Alkanes

Hydrocarbons
Alkane Nomenclature
Alkane properties
Cycloalkanes

Cycloalkanes

- Carbon chains that are connected at the ends form 
  rings or cyclic structures.
- The chain has two fewer hydrogens than straight 
  chain alkanes.
  - Formula: C\(_n\)H\(_{2n}\)
- The simplest cycloalkane has three carbons.
  - What is its molecular formula?
  - What would it be named?
  - Cyclo-?

![Cyclopropane structure]

![Cyclobutane structure]

![Cyclopentane structure]

![Cyclohexane structure]
Nomenclature: Substituents

- For one substituent, place the name of substituent at beginning of parent name
  - Methylcyclopentane

Nomenclature

- Multiple substituents
  - Number so all substituents get the lowest number possible.
  - Example:
    - 1,3,4-trimethylcyclopentane or 1,2,4-trimethylcyclopentane?
  - If all substituents could get the same number, number them alphabetically
  - Name example:

Cis-trans isomers

- The bonds in straight chain alkanes can rotate
  - Substituents can point up or down
  - Does rotation change the identity of the compound?
- Can bonds in cyclic compounds rotate?
Cis-Trans isomers

- Rings are “two-sided”
- Substituent stays on one side (face) of the ring.
  - On each carbon, one substituent points up and the other down
  - Fill in the rest of the hydrogens

Cis-Trans isomers

- Substituents on different carbons will have one orientation in relation to one another
  - They can be on opposite sides of the ring – trans
  - They can be on the same side of the ring – cis
  - They cannot change from trans to cis without breaking bonds!
  - Changing from trans to cis changes the identity of the compound

Cis-Trans Isomer

- Cis-trans isomers differ in the orientation of atoms in space.
  - Cis-trans isomers represent different compounds
  - Bonds must be broken to change from one isomer to the other
  - Which isomer is shown?
  - Name this compound.
Nomenclature

- To determine cis or trans, look at substituents attached to ring
  - The ring must be drawn in perspective
  - Remember, hydrogen is not considered a substituent
  - The substituents may not be identical
- What are the substituent groups in the compound shown?
- Are they cis or trans?
- Insert the hydrogens not shown into the structure.

Properties of Cycloalkanes

Melting and Boiling point

- Cycloalkanes are more rigid than straight chain alkanes
  - Why do you think this is true?
- Higher boiling points than straight chain alkanes with the same number of carbons.
  - The rings are able to stack
  - Atoms remain in contact more than in more flexible alkanes
  - Molecules harder to separate – harder to boil (evaporate)

Properties of Cycloalkanes

Solubility

- What determined the solubility of alkanes in water?
- Do you think cycloalkanes will be different?
Cyclohexanes: examples

- Alkane products contain mixture that include cycloalkanes
  - Mineral oil
- Many biomolecules contain fused rings
  - Steroids
    - What kinds of rings are present?

Cycloalkanes: steroids