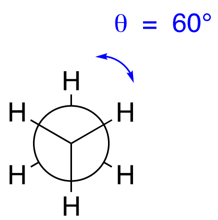
Saturated Acyclic Hydrocarbons

from chapter(s) ______ in the recommended text

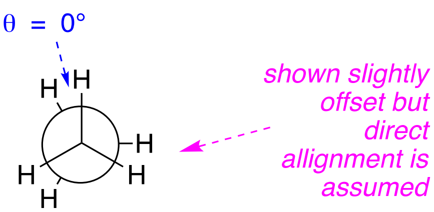
A Introduction

B Conformations Of Acyclic Hydrocarbons

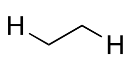
Ethane



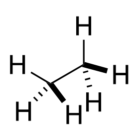
staggered



eclipsed



staggered



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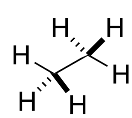
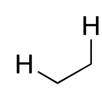
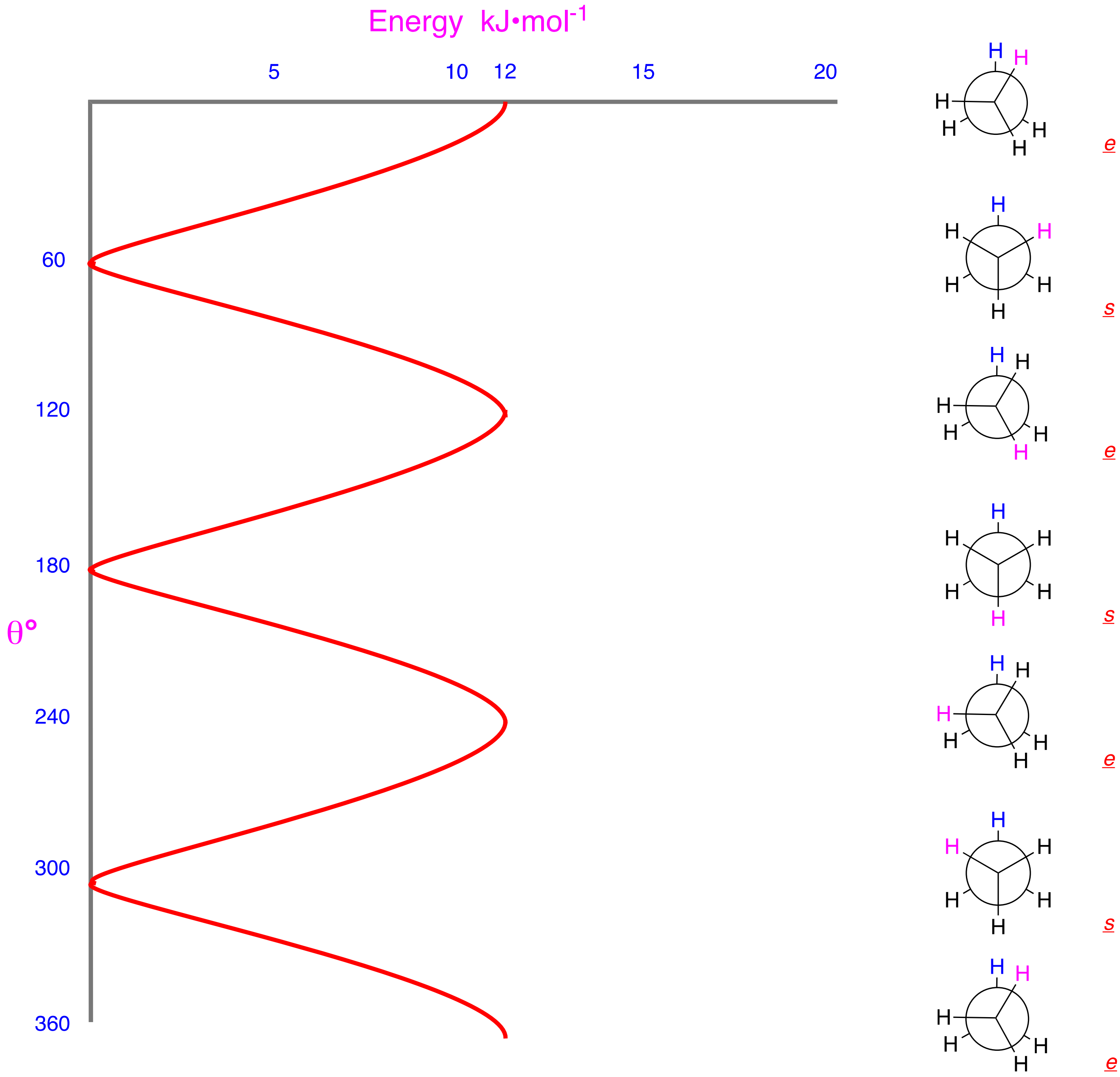


staggered



eclipsed

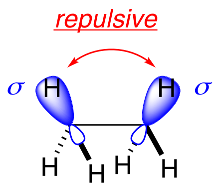
The *staggered* ethane conformer is more stable



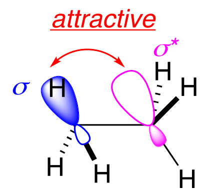
that repulsion is called *torsional* strain.

molecular orbital diagrams to indicate *destabilizing* interactions and *stabilizing* interactions

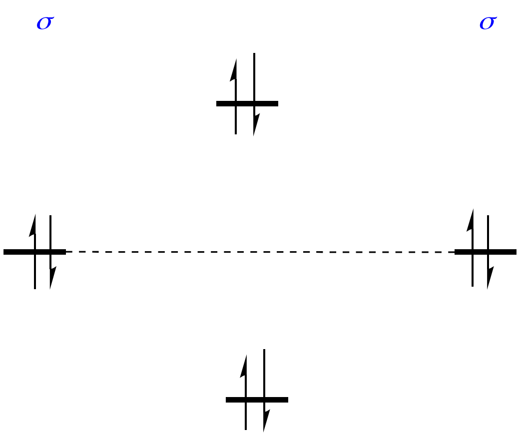
σ-orbital contributes *2* e
an empty one donates *0* e



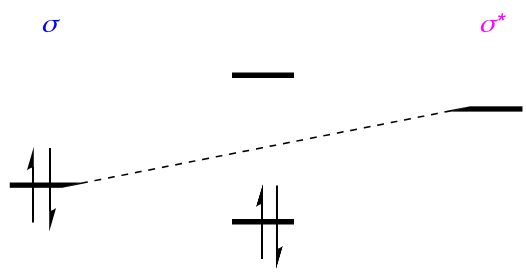
torsional strain



add electrons to the diagrams below and indicate bond orders:

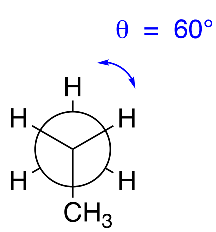


non-bonding

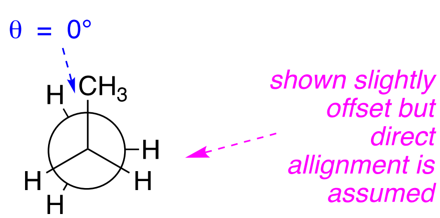


bonding

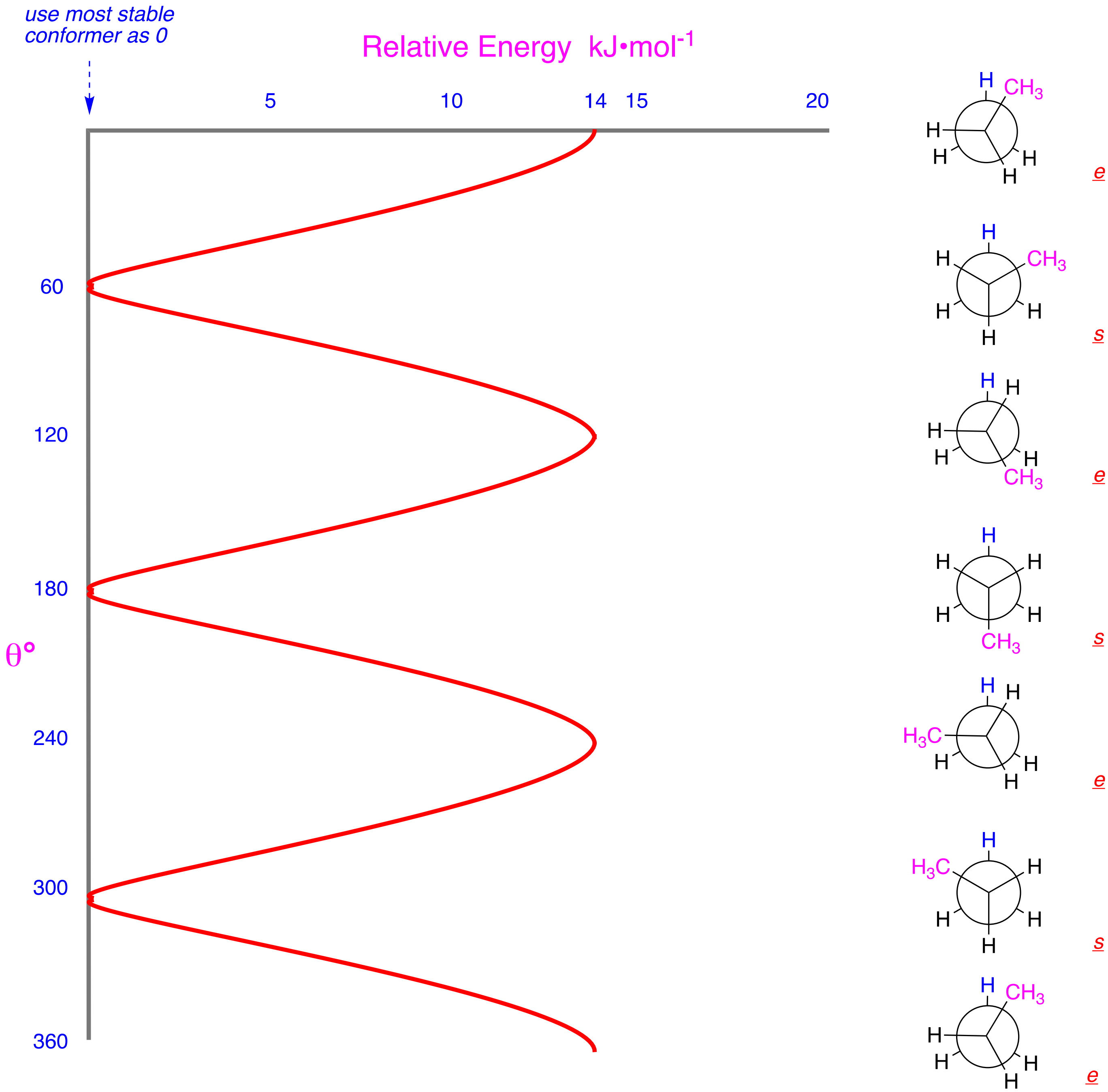
Propane



staggered



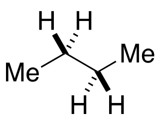
eclipsed



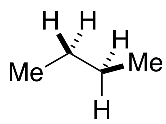
use most stable
conformer as 0
Relative Energy kJ•mol-1
5
10
14
15
20
60
120
180
θ°
240
300
360
e
s
e
s
e
s
e

eclipsed

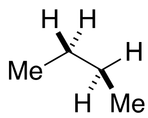
Butane



very low



high



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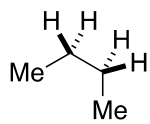
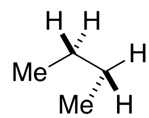


very high



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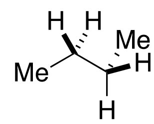
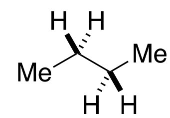
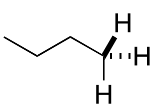
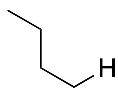


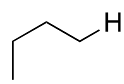
high

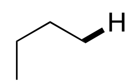


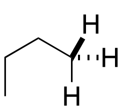
very low

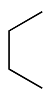


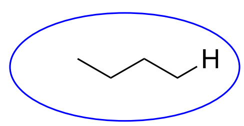


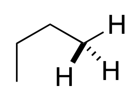


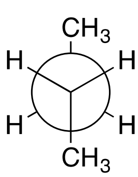




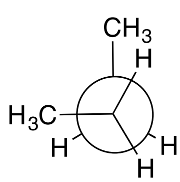








a



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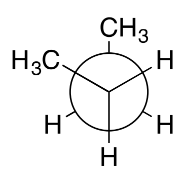
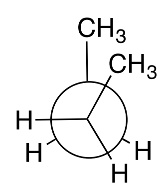


g



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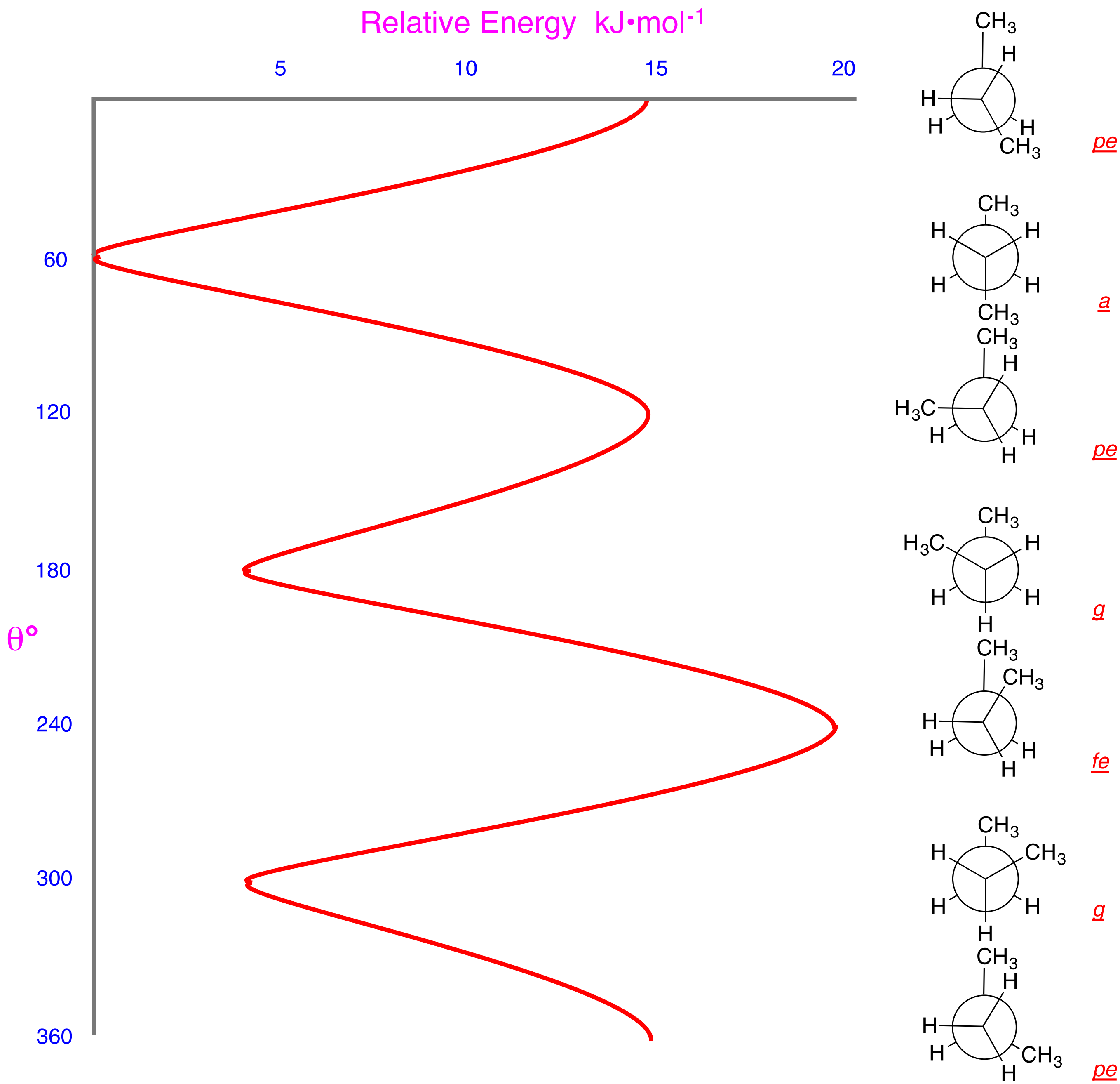


Destabilization of butane in the totally eclipsed conformation is a result of combinations of *torsional / steric* strain.

Steric strain between the methyl groups in butane is that which results when atoms compete for the same region of space.

C Art In Organic Chemistry

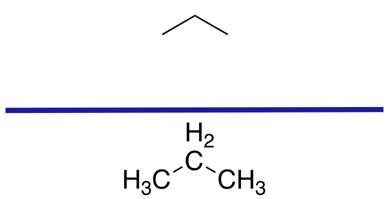
Two Dimensional Diagrams Of Organic Molecules

is one bond to an apex that {terminal point} represents *CH_3*
two bonds to an apex means it is a *CH_2*
three bonds to a branch point represent *CH*.
this means there are *0* hydrogen atoms on that carbon.

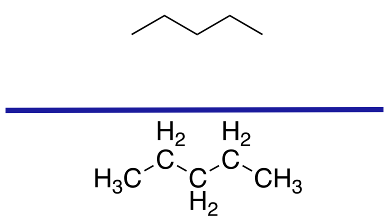
Zigzag conformations represent *staggered* conformers

it *does not* matter if the chains zigzag

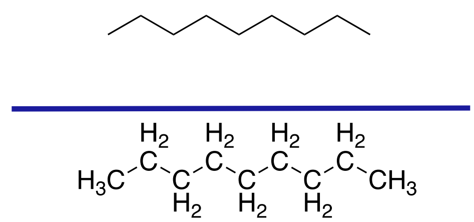
propane



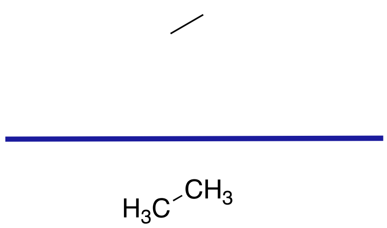
pentane



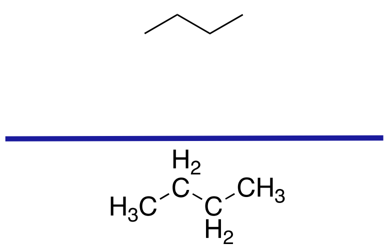
nonane



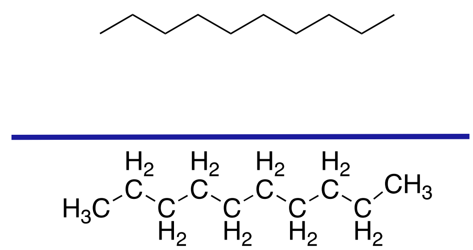
ethane



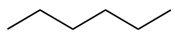
butane

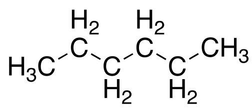


decane

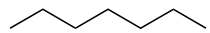


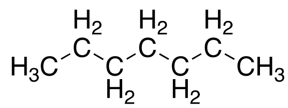
hexane



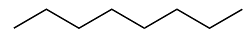


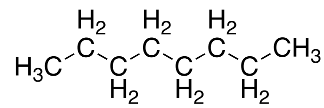
heptane





octane





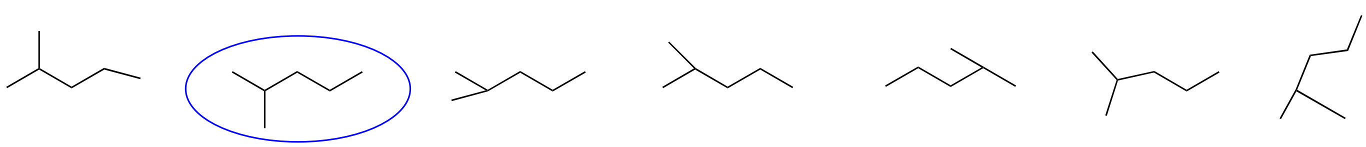
ideal bond (*H-C-H*) angles for sp^3-hybridized carbons ~*109°*

has *4* bonds to other atoms.

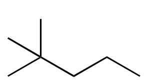
carbon atoms in organic structures *always* have
C-atoms in common organic molecules *never*

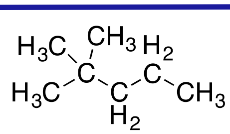
hybridization state of the carbons in the above molecules is *sp^3* *because* they have *4* atoms attached.

corners of a *tetrahedral* shape
ideally about *109°*

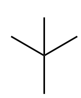


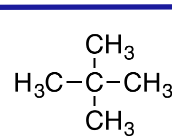
2,2-dimethylpentane



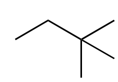


2,2-dimethylpropane

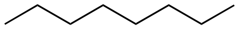




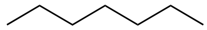
2,2-dimethylbutane



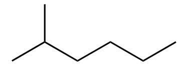
$CH_3CH_2C(CH_3)_2CH_3$



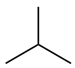
octane



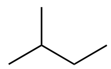
heptane



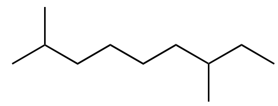
2-methylhexane



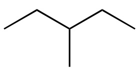
methylpropane



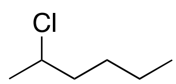
2-methylbutane



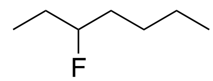
2,7-dimethylnonane



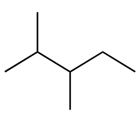
3-methylpentane



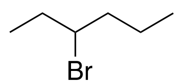
2-chlorohexane



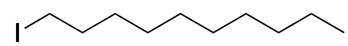
3-fluoroheptane



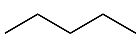
2,3-dimethylpentane



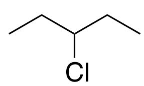
3-bromohexane



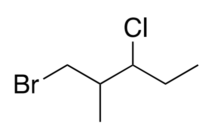
1-iododecanane



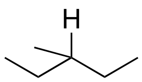
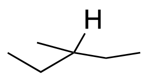
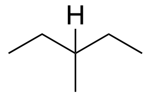
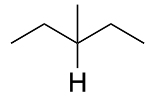
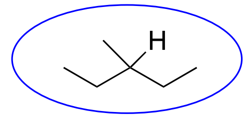
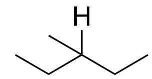
$CH_3CH_2CH_2CH_2CH_3$

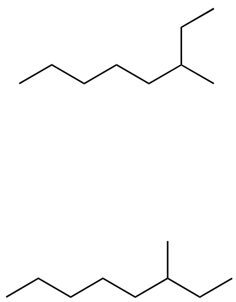
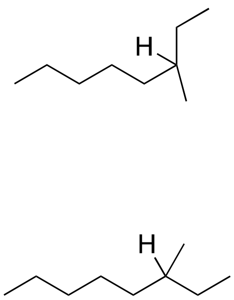
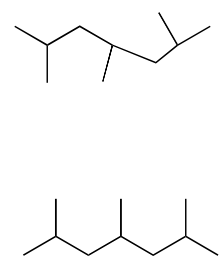


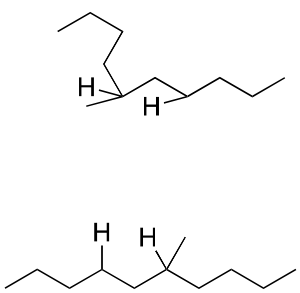
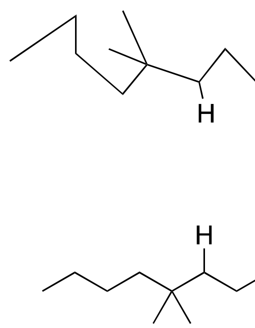
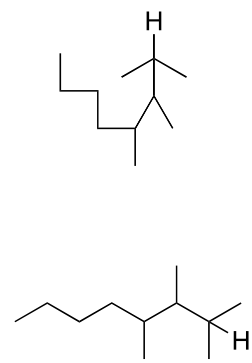
$CH_3CH_2CHClCH_2CH_3$

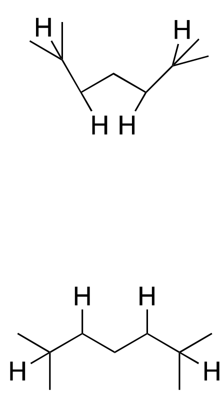
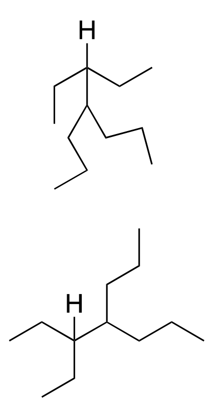
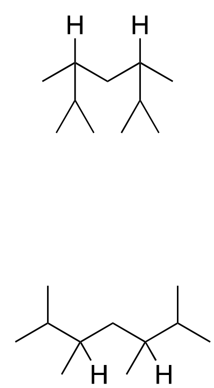


$BrCH_2CH(CH_3)CHClCH_2CH_3$

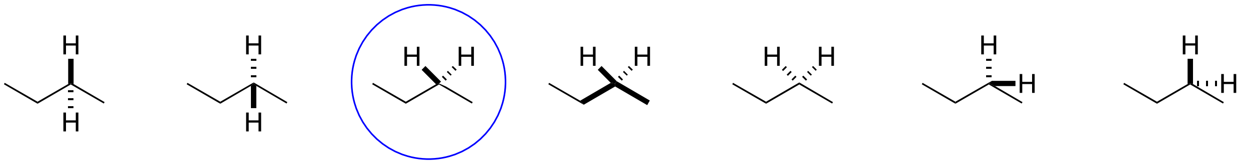







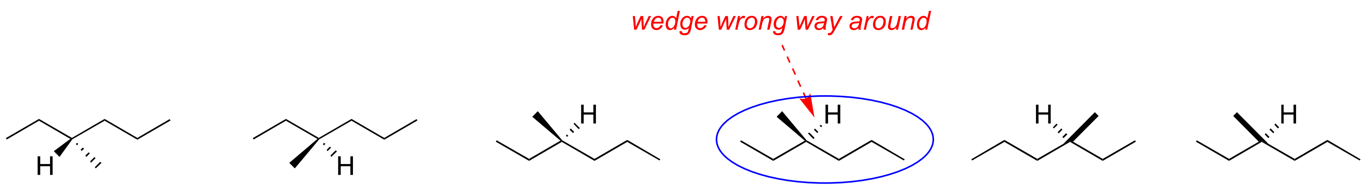




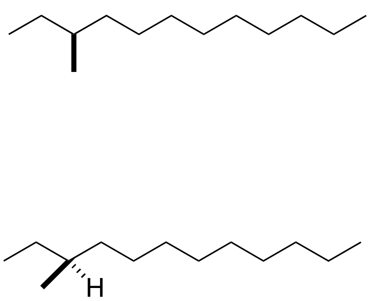




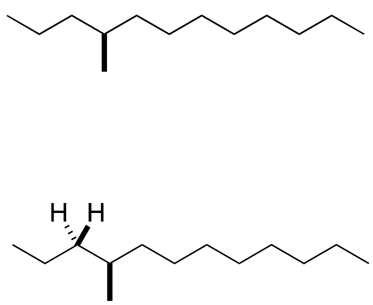
Three Dimensional Diagrams Of Organic Molecules



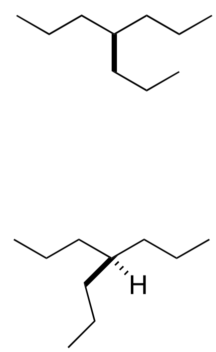




.... the C^3 hydrogen



.... both hydrogens on C^3

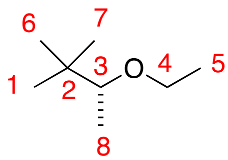


.... the H on unique C

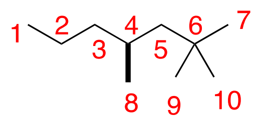
Alkyl Fragments

In Acyclic Hydrocarbons

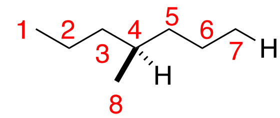
carbon connected to three hydrogens is called a *methyl*
Methylene fragments (of molecules) are those that have *CH_2* connected
Methine is the name given to *CH* fragments
CH_3 connected to anything is called a *methyl*
A quaternary *C* has *0* hydrogen



C1, C5, C6, C7, C8 methyl
C2 quarternary
C3 methine
C4 methylene



C1, C7, C8, C9, C10 methyl
C2, C3, C5 methylene
C4 = methine
C6 = quartenary



C1, C7, C8 methyl
C2, C3, C6 methylene
C4 = methine

removed and replaced with something else *ie substituted*

represented as *CH_3, Me*

represented as *CH_3CH_2, Et*

ethyl group *cannot* be isolated and put in a bottle; it *is not* a discrete compound, but it *is* a molecular fragment

the fragment *is* attached to something else

Propane contains *2* types of

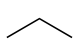
gives *different* outcomes

chain gives *a normal* propyl

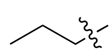
represented as *$MeCH_2CH_2$, $EtCH_2$, ^nPr*

a(n) *iso-* propyl group

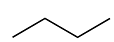
can be represented as *^iPr, $(CH_3)_2CH$*



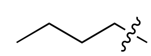
propane



n-propyl



butane



n-butyl

3 types of hydrogen

butyl chain gives a *normal* butyl group

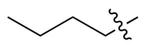
represented as *$MeCH_2CH_2CH_2$, $^nPrCH_2$, $CH_3CH_2CH_2CH_2$*

a(n) *sec* butyl group

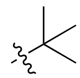
represented as *$CH_3CH_2CHCH_3$*

2-Methylpropane is an *isomer* of butane: it has __2__ chemically inequivalent hydrogen
ie a *^iBu* group.

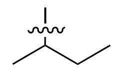
ie ^tBu.



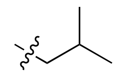
n-butyl



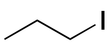
tert-butyl



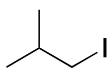
sec-butyl



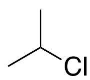
iso-butyl



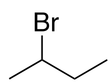
^{n}PrI



^{i}BuI



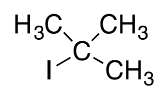
^{i}PrCl



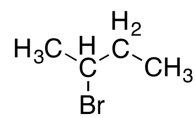
^{s}BuBr

CH_3Br

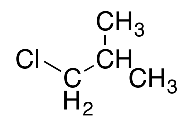
MeBr



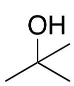
^{t}BuI



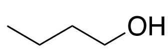
^{s}BuBr



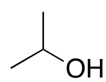
^{i}BuCl



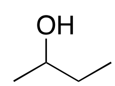
^{t}BuOH



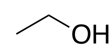
^{n}BuOH



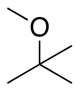
^{i}PrOH



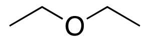
^{s}BuOH



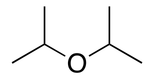
EtOH



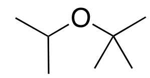
^{t}BuOMe



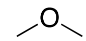
EtOEt
an anesthetic



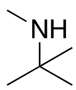
^{i}PrO^{i}Pr



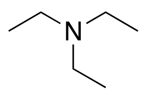
^{t}BuO^{i}Pr



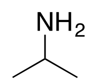
MeOMe



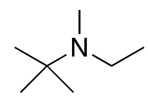
^{t}BuNHMe



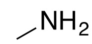
Et_3N



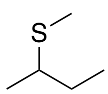
$^{i}PrNH_2$



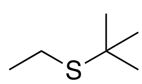
^{t}BuNMeEt



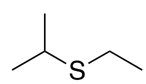
$MeNH_2$



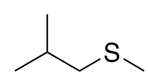
^{s}BuSMe



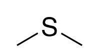
EtS^{t}Bu



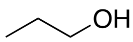
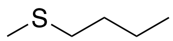
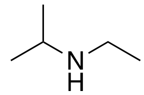
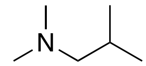
^{i}PrSEt



^{i}BuSMe



Me_2S

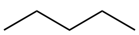
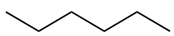
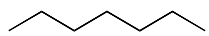
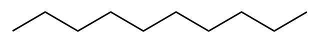
HO^nPr | MeS^nBu | ^iPrNHEt | $^iBuNMe_2$

alcohol | thioether | amine | amine

name functional groups as alcohol, amine, ether, or thioether on the dashed lines

D Conclusion

These *are* zigzag conformations.

pentane | *hexane* | *heptane* | *decane*

linear hydrocarbons *can* be represented