Stereochemistry Assignment

CHM1321
Section A03

Lab Assistant:

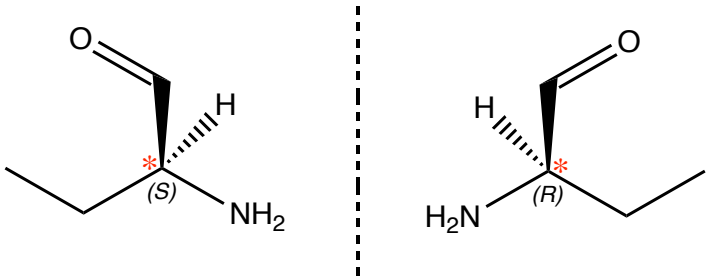
February 9, 2018

University of Ottawa

Enantiomers and Diastereomers

Let * represent a stereogenic centre, and dotted lines represent mirrors.
Maximum number of stereoisomers = 2^n, where n is the number of stereogenic centres.

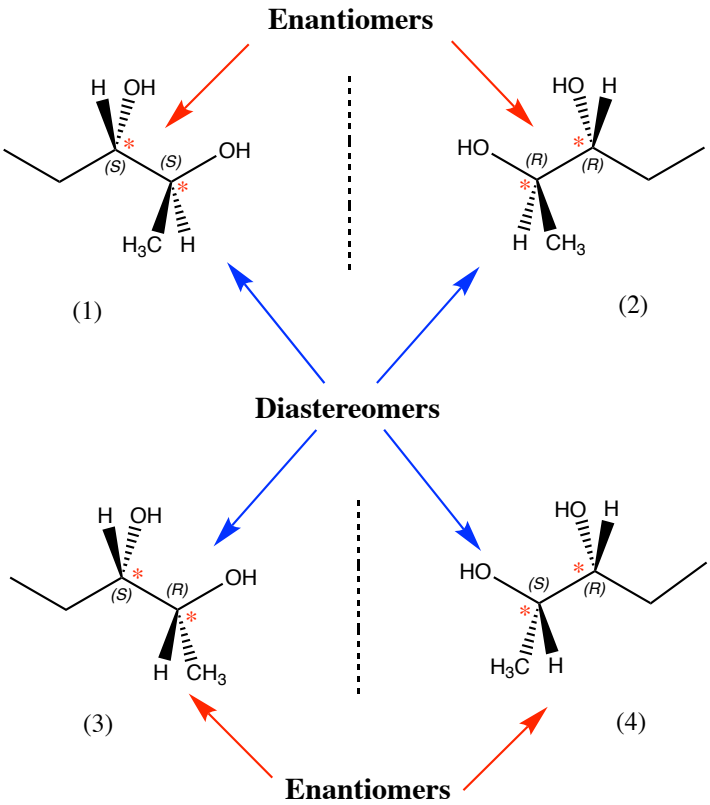
A) $CH_3CH_2CH(CHO)NH_2$



Enantiomers

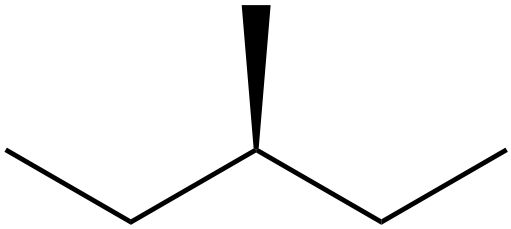
- Compound has one stereogenic centre (n)
  - $2^1 = 2$ is the maximum number of stereoisomers
- The mirror images are non-superimposable
  - Chiral → enantiomers

B) $CH_3CH_2CH(OH)CH(CH_3)OH$



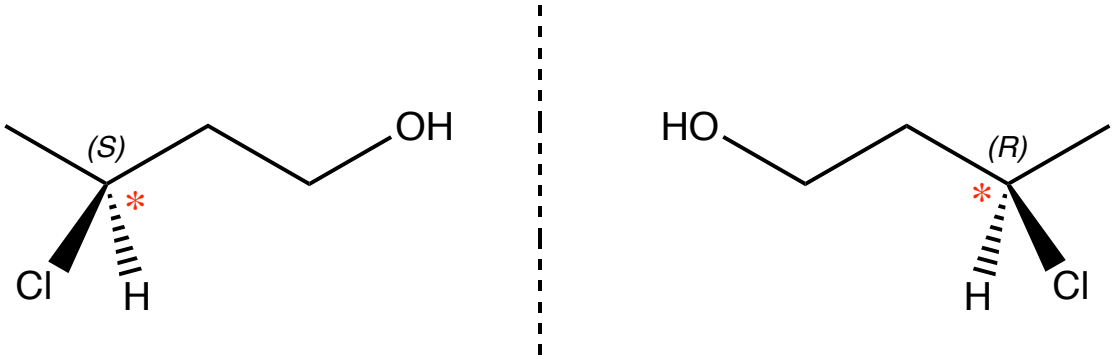
- Compound has two stereogenic centres (n)
  - $2^2 = 4$ is the maximum number of stereoisomers
- **(1) and (2)** are non-superimposable mirror images, as are **(3) and (4)**
  - Chiral → enantiomers
- **[(1) and (3)]**, **[(1) and (4)]**, **[(2) and (3)]**, and **[(2) and (4)]** are diastereomers because they are not mirror images and non-superimposable

C) $CH_3\ CH_2CH(CH_3)CH_2CH_3$



- This molecule has no stereogenic centres → no stereoisomers

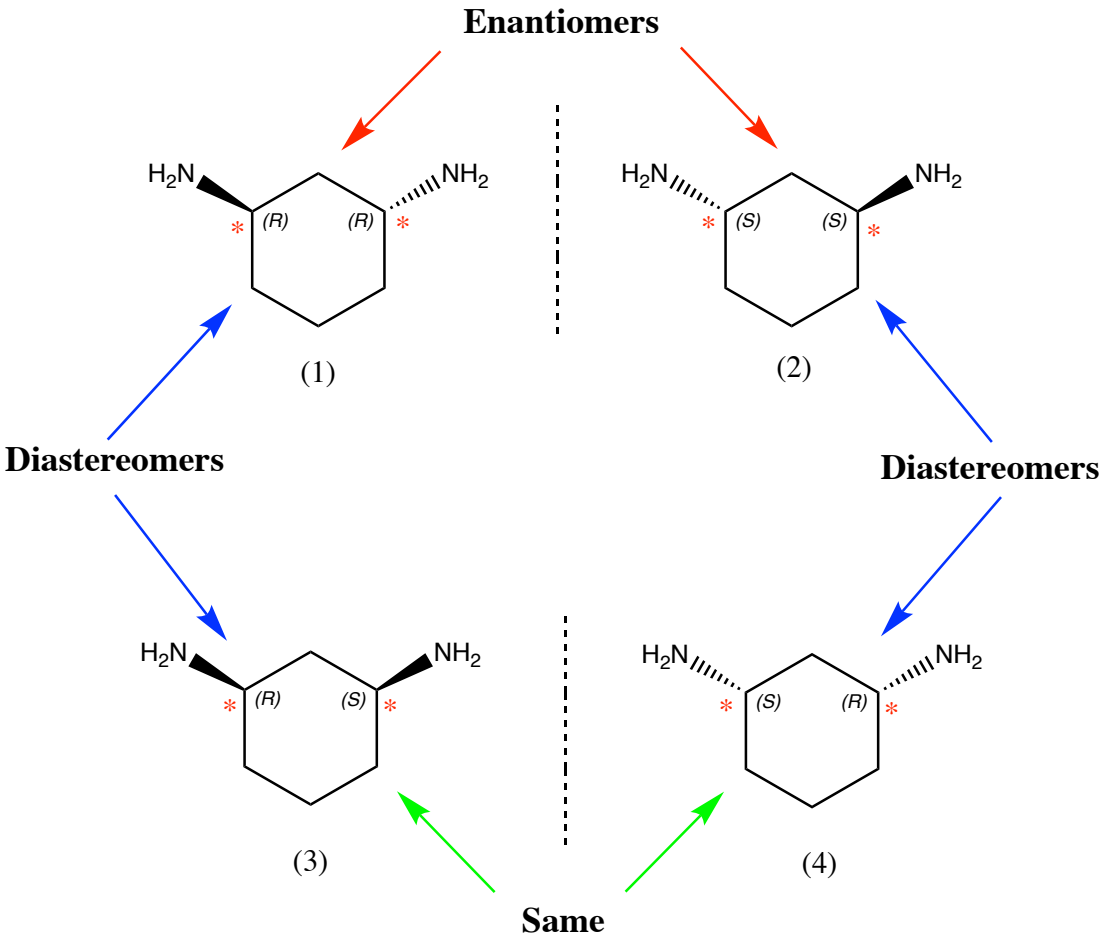
D) $CH_3CHClCH(CH_2OH)CH_2OH$



Enantiomers

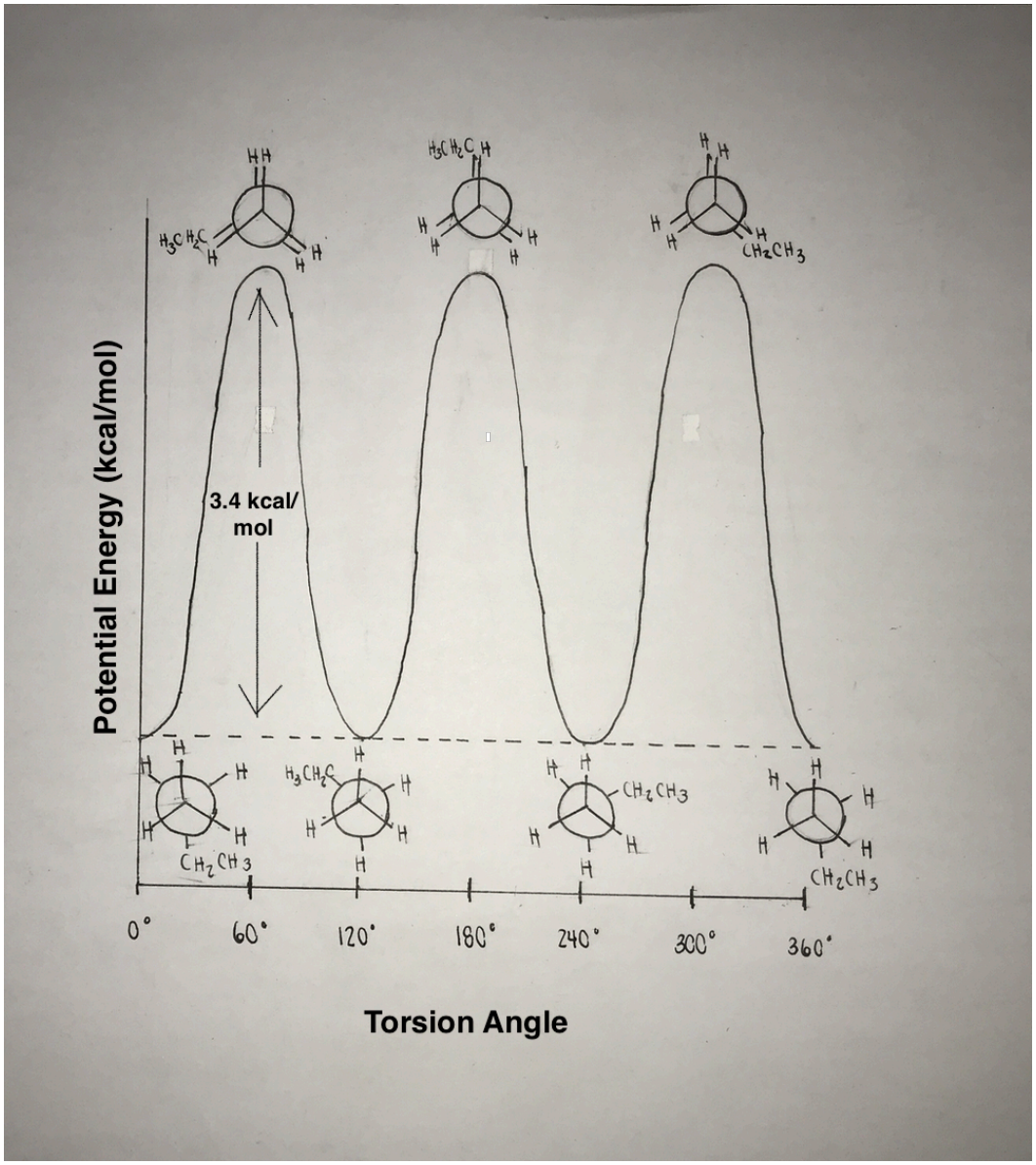
- Compound has one stereogenic centre (n)
  - $2^1 = 2$ is the maximum number of stereoisomers
- The mirror images are non-superimposable
  - Chiral → enantiomers

E)



- Compound has two stereogenic centre (n)
  - $2^2 = 4$ is the maximum number of stereoisomers
    - But there are only 3
- **(1) and (2)** are non-superimposable mirror images
  - Chiral → enantiomers
- **[(1) and (3)]**, **[(1) and (4)]**, **[(2) and (3)]**, and **[(2) and (4)]** are diastereomers because they are not mirror images and non-superimposable
- **(3) and (4)** are the same compound because they are superimposable mirror images of each other
  - they are meso compounds
  - They also have a plane of symmetry straight down the vertical

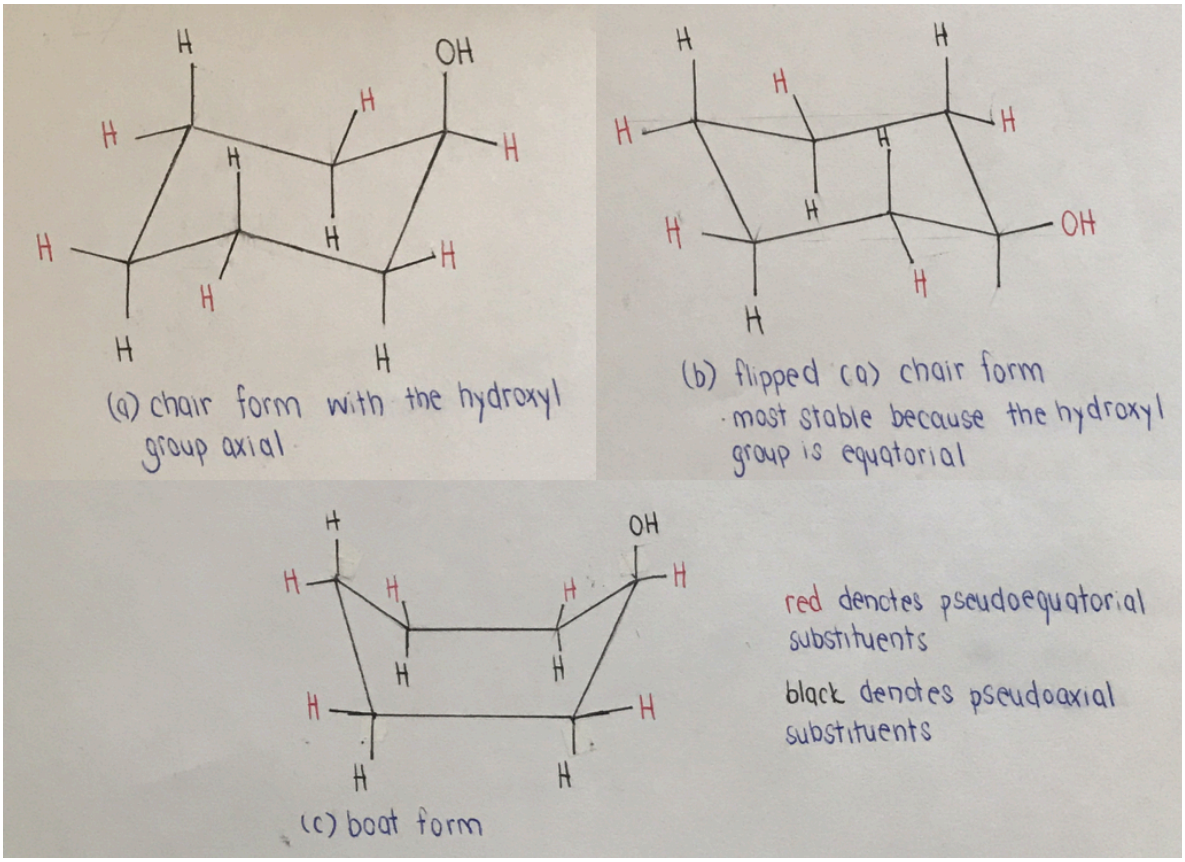
Newman Projections



The most stable conformers are the anti-staggered (at 0 °) and gauche (at 120°). The energy difference between the two most stable conformers is 0 kcal/mol, since they have the same amount of steric interactions with the hydrogen.

Cyclohexanol

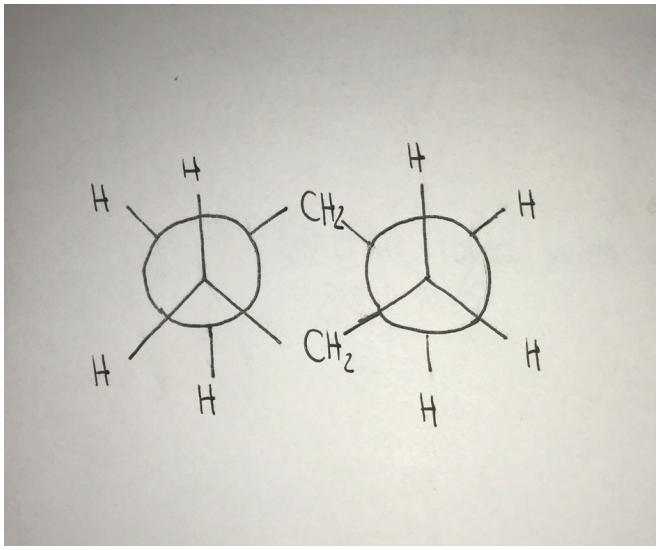
Red in (a) and (b) denote equatorial substituents, and black denotes axial substituents.



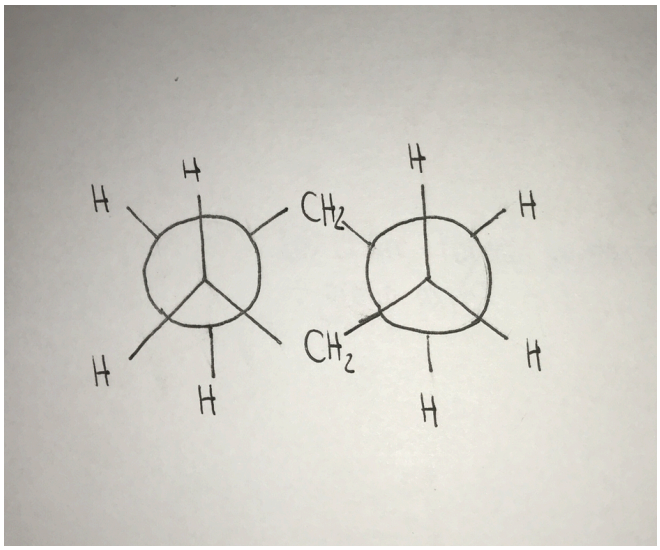
(a) is a chair form with the hydroxyl group in the axial position
(b) is the more stable chair conformer for cyclohexanol as large groups in the equatorial position are preferred
(c) boat form

The other possible boat form has the hydroxyl group is on the pseudo-equatorial position.

This is the Newman projection (a) chair conformation of cyclohexanol.



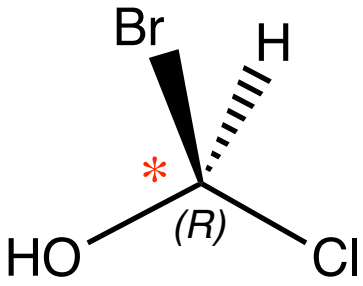
This is the Newman projection of the flipped (b) chair conformation of cyclohexanol.



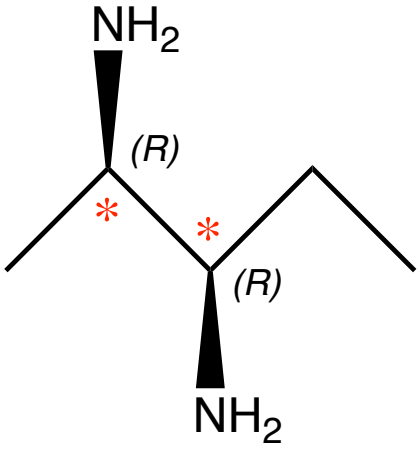
Questions

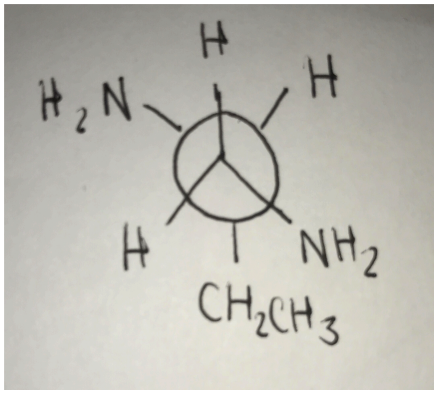
Let * represent a stereogenic centre, and dotted lines represent mirrors.

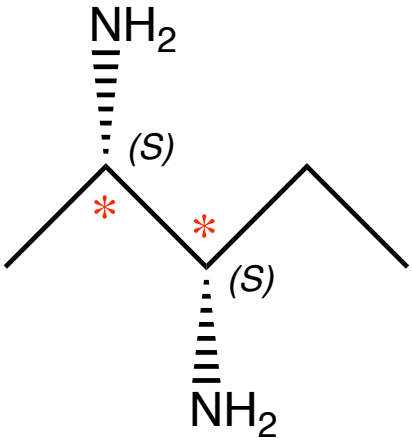
1. R isomer of CH(OH)ClBr

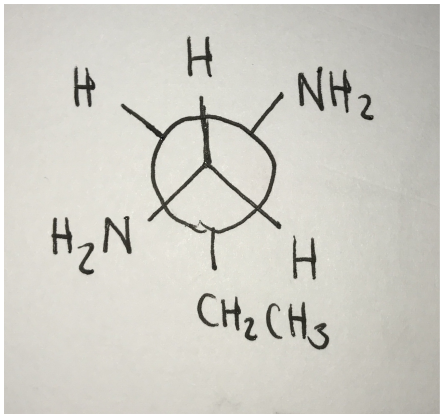


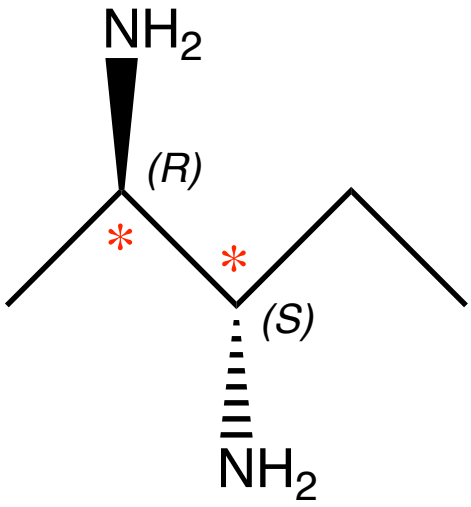
2. 2,3-diaminopentane, zig-zag structures to the left, and Newman projections to the right.

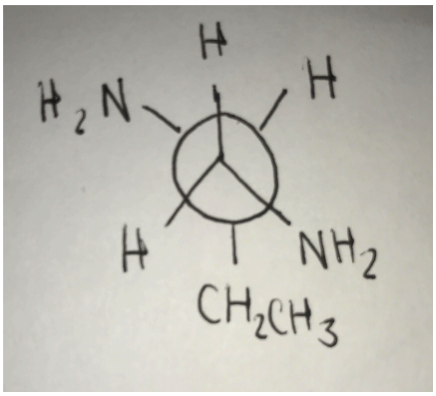


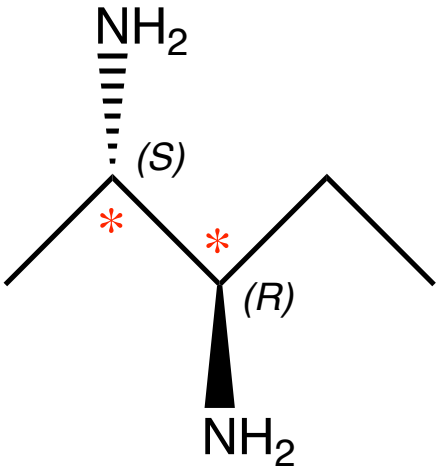


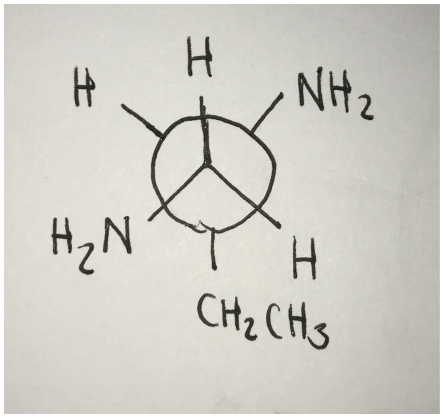





NH2
(R)
*
*
(S)
NH2


H
H2N
H
H
NH2
CH2CH3


NH2
(S)
*
*
(R)
NH2


H
H
NH2
H2N
H
CH2CH3

3. This compound has three stereogenic centres. The maximum number of stereoisomers is represented by 2^n where n is the number of stereogenic centres, therefore $2^3 = 8$. This compound has 8 possible stereoisomers.