Organic Chemistry Take Home Assignment: Stereochemistry

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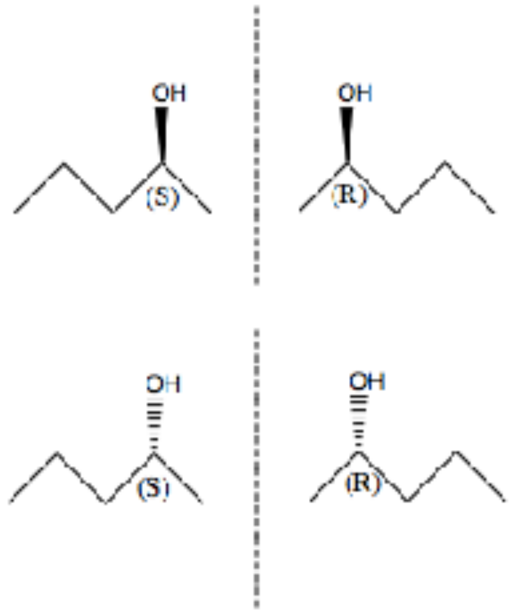
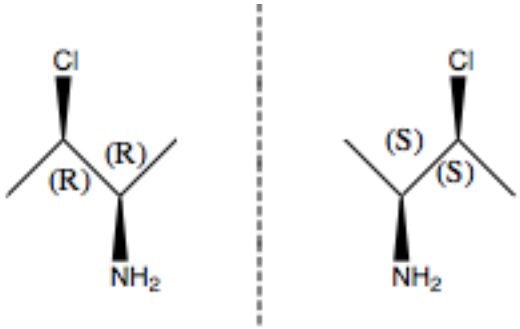
1. Enantiomers and Diastereomers:

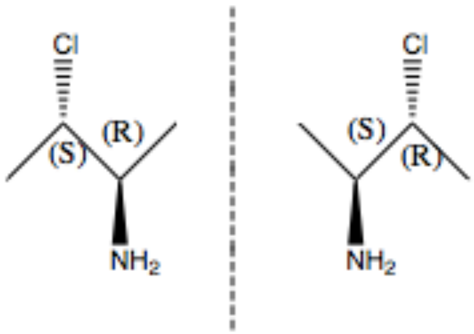
A. CH3CH2CH2CH(OH)CH3

	These molecules are enantiomers. Their mirror images are non-superimposable. When the chirality of the molecule is Sinister (S), the chirality of the mirror image molecule is Rectus (R). The S molecule is such because you encounter the subgroups in order of priority when traveling counterclockwise. The R molecule is such because you encounter the subgroups in order of priority when traveling clockwise. The order of priority is: 1) OH 2) Propane 3) Methane 4) H (unrepresented in zig-zag style)

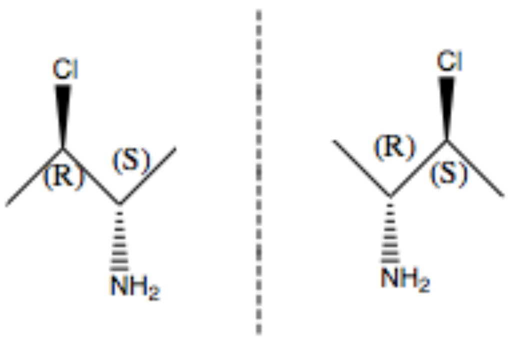
B. CH3CClHCH(NH2)CH3



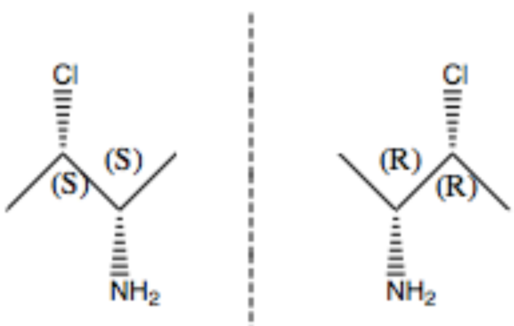
These molecules are enantiomers. Their mirror images are non-superimposable. For the first molecule both stereocentres have R chirality because the priority subgroups fall in a clockwise direction. The mirror image therefore has S chirality.
The priority of the first centre is:
1) Cl 2) CH(NH2)CH3. 3) CH 4) H
The priority of the second centre is:
1) NH2. 2) CH3CClH 3) CH3. 4) H
The priority does not change for all isomers.



These molecules are enantiomers. Their mirror images are non-superimposable. For the first molecule the first stereo centre has S chirality and the second has R chirality. The mirror image switches the chiral centres causing them to be the opposite to it's pair.

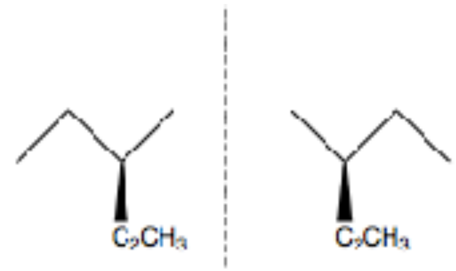
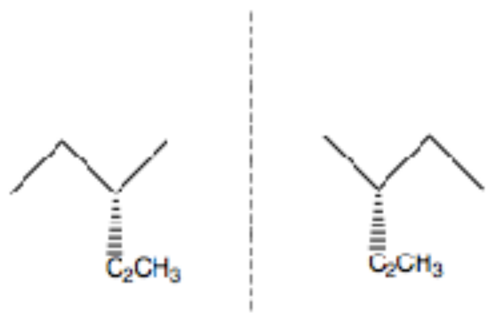


These molecules are also enantiomers. Their mirror images are non-superimposable. For the first molecule the first stereo centre has R chirality and the second has S chirality. The mirror image again switches the chiral centres causing them to be the opposite to it's pair.

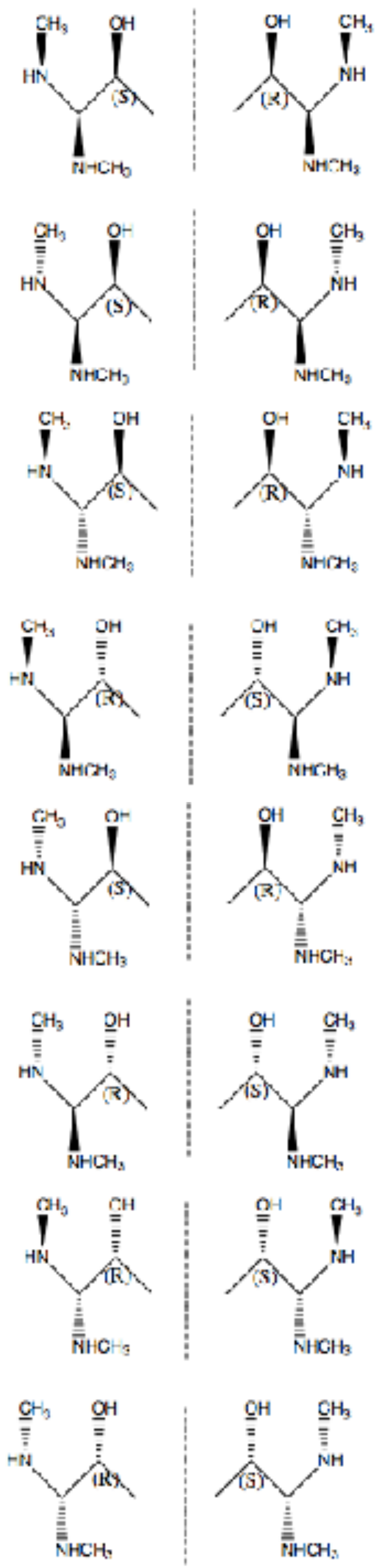


These molecules are also enantiomers. Their mirror images are non-superimposable. For the first molecule the first stereo centre has R chirality and the second has S chirality. The mirror image again switches the chiral centres causing them to be the opposite to it's pair.

C. CH3CH2CH(CH2CH3)CH3

 	These molecules are enantiomers. Their mirror images are non-superimposable. There are no stereocentres in this molecule because the there are no carbon molecules with 4 different subgroups attached to it. The carbon with the ethyl group attached to it not in the plane of the paper also has a ethyl group attached to it in the plane of the paper represented by the 2 lines in the zig-zag style.

D. CH3NHCH(NHCH3)CHOHCH3

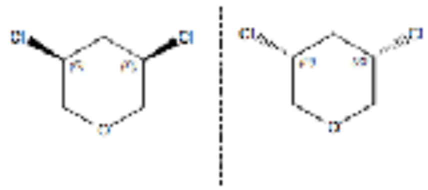
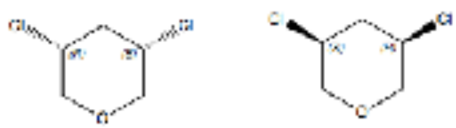
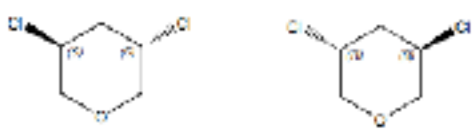
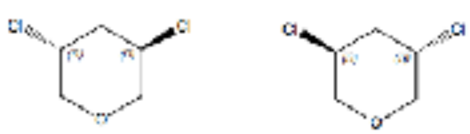


All of these molecules shown are enantiomers. The molecules cannot be imposed on their mirror images. Also, None are meso isomers because there is no internal plane of symmetry in any of the molecules. There is one stereo centre because it is the only carbon with 4 different subgroups attached.

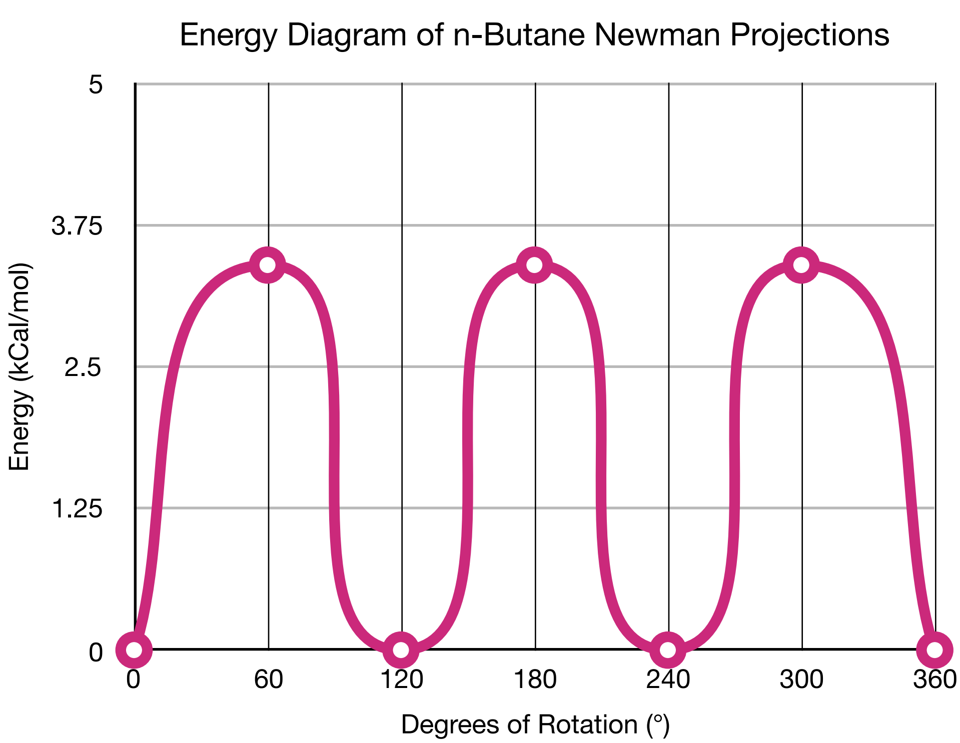
The order of priority for the subgroups are:

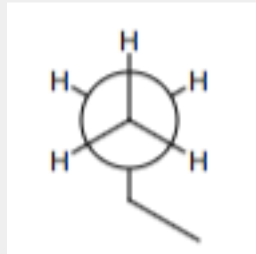
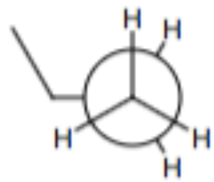
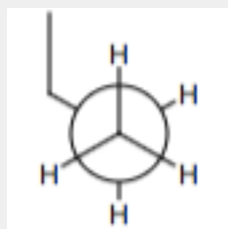
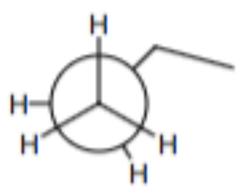
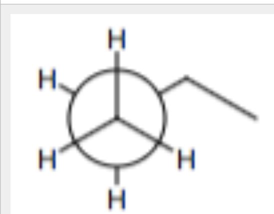
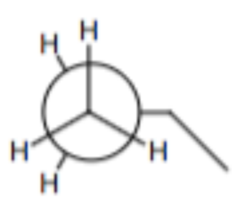
1) OH
2) CH3NHCH(NHCH3)
3) CH3
4) H

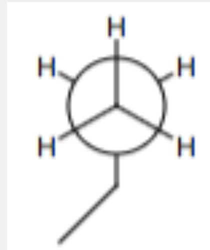
E. 3,5 dichloride - Oxocyclohexane

 	These molecules are meso isomers. They have internal mirror planes and are super-imposable mirror images. It has 2 stereo centres. For the first molecule the first centre is in the S configuration, while the second is in the R configuration. The priority of the first centre is: 1) Cl 2) CH2O 3) CH2CHCl 4) H
 	These molecules are enantiomers. They are non-superimposable mirror images. The priority is the same as above.

2. Newman Projections

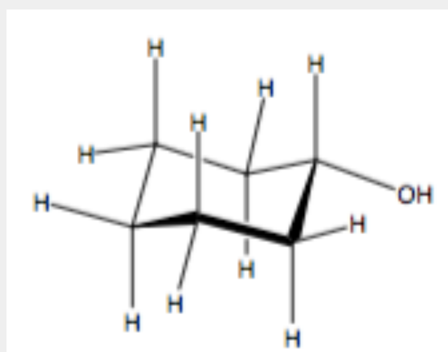
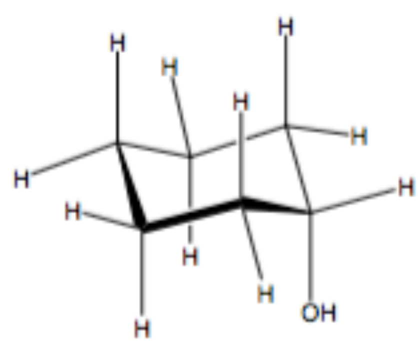


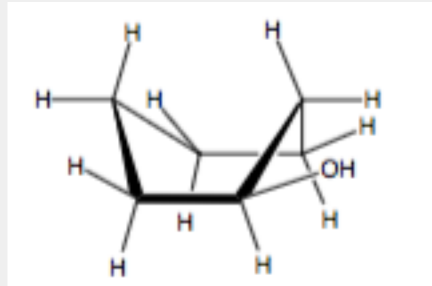
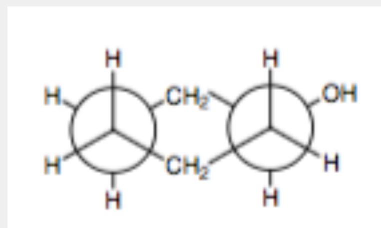
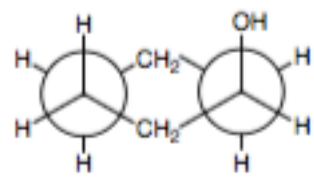
	Angle	Newman Projection
1	0°	
2	60°	
3	120°	
4	180°	
5	240°	
6	300°	

7	360°	

There are 6 possible Newman projections with 60° rotations between them. Newman projection 1 and 7 are identical, having done a full rotation. Out of these options, 4 conformations are equally stable, the ones at rotations 0°, 120°, 240°, and 360°. This is because there is the furthest possible distancing between the groups. The energy differences between these four conformers is zero because they are essentially the same compound.

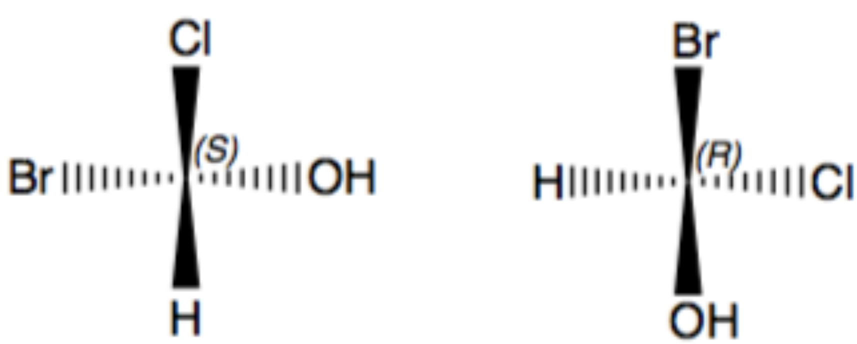
3. Cyclohexanol

Line Drawings	
This first conformation of cyclohexanol, the chair conformation, shows the most stable form. This is because the hydroxyl group, the largest group on the ring, is in an equatorial position. This positioning limits steric strain on the molecule.	
This second conformations shows the second "chair flip" or second chair conformation of cyclohexanol. When a chair flip occurs all axial positions become equatorial so now the hydroxyl group is in an axial position. This causes an unfavourable steric strain known as the 1,3-diaxial interaction.	

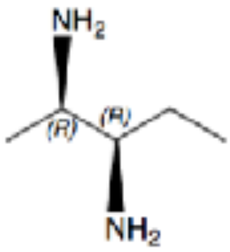
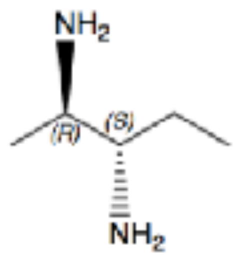
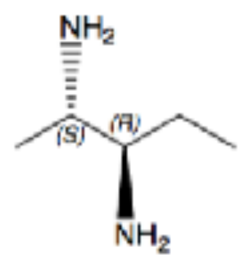
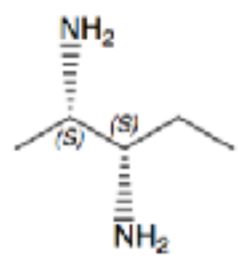
The third conformation is known as the boat conformation is known as the boat conformation. This occurs mid flip between the two chair conformers. This conformer causes steric strain between the atoms, in this case Hydrogens, in the “flagpole positions” above the atom, although it is favourable that hydroxyl is equatorial. Like the chair conformation, this boat conformation can be flipped which would produce a less stable conformer. In this conformer the hydroxyl group would be in the axial position which would cause the same strain issues as with the less stable chair conformer.	
Newman Projections	
Stable: Chair conformer with the hydroxyl group in the equatorial position	
Less stable: Chair conformer with the hydroxyl group in the axial position	

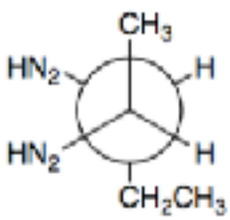
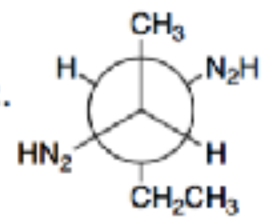
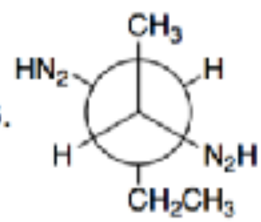
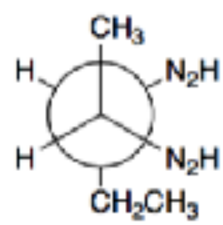
Questions:

1.



2.

1. 
2. 
3. 
4. 

1. 
2. 
3. 
4. 

3.