3.12
Disubstituted Cycloalkanes:
Stereoisomers

Stereoisomers are isomers that have the same constitution but different arrangement of atoms in space.
Isomers

Constitutional isomers

Stereoisomers
There are two stereoisomers of 1,2-dimethylcyclopropane. They differ in spatial arrangement of atoms.
1,2-Dimethylcyclopropane

* cis-1,2-Dimethylcyclopropane has methyl groups on same side of ring. *

* trans-1,2-Dimethylcyclopropane has methyl groups on opposite sides. *
Relative stabilities of stereoisomers may be determined from heats of combustion.
van der Waals strain makes cis stereoisomer less stable than trans
3.13
Conformational Analysis of Disubstituted Cyclohexanes
1,4-Dimethylcyclohexane Stereoisomers

Trans stereoisomer is more stable than cis, but methyl groups are too far apart to crowd each other.
Conformational analysis of cis-1,4-dimethylcyclohexane

Two equivalent conformations; each has one axial methyl group and one equatorial methyl group
Two conformations are not equivalent; most stable conformation has both methyl groups equatorial.
1,2-Dimethylcyclohexane Stereoisomers

Analogous to 1,4 in that trans is more stable than cis.

cis
5223 kJ/mol
less stable

trans
5217 kJ/mol
more stable

Analogous to 1,4 in that trans is more stable than cis.
Conformational analysis of \textit{cis}-1,2-dimethylcyclohexane

Two equivalent conformations; each has one axial methyl group and one equatorial methyl group.
Conformational analysis of \textit{trans}-1,2-dimethylcyclohexane

Two conformations are not equivalent; most stable conformation has both methyl groups equatorial.
Unlike 1,2 and 1,4; cis-1,3 is more stable than trans.
Conformational analysis of cis-1,3-dimethylcyclohexane

Two conformations are not equivalent; most stable conformation has both methyl groups equatorial.
Conformational analysis of trans-1,3-dimethylcyclohexane

Two equivalent conformations; each has one axial and one equatorial methyl group.
<table>
<thead>
<tr>
<th>Compound</th>
<th>Orientation</th>
<th>$-\Delta H^\circ$</th>
</tr>
</thead>
<tbody>
<tr>
<td>cis-1,2-dimethyl</td>
<td>ax-eq</td>
<td>5223</td>
</tr>
<tr>
<td>trans-1,2-dimethyl</td>
<td>eq-eq</td>
<td>5217*</td>
</tr>
<tr>
<td>cis-1,3-dimethyl</td>
<td>eq-eq</td>
<td>5212*</td>
</tr>
<tr>
<td>trans-1,3-dimethyl</td>
<td>ax-eq</td>
<td>5219</td>
</tr>
<tr>
<td>cis-1,4-dimethyl</td>
<td>ax-eq</td>
<td>5219</td>
</tr>
<tr>
<td>trans-1,4-dimethyl</td>
<td>eq-eq</td>
<td>5212*</td>
</tr>
</tbody>
</table>

*more stable stereoisomer of pair