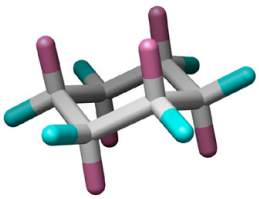


Chem 341 • Organic Chemistry I

Lecture Summary 08 • September 10, 2007

Chapter 3 - Organic Compounds: Alkanes and Cycloalkanes

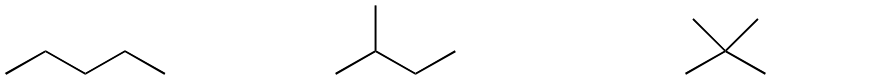
Properties of Alkanes

Alkanes are relatively inert molecules. There are only a few specific reactions that they will undergo. This is largely due to the fact that the bonds are very non-polar and without some polarization of bonds, it is often difficult to break them. Alkanes can be oxidized (combustion) or reacted with very reactive species like chlorine free radicals (chlorine molecules plus light).

Combustion

Free Radical Chlorination

Alkanes are non-polar, or also called hydrophobic (water hating). But they do have some attractive forces that we call Van der Waals forces. These Van der Waals interactions are sort of like transient small dipoles that result when molecules come close together. These forces are stronger when the alkyl chains are linear (greatest interaction). This is easily observed in the boiling point and melting point of molecules. Generally, the longer the chain, the higher the MP or BP. However, if the molecule is more branched, the BP will decrease. See for example the boiling points of isomers of pentane.

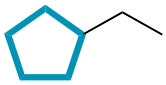


***n*-pentane**	**2-methylbutane**	**2,2-dimethylpropane**
bp 36°C	**bp 28°C**	**bp 10°C**

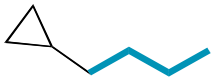
Cycloalkanes

Alkanes can be joined at the ends to make ring compounds. In order to do this, two hydrogens must be lost. Thus, the general formula for cycloalkanes is C_nH_{2n}. Cycloalkanes take precedent as the parent of the name if it is the same size or larger than any other alkyl chains in the molecule.

Rule 1: Count the number of C's in the ring. If greater than or equal to the largest substituent chain, the ring is the parent. If a substituent is larger, that is the parent.

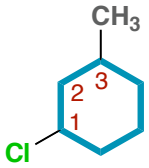


ethylcyclopentane

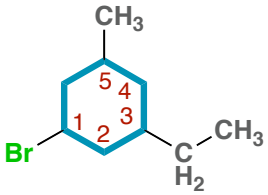


1-cyclopropylbutane

Rule 2: for multi-substituted rings - start numbering at a point of attachment - number in the direction that gives the lowest numbers (sum the numbers to get a good idea). Substituents are numbered according to their alphabetical priority - halogens included.



1-chloro-3-methylcyclohexane

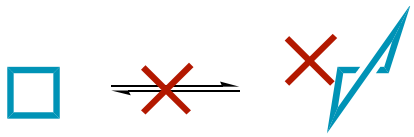


1-bromo-3-ethyl-5-methylcyclohexane

Cycloalkanes

All single bonds freely rotate at room temperature (and even much lower). Thus, linear alkanes are constantly spinning and twisting. By tying the two ends into a ring, this prohibits free rotation around the single bonds and this makes cycloalkanes much less flexible.

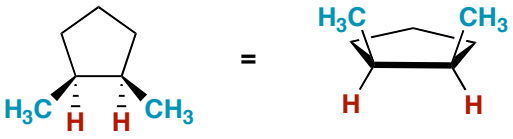
single bonds have free rotation



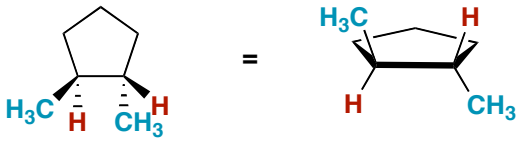
rings can't rotate as you'd eventually have to break the bond

Stereoisomers: Isomers (different compounds) that have all the same number and kind of atoms that are all connected the same, but differ in their arrangement in three dimensions.

Because of the restricted rotation in cycloalkanes, substituents could either be on the same side (cis) or opposite sides (trans) of the plane of the ring. These are only different in their three dimensional arrangement of the substituents.

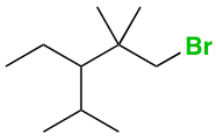


cis-1,2-dimethylcyclopentane



trans-1,2-dimethylcyclopentane

Quiz of the day

Q:			
	What is the correct IUPAC name for the following molecule? 	☐ 1:	1-bromo-2,2-dimethyl-3-isopropylpentane
		☐ 2:	1-bromo-2,2,3,4-tetramethylpentane
		☐ 3:	1-bromo-3-ethyl-2,4,4-trimethylpentane
		☑ 4:	1-bromo-3-ethyl-2,2,4-trimethylpentane