Discussion Worksheet #3

Cycloalkanes and Cyclohexane Conformations

Skill 1: Nomenclature of cycloalkanes

* Name the parent chain “cyclo-“
* Number to give substituents lowest possible numbers
  + If tie, go alphabetically
* Name a cyclic substituent “cycloalkyl”
* Know “cis/trans” nomenclature

Problem 1. Draw these compounds:

A. *trans*-1,2-dimethylcyclobutane

B. 1,1,4-trichlorocyclohexane

C. 1-cyclobutyl-2-isopropylcyclooctane

Problem 2: Name these compounds using systematic nomenclature



Skill 2: Drawing cyclohexane chair structures

* Practice drawing chair and boat structures from flat structures, and vice versa
* Know the difference between “axial/equatorial” and “up/down” substituents
* Be able to draw a “chair flip” structure

Problem 3. Draw two chair structures for each of these compounds. Label each substituent as axial or equatorial.

A. trans-1,2-dimethylcyclohexane

B. cis-1,2-dimethylcyclohexane

C. trans-1,3-dimethylcyclohexane

Problem 4. Fill in the chart below:

“Flat” structure chair flip 1 chair flip 2

|  |  |  |
| --- | --- | --- |
|  |  |  |
| B. |  |  |
| C. |  |  |
| D. |  |  |
|  |  |  |

Skill 3: Relative stability of chair conformations.

* Substituents in the equatorial position are generally more stable than in the axial position due to torsional strain and gauche interactions (1,3-diaxial interactions)
* Use Vollhardt Table 4.3 to quantitate chair stability

Problem 5. Draw the most stable chair structure for each of the following. If both are identical in energy, state so.

a. *trans*-1-t-butyl-4-methylcyclohexane

b. *cis*-1-t-butyl-4-methylcyclohexane



Problem 6. Calculate the difference in energy between the two chair conformations of each of these compounds. Use the thermodynamic rule of thumb to estimate a ratio of the two conformations.

a. *trans*-1-ethyl-2-methylcyclohexane

b. *cis*-1-ethyl-2-methylcyclohexane

