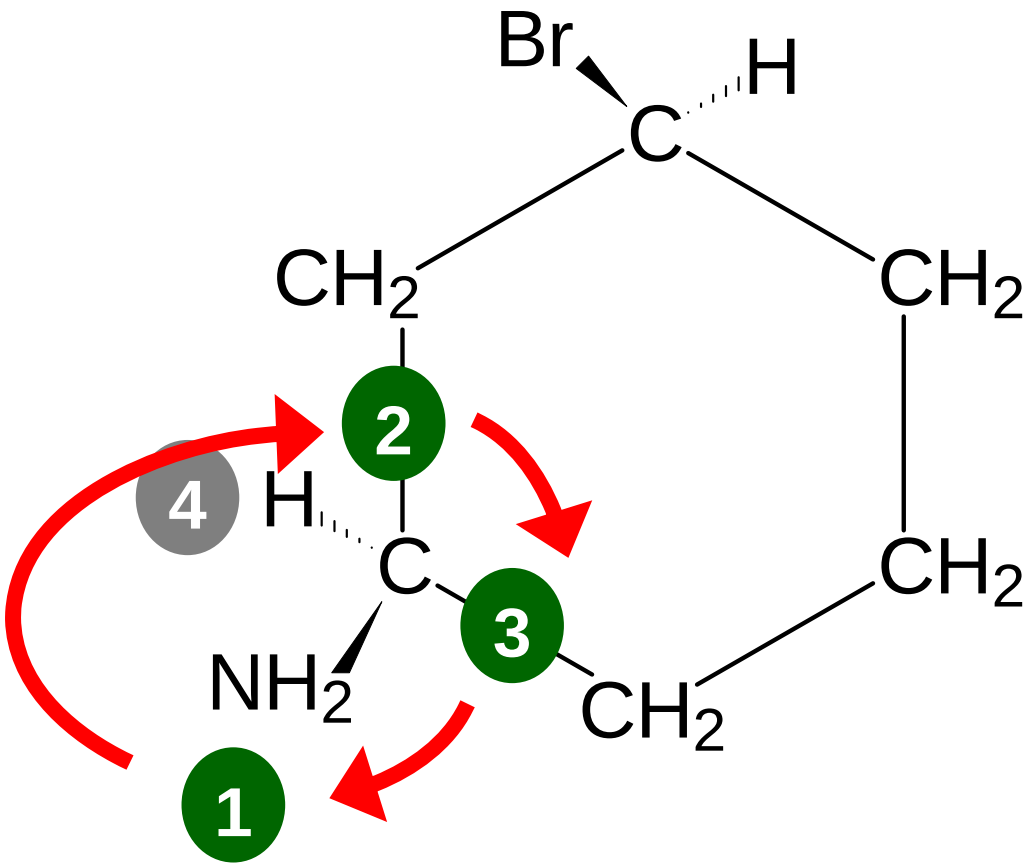
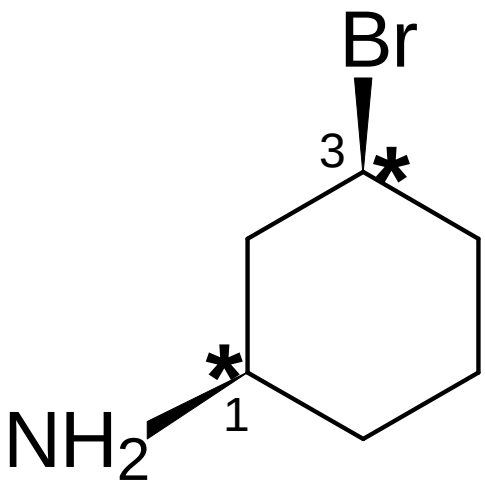


Cyclic Optical Isomers



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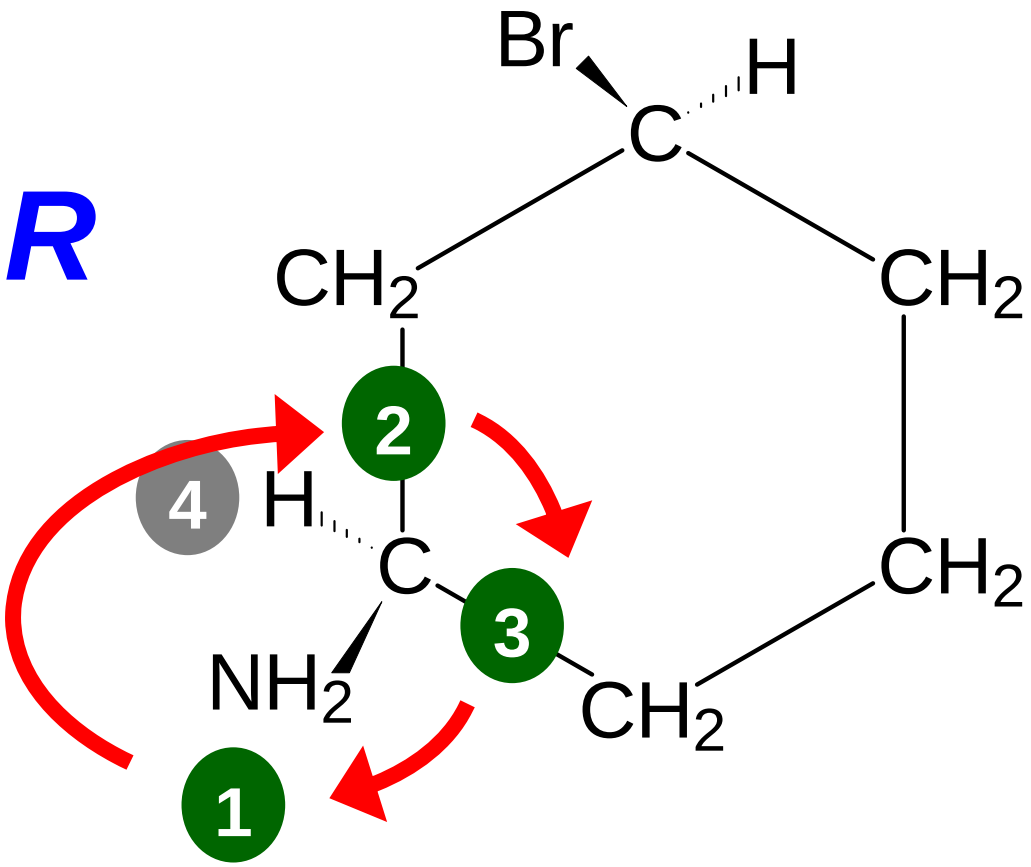
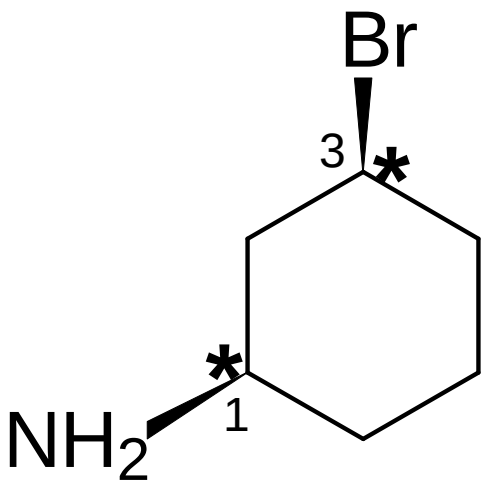
Assign chirality (R or S)

R



Cyclic Optical Isomers



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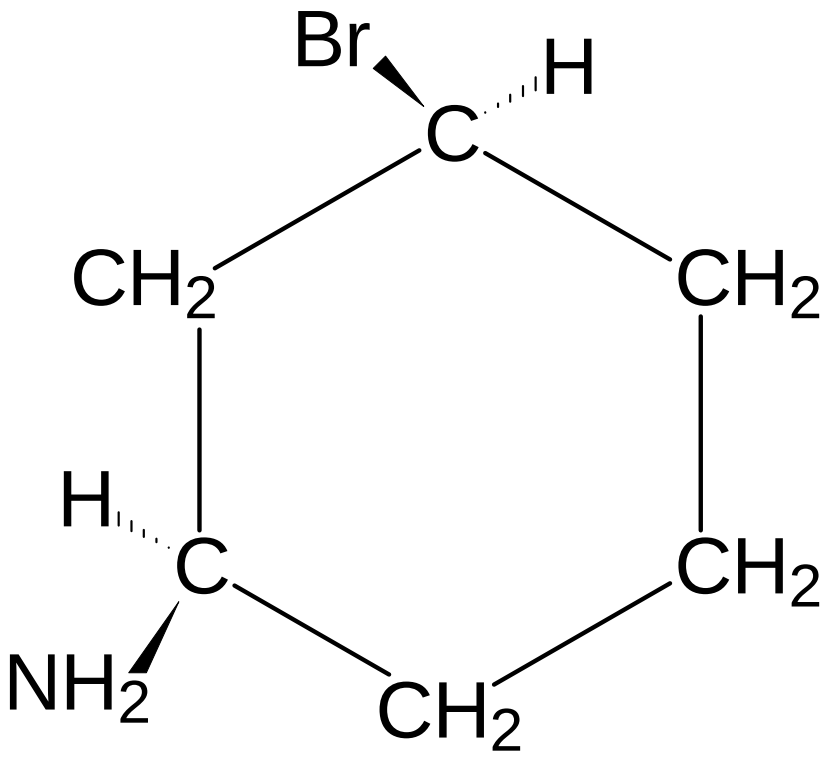
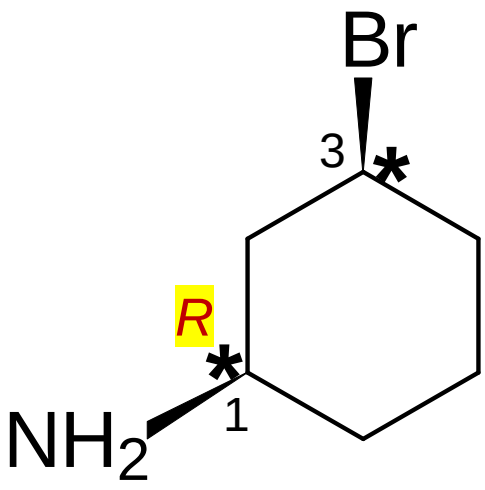


Cyclic Optical Isomers



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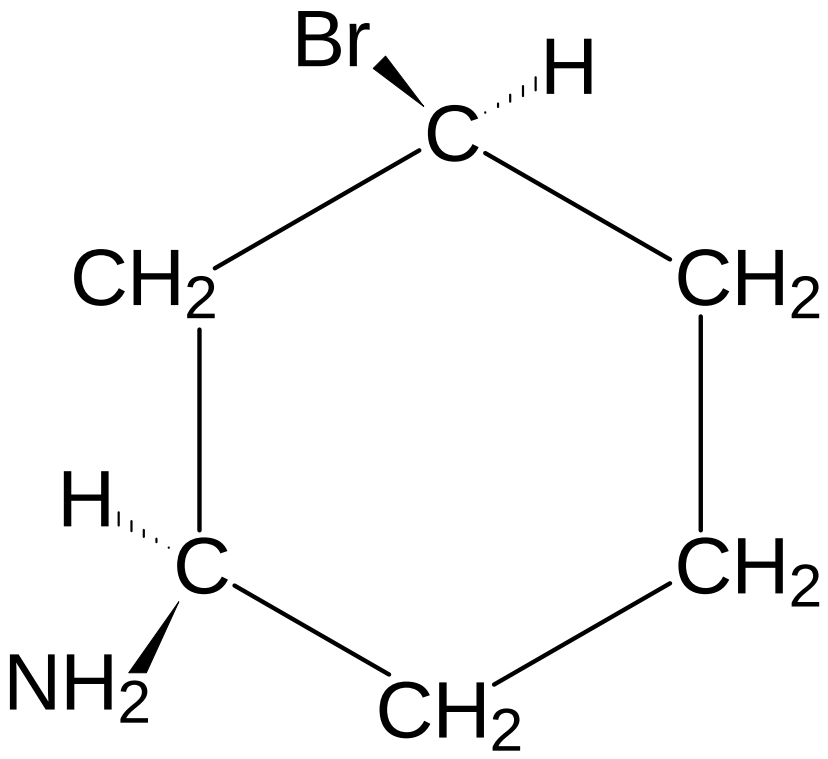
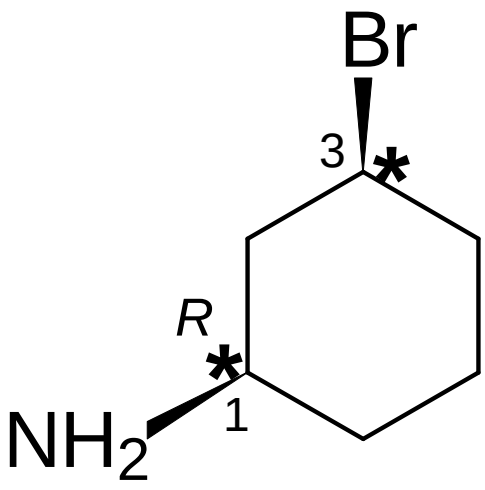


Cyclic Optical Isomers



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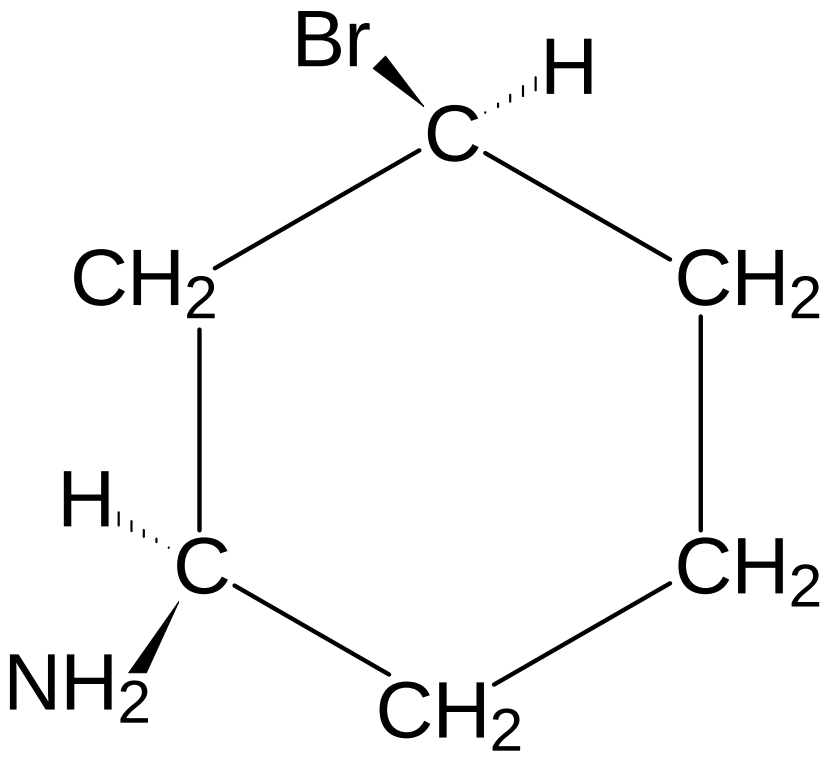

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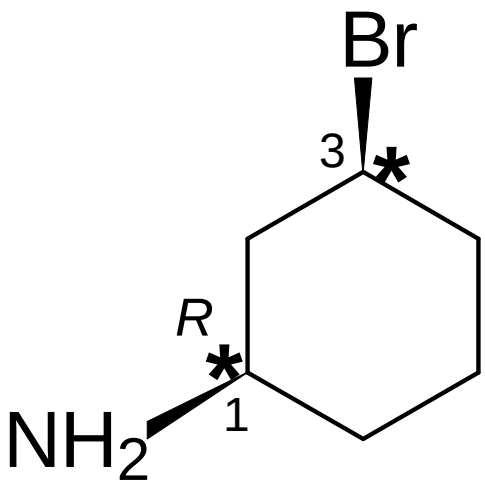

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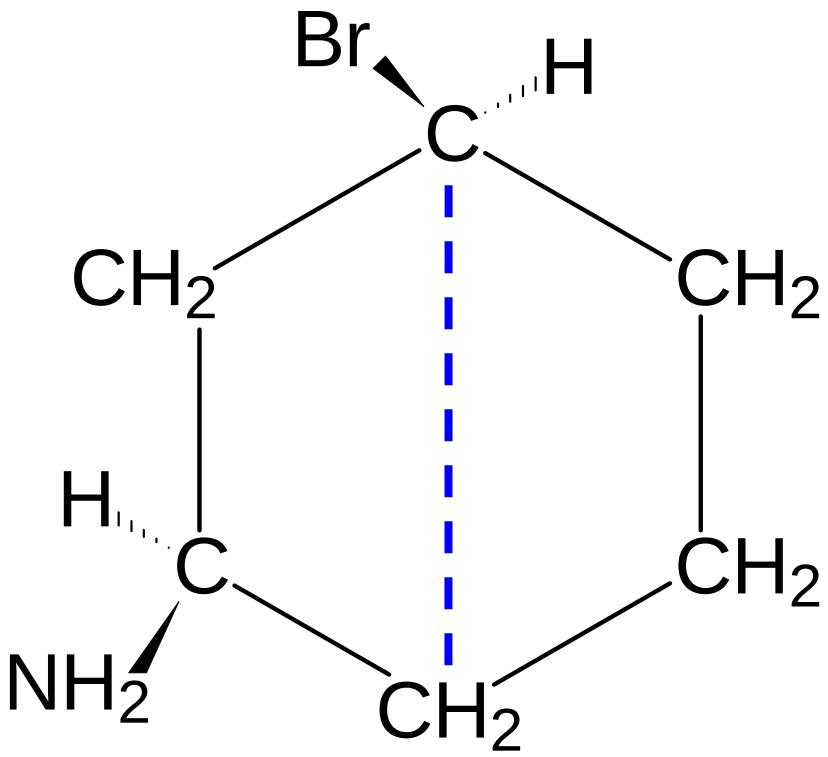
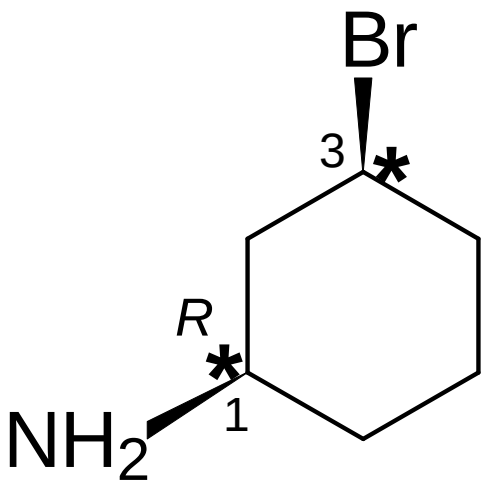


Cyclic Optical Isomers



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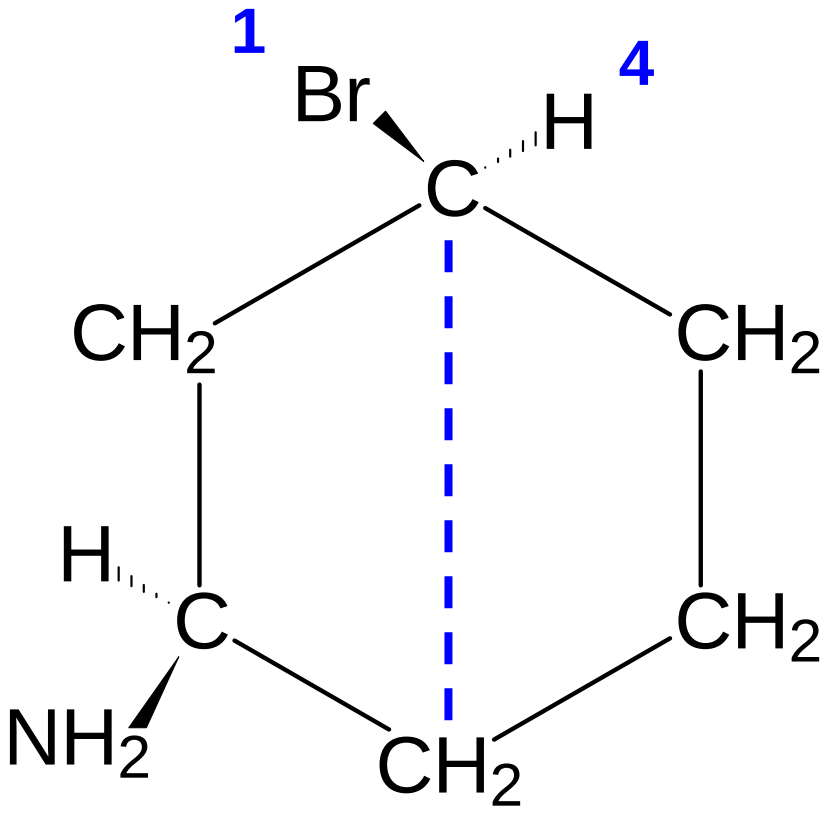

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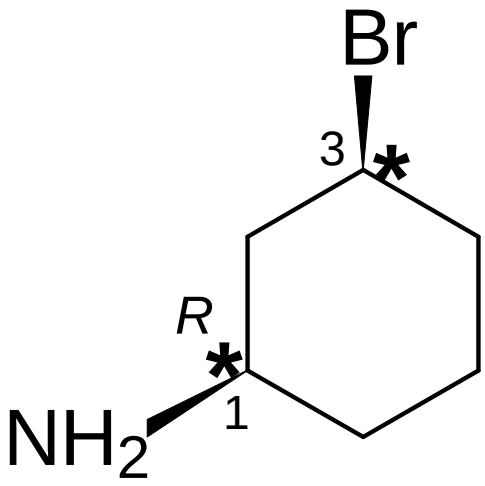

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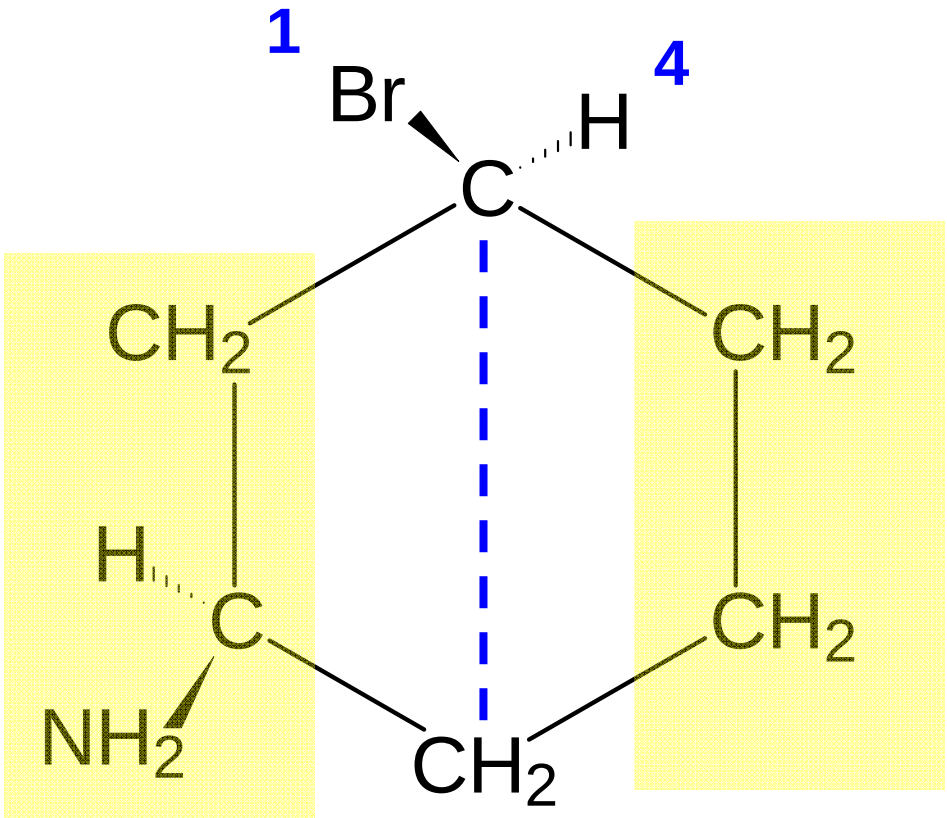

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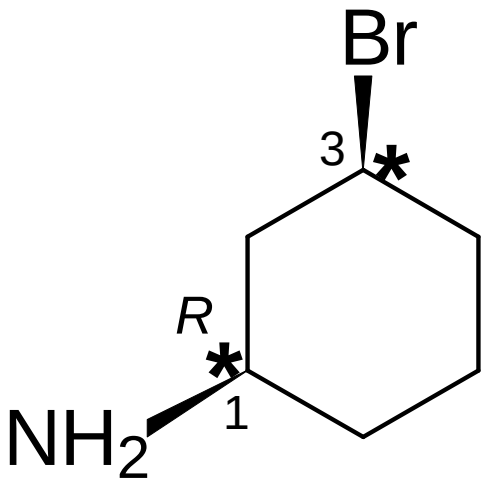

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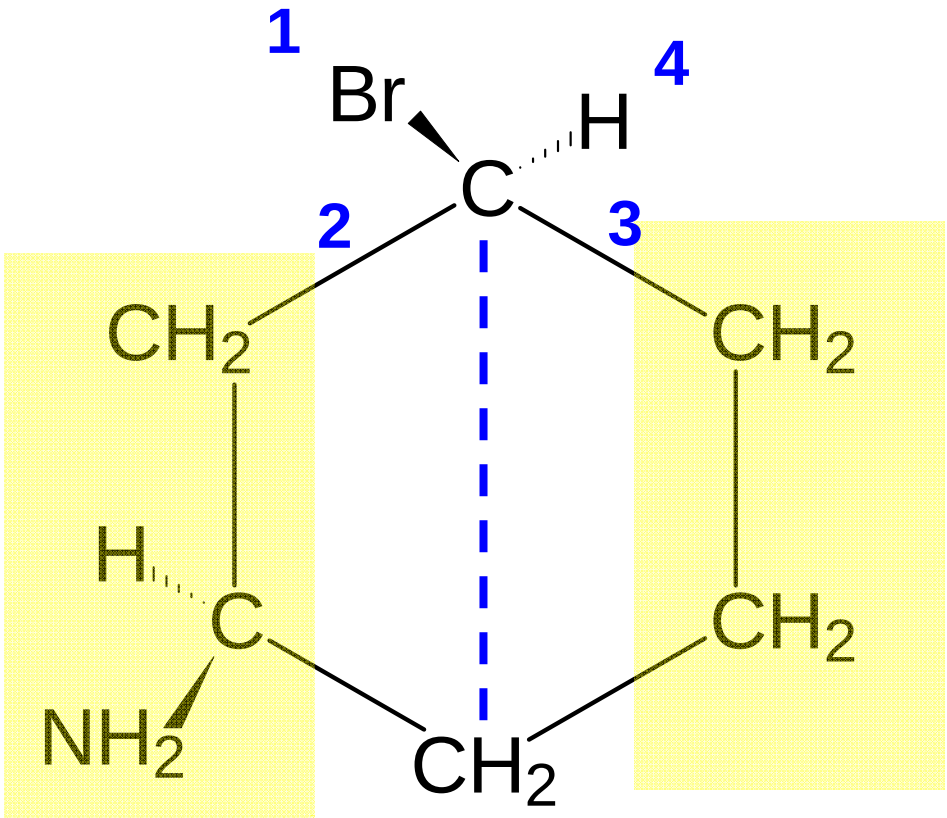

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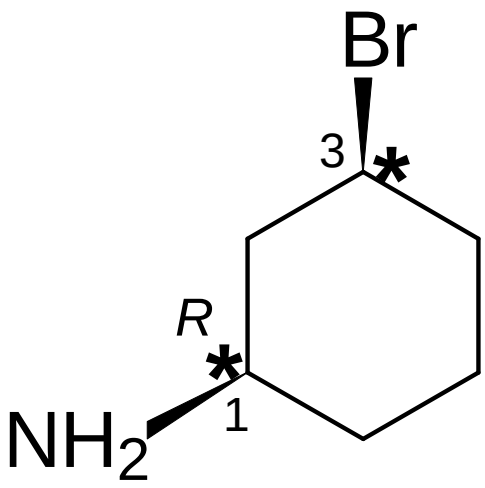

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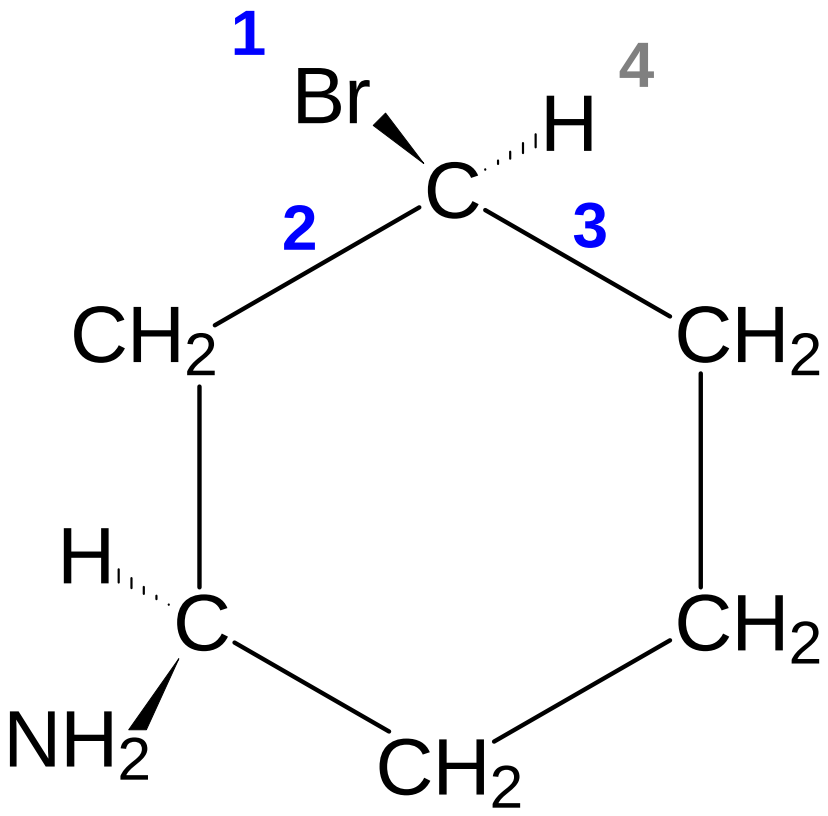

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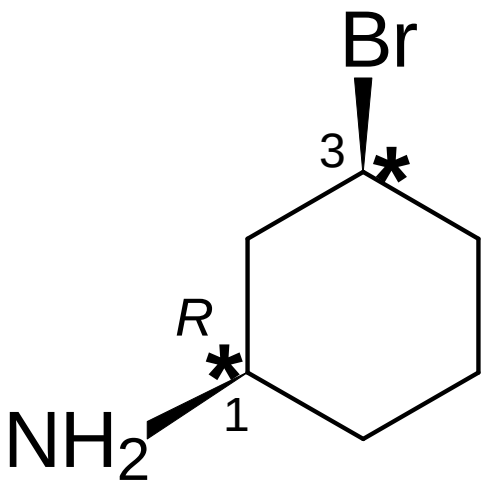

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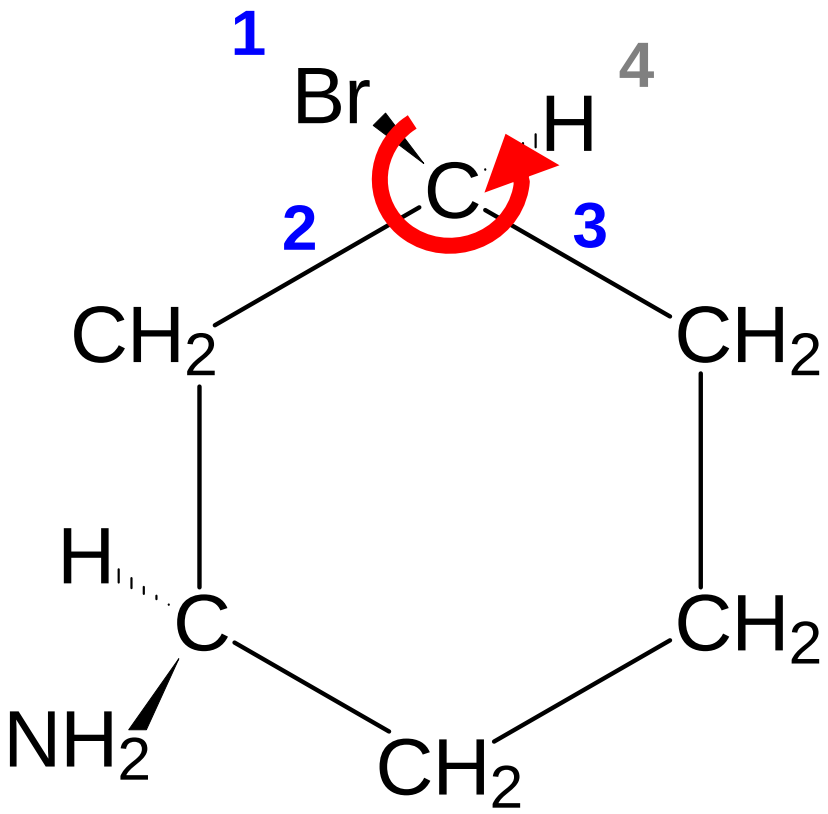
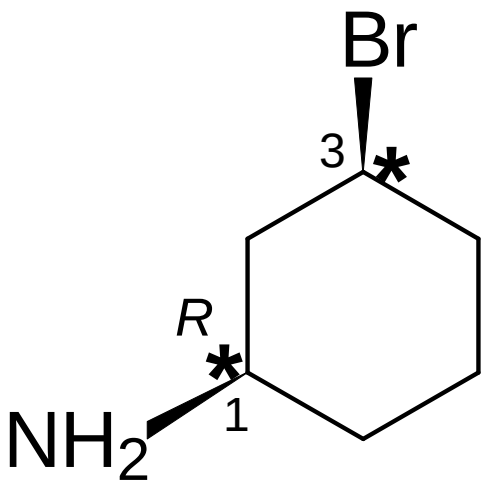


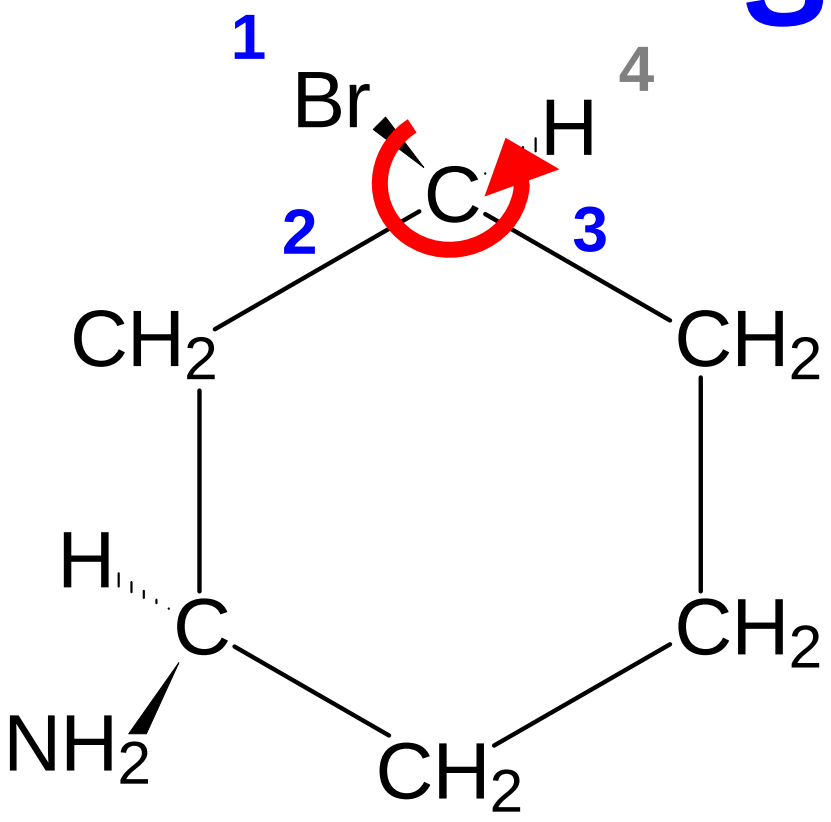
Cyclic Optical Isomers



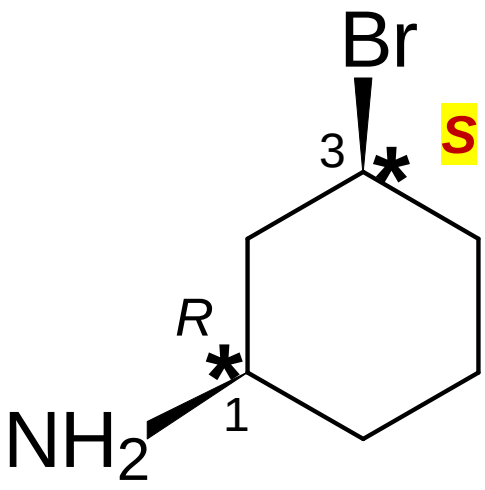
C1 and C3 are both chiral.

Assign chirality (R or S)

S



Cyclic Optical Isomers



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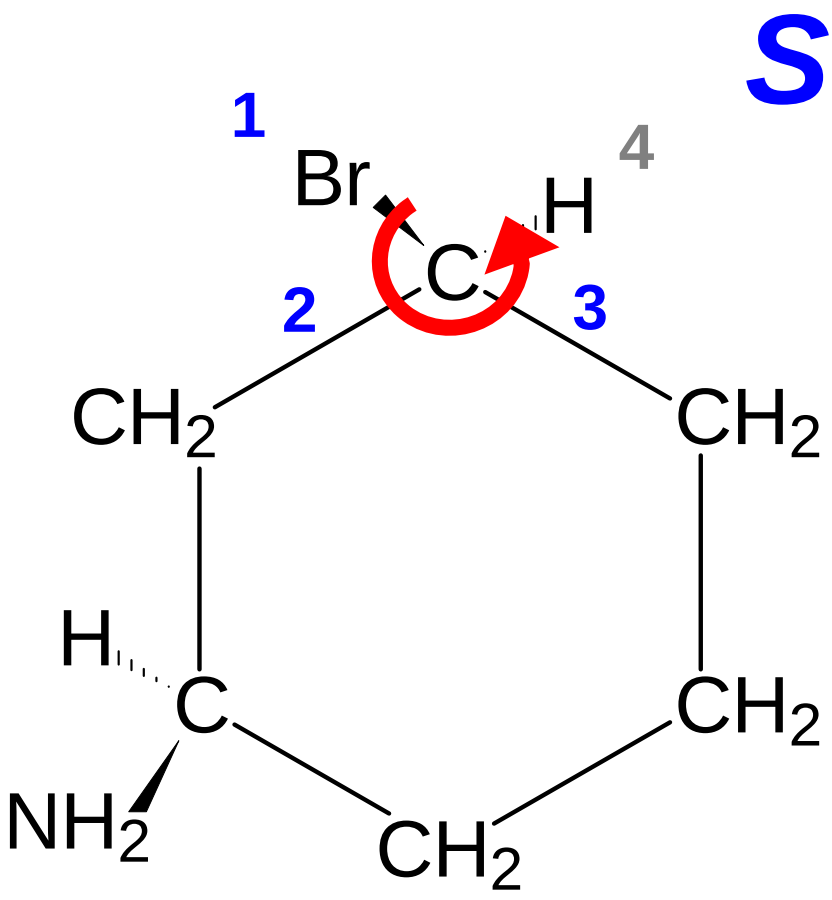
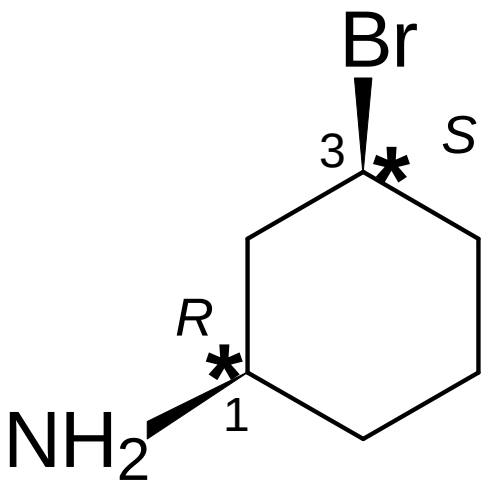


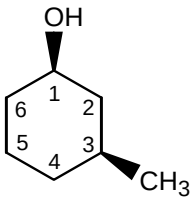
Cyclic Optical Isomers



C1 and C3 are both chiral.

Assign chirality (R or S)

5. ***cis*-3-methylcyclohexanol:**

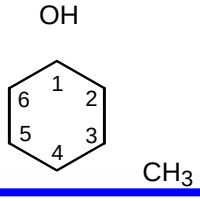


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

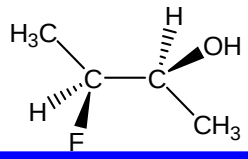
Use the dashed-line-wedge notation to depict the mirror image:



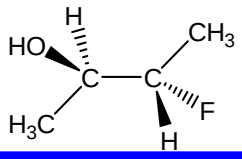
*What is the R/S configuration at carbon 1?*_____

6. **3-fluorobutan-2-ol: $^{4}CH_3\,^{3}CHF\text{-}\,^{2}CH(OH)\,^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:

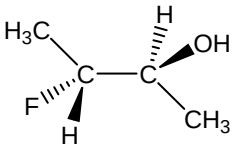


(a)



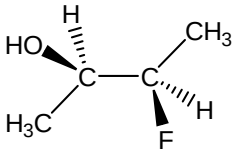
(b)

enantiomers & diasteroemers



2___,3___

(c)



2___,3___

(d)

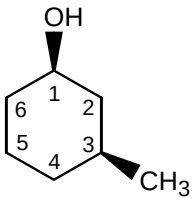
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

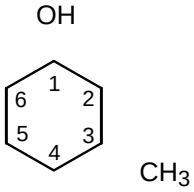


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

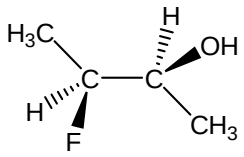
Use the dashed-line-wedge notation to depict the mirror image:



*What is the R/S configuration at carbon 1?*_____

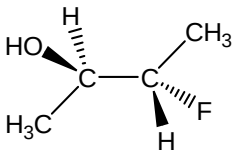
6. **3-fluorobutan-2-ol:** $^{4}CH_3\,^{3}CHF\text{-}\,^{2}CH(OH)\,^{1}CH_3$. **Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



2S,3S

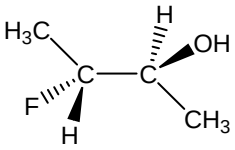
(a)



2___,3___

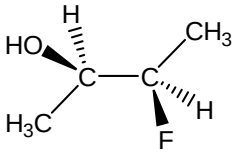
(b)

R or S ?



2___,3___

(c)



2___,3___

(d)

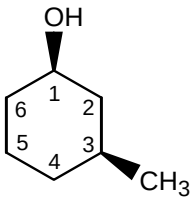
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

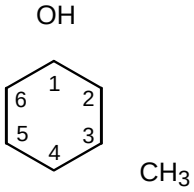


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

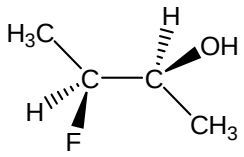
Use the dashed-line-wedge notation to depict the mirror image:



*What is the R/S configuration at carbon 1?*_____

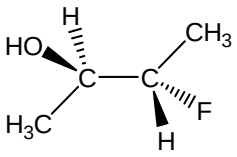
6. **3-fluorobutan-2-ol:** $^{4}CH_3\overset{3}{C}HF\text{-}\overset{2}{C}H(OH)\overset{1}{C}H_3$. **Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



2S,3S

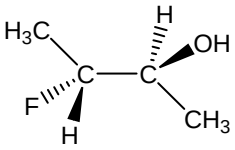
(a)



2___,3___

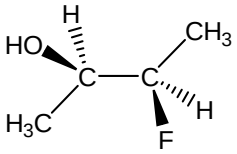
(b)

R or S ?



2___,3___

(c)



2___,3___

(d)

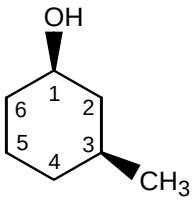
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

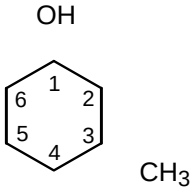


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

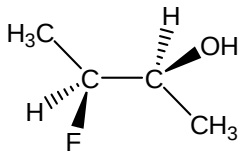
Use the dashed-line-wedge notation to depict the mirror image:



*What is the R/S configuration at carbon 1?*_____

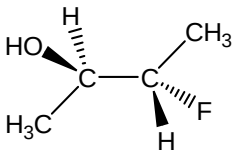
6. **3-fluorobutan-2-ol: $^{4}CH_3{}^{3}CHF\text{-}{}^{2}CH(OH){}^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



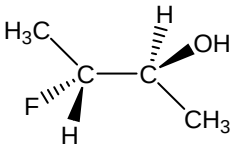
2S,3S

(a)



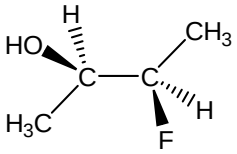
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

enantiomer

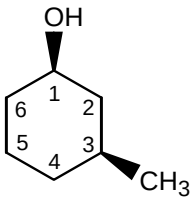
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

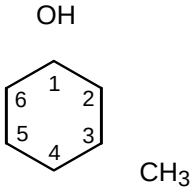


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

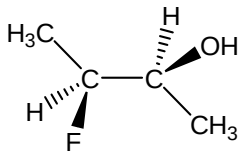
Use the dashed-line-wedge notation to depict the mirror image:



*What is the R/S configuration at carbon 1?*_____

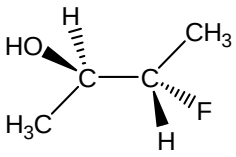
6. **3-fluorobutan-2-ol: $^{4}CH_3\,^{3}CHF\text{-}\,^{2}CH(OH)\,^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



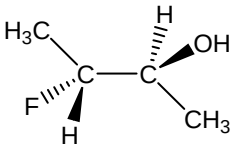
2S,3S

(a)



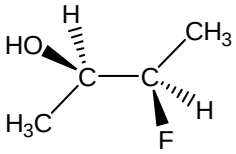
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

enantiomer

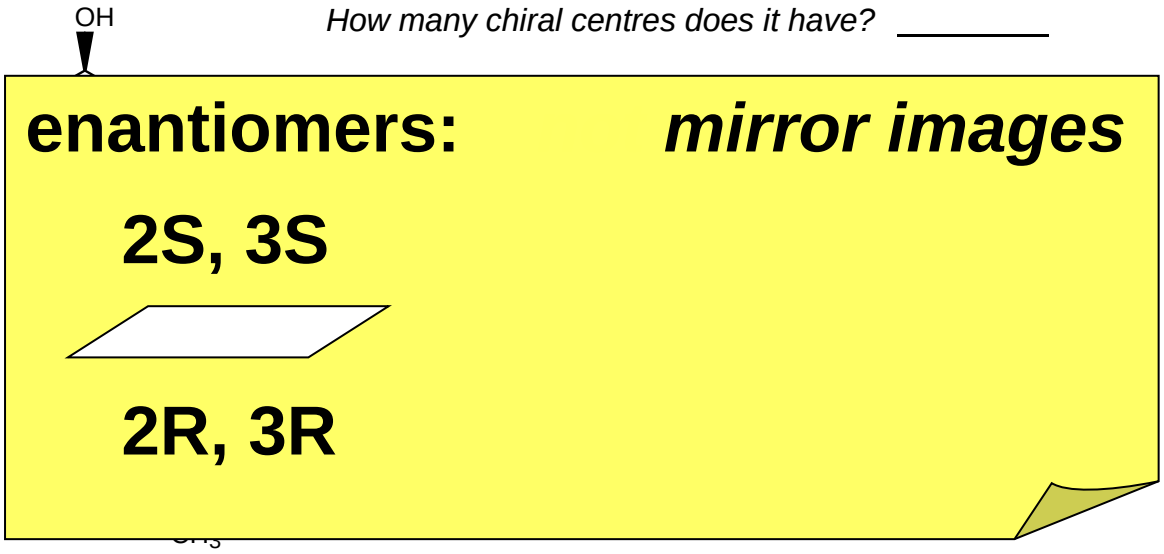
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

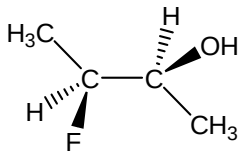
How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**



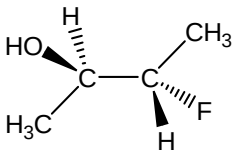
6. **3-fluorobutan-2-ol: $^{4}CH_3{}^{3}CHF\text{-}{}^{2}CH(OH){}^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



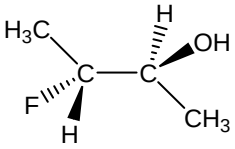
2S,3S

(a)



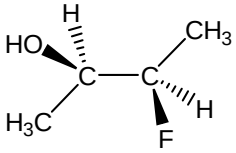
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

enantiomer

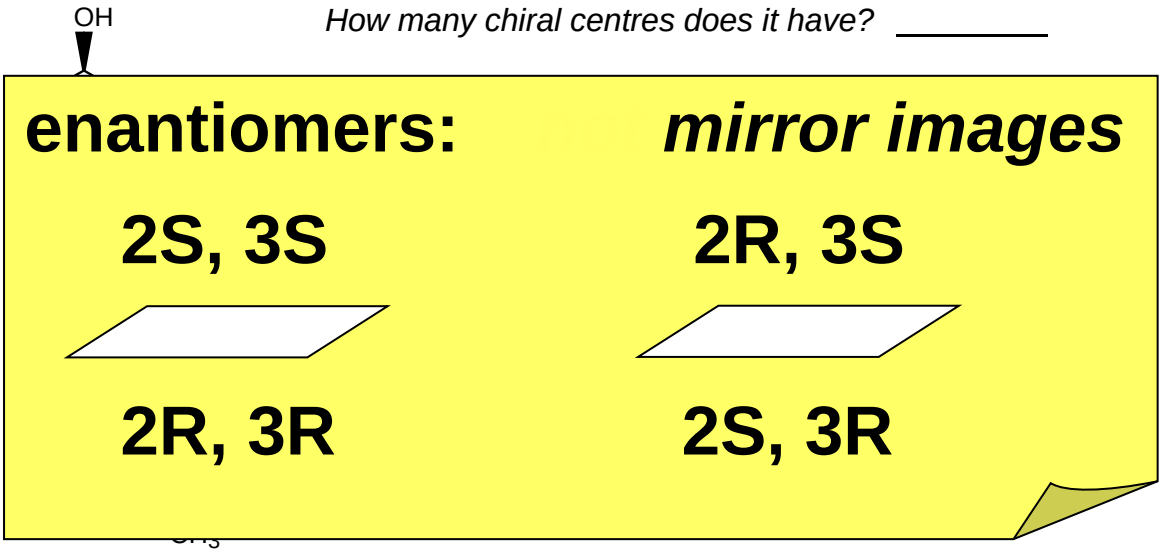
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

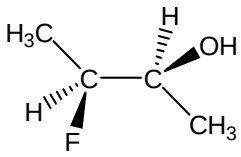
How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**



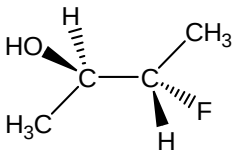
6. **3-fluorobutan-2-ol: $^{4}CH_3{}^{3}CHF\text{-}{}^{2}CH(OH){}^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



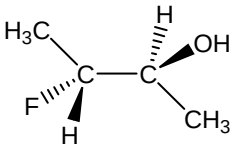
2S,3S

(a)



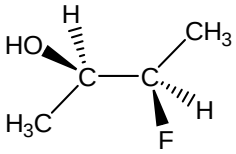
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

enantiomer

*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

How many chiral centres does it have? _____

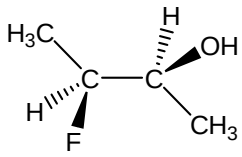
enantiomers: ***mirror images***

2S, 3S ↕ **two pairs** ↕ **2R, 3S**

2R, 3R **2S, 3R**

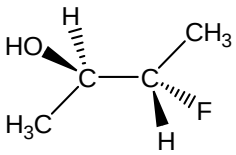
6. **3-fluorobutan-2-ol:** $^{4}CH_3\,^{3}CHF\text{-}\,^{2}CH(OH)\,^{1}CH_3$. **Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



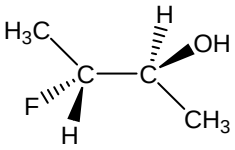
2S,3S

(a)



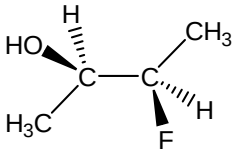
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

enantiomer

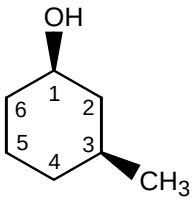
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

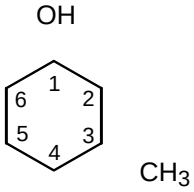


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

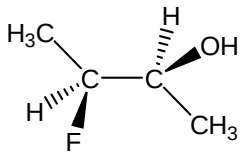
Use the dashed-line-wedge notation to depict the mirror image:



*What is the R/S configuration at carbon 1?*_____

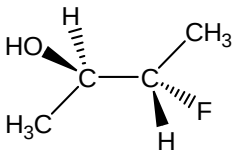
6. **3-fluorobutan-2-ol: $^{4}CH_3\,^{3}CHF\text{-}\,^{2}CH(OH)\,^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



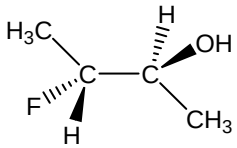
2S,3S

(a)



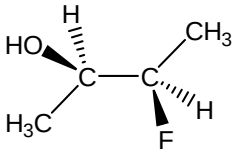
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

diastereomer

*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____.

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

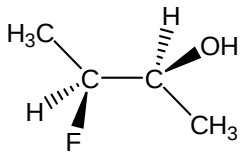
5. ***cis*-3-methylcyclohexanol:**

How many chiral centres does it have? _____

diastereomers: *not* *mirror images*

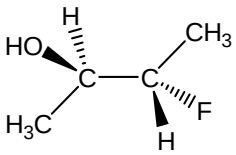
6. **3-fluorobutan-2-ol: $^{4}CH_3{}^{3}CHF\text{-}{}^{2}CH(OH){}^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



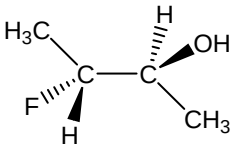
2S,3S

(a)



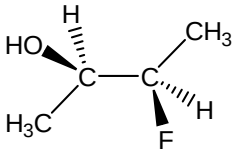
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

diastereomer

*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____.

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

How many chiral centres does it have? _____

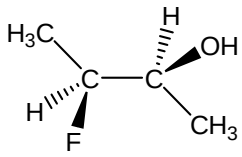
diastereomers: ***not* mirror images**

S,S	S,S	R,R	R,R
↕	↕	↕	↕
S,R	R,S	S,R	R,S

4 sets

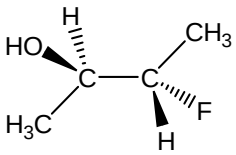
6. **3-fluorobutan-2-ol:** $^{4}CH_3\,^{3}CHF\text{-}\,^{2}CH(OH)\,^{1}CH_3$. **Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



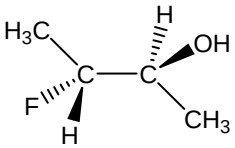
2S,3S

(a)



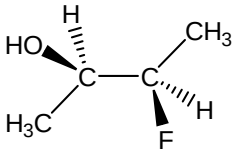
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

diastereomer

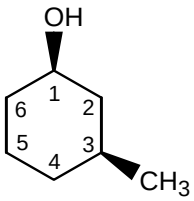
*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____.

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

5. ***cis*-3-methylcyclohexanol:**

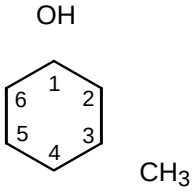


How many chiral centres does it have? _____

Is there a plane of symmetry? _____

What is the R/S configuration at carbon 1? _____

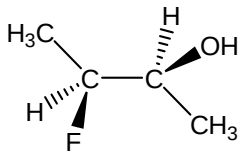
Use the dashed-line-wedge notation to depict the mirror image:



*What is the R/S configuration at carbon 1?*_____

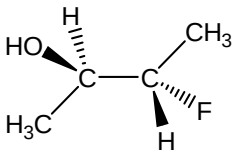
6. **3-fluorobutan-2-ol: $^{4}CH_3{}^{3}CHF\text{-}{}^{2}CH(OH){}^{1}CH_3$. Fill in the blanks below:**

Show the configuration (R or S) at carbons 2 & 3 on stereoisomers (b), (c) & (d) below:



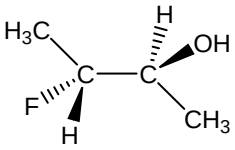
2S,3S

(a)



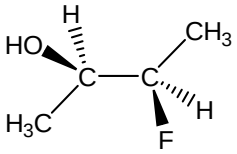
2___,3___

(b)



2___,3___

(c)



2___,3___

(d)

*Give the letter (b, c or d) of **one** enantiomer of conformer (a):* _____

*Give the letters (a, b, d) of **two** diastereomers of conformer (c):* _____ *and* _____.

How many stereoisomers are possible for $CH_3CHF\text{-}CH(OH)CH_3$*?* _____

How many pairs of enantiomers are there? _____

2^n rule