2.1 Newman projections

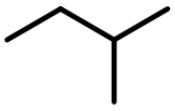
a) Draw the Newman projections of the lowest-energy and highest-energy conformations of butane when looking down the C2-C3 bond. Which conformation is more stable? Explain your answer.

b) Draw a Newman projection, looking down the C3-C4 bond of 2-methylpentane, in a gauche conformation. Now, draw the anti conformation. Which conformation is more stable and why?

c) Draw a Newman projection of α-D-glucose along the bond between C3 and C4 and along C1 and C2.

2.2 Conformational energies

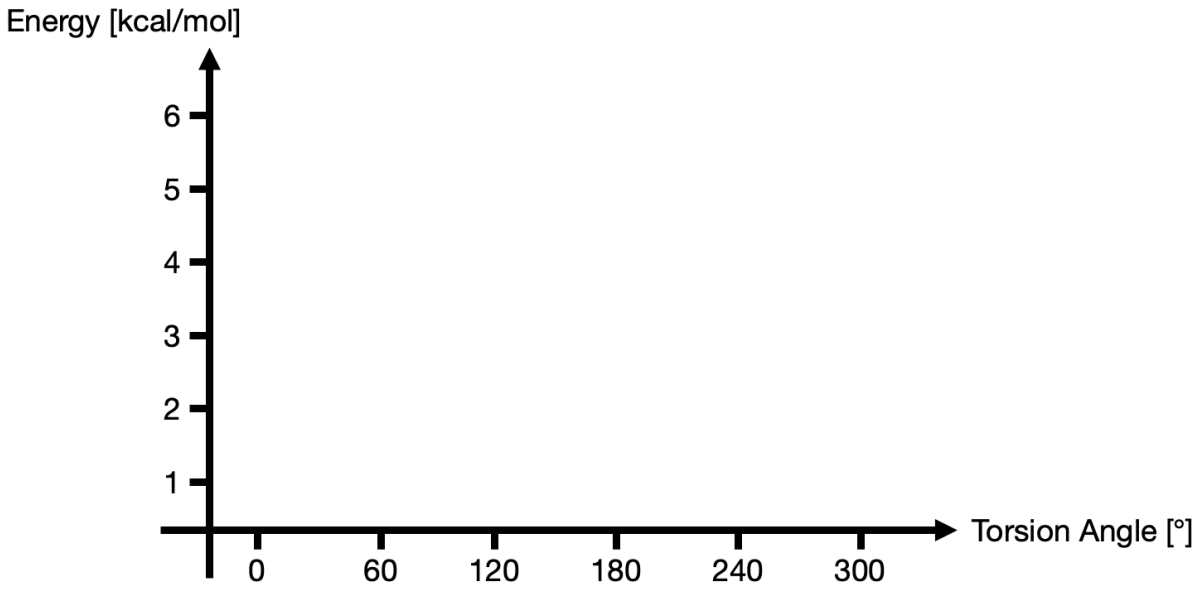
a) Draw the conformations for 2-methylbutane as Newman projections along the bond between C2 and C3 for the dihedral angles 0°, 60°, 120°, 180°, 240° and 300° in the energy diagram below. Estimate the relative energies of all conformations. To do this, create an energy diagram on which the relative potential energies of the respective conformations are plotted against the dihedral angle.



Keep in mind the following table of conformational energies:

Conformer	Energy / kcal mol-1
H ecliptic to H	1

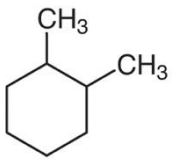
H ecliptic to Me	1.4
Me ecliptic to Me	2.5
Me gauche to Me	0.9



2.3 Chair conformations of cyclohexane

Draw the lower-energy chair conformations of the following molecules, indicating all axial and equatorial positions, including hydrogen atoms:

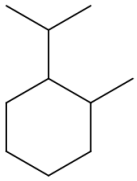
a) trans-1,2-dimethylcyclohexane



Draw the alternative chair conformation. Compare the energies of the two conformations.

Which molecule, trans-1,2-dimethylcyclohexane or trans-1,3-dimethylcyclohexane, has a greater energy difference between its two chair conformations?

b) trans-1-isopropyl-2-methylcyclohexane

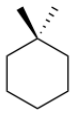


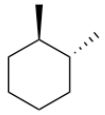
Draw the alternative chair conformation. Compare the energies of the two conformations.

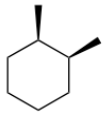
Which molecule, trans-1-isopropyl-2-methylcyclohexane or cis-1-isopropyl-2-methylcyclohexane, has a greater energy difference between its two chair conformations?

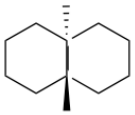
2.4 Energetically Favorable Chair Conformations

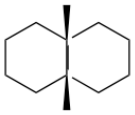
Draw the most energetically favorable conformations of the following molecules:





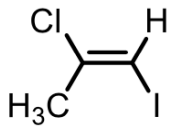


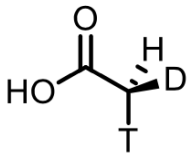


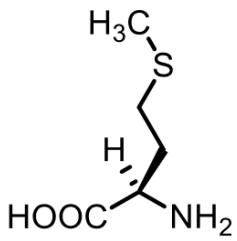


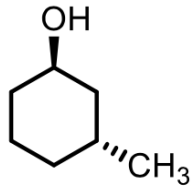
2.5 Stereochemistry

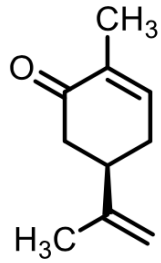
a. Which of the following compounds are chiral? Mark the stereogenic centers with an asterisk (*).

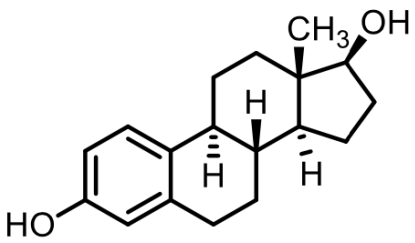




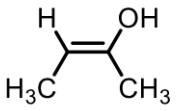


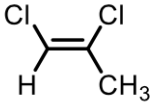


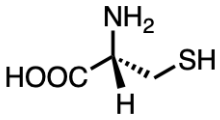




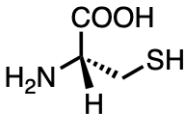
b. Indicate the absolute configuration of all stereogenic centers and double bonds in the compounds shown below according to the Cahn-Ingold-Prelog priority rules with R/S and E/Z, respectively.



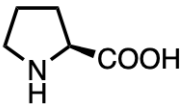




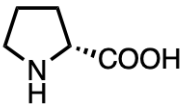
L-Cystein



D-Cystein



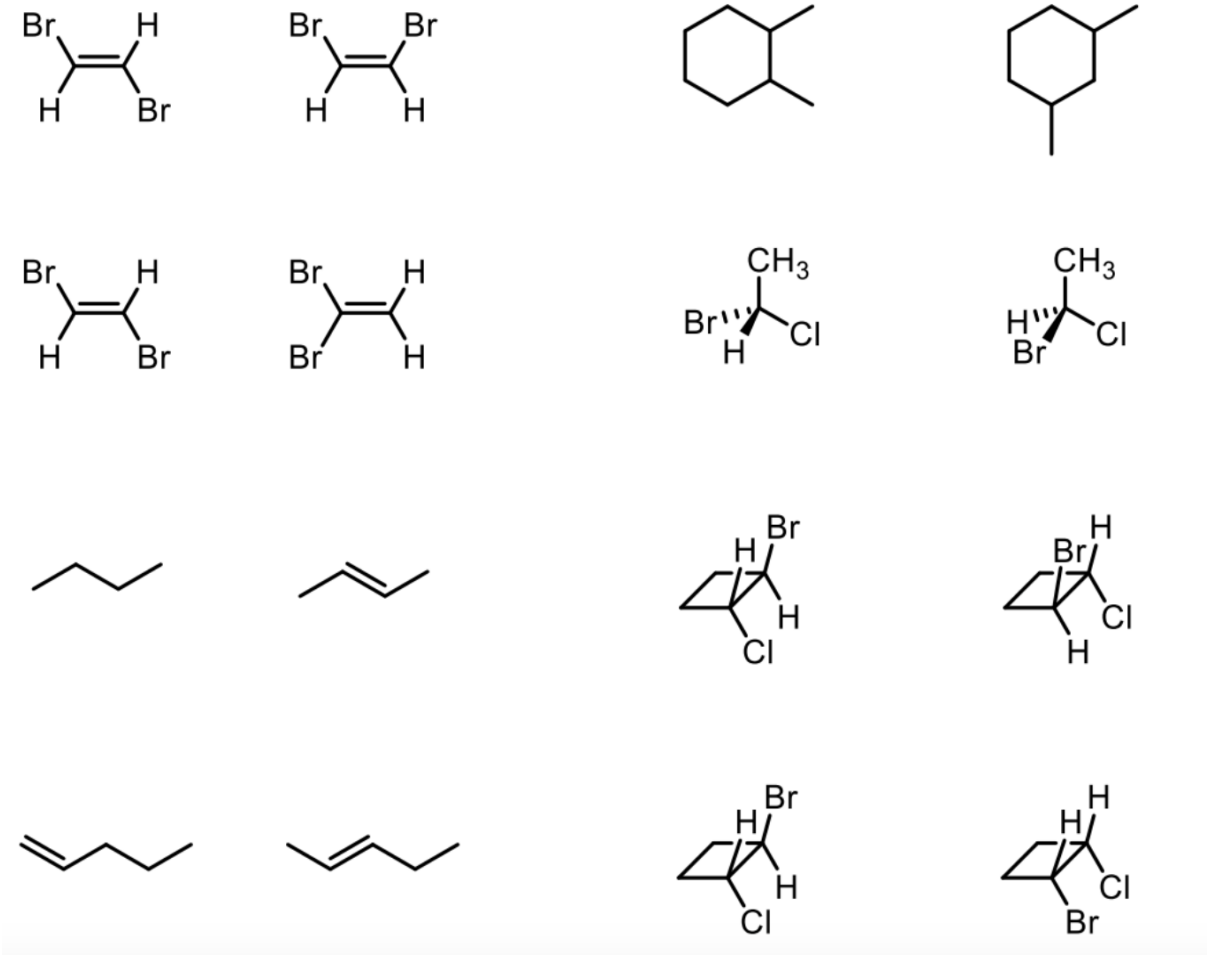
L-Prolin



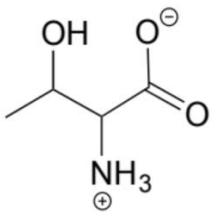
D-Prolin

2.6 Stereochemistry - Isomers

Which of the following pairs of molecules are isomers? Indicate which kind of isomers (constitutional isomers, diastereomers or enantiomers) they are.

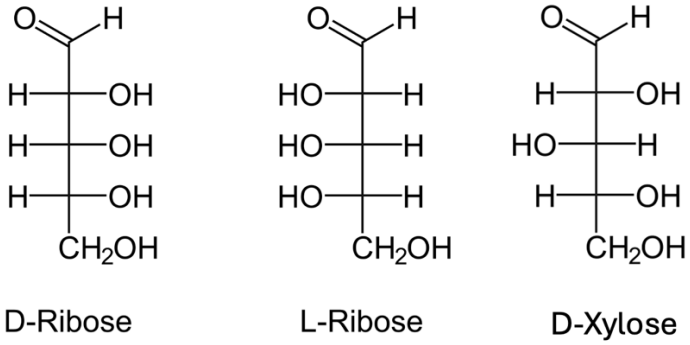


2.7 Compounds with multiple chiral centers. The structure of the amino acid D-threonine, drawn without stereochemistry, is shown below. D-threonine has the (S) configuration at both of its chiral centers. Draw D-threonine, it's enantiomer, and its two diastereomers.



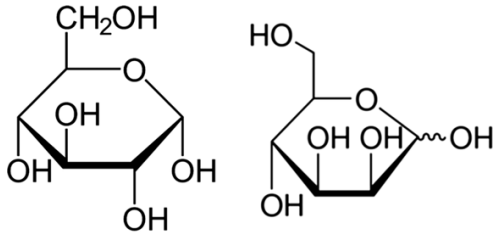
2.8 Fischer and Haworth projections.

a) Draw 'zigzag' structures (using the solid/dash wedge convention to show stereochemistry) for the sugars below. Label all stereocenters R or S.To make it easy to check your answers, draw your structures using the framework below.



D-Ribose L-Ribose D-Xylose

b) Convert the following Haworth projections into their chair conformations.



D-Glucose D-Mannose