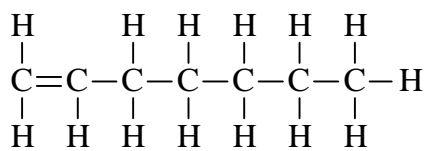


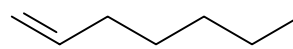
## Chapter 2

26. Propose suitable structures for the following:  
 (a) and alkene, C<sub>7</sub>H<sub>14</sub>.

There are a number of possible isomers that one could draw. *Some* of them are shown below.



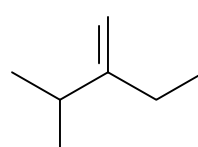
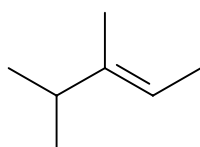
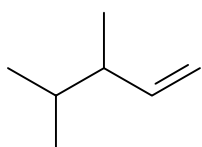
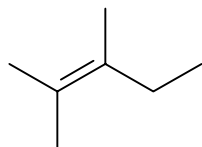
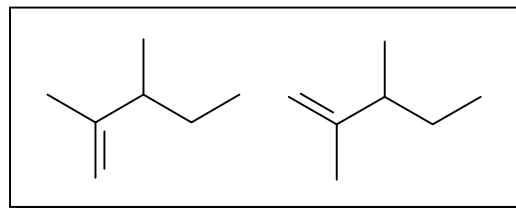
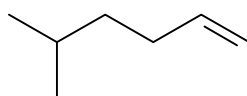
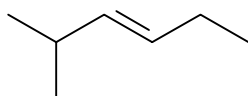
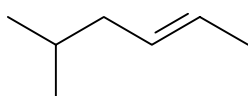
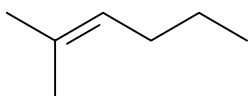
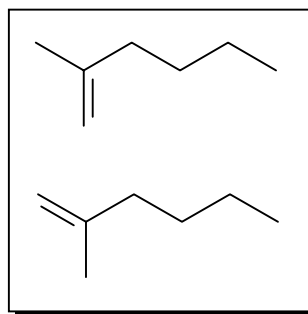
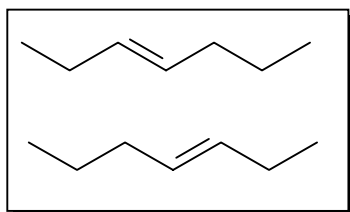
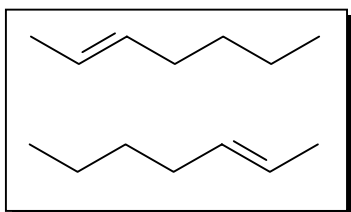
This Lewis structure can be condensed in a number of ways as shown here.



This is one possible isomer.

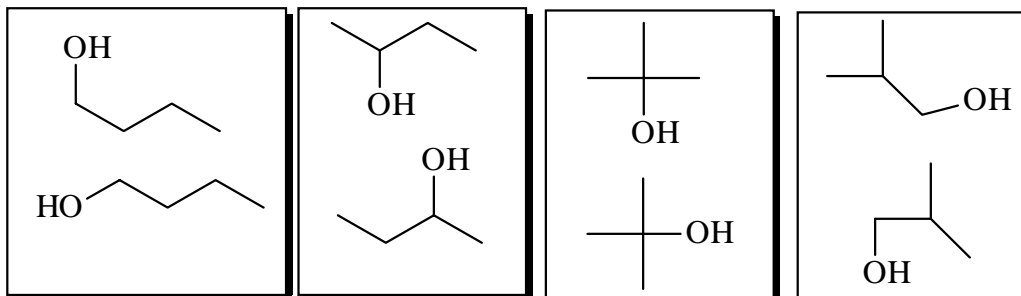
Some other isomers --

Note: The boxed structures are identical; they are the same molecule.



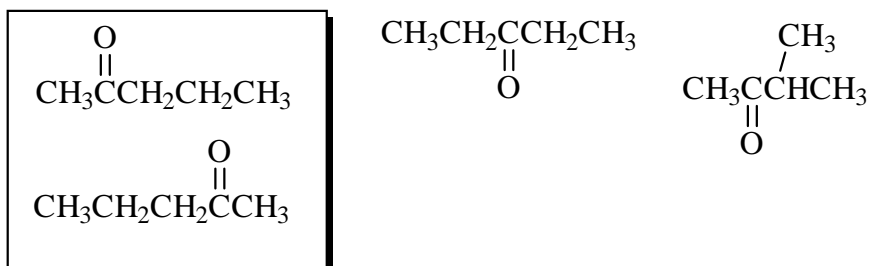
27. Write as many structures as you can that fit the following descriptions.  
 (a) Alcohols with formula  $C_4H_{10}O$ .

Note: The boxed formulas are the *same* -- they represent the *same* molecule.



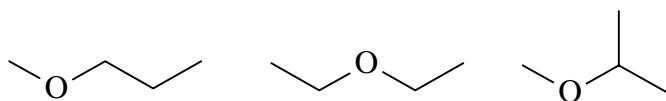
- (c) Ketones with formula  $C_5H_{10}O$ .

Note: Boxed structures are the *same* -- they represent the *same* molecule.



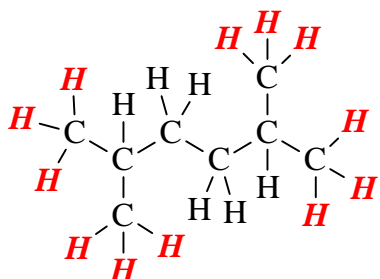
- (e) Ethers with formula  $C_4H_{10}O$ .

Note: I'm tired of drawing different pictures of the same structure. Hopefully, by now you've got the idea that it doesn't matter how the atoms are oriented in space when we draw these Lewis or line-bond structures; we are not trying for a three-dimensional picture. What does matter is which atoms are attached to which.

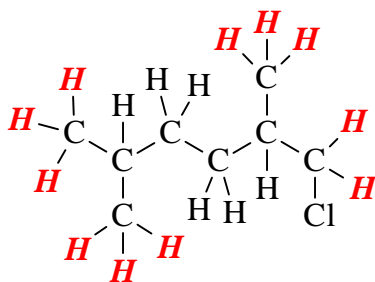


29. Draw all monochloro derivatives of 2,5-dimethylhexane.

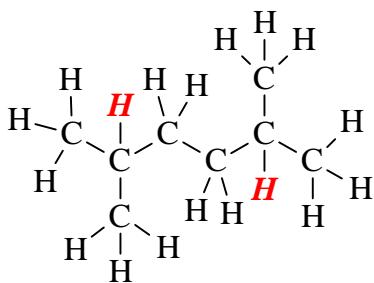
So, first we have to know what 2,5-dimethylhexane is. Then we have to replace one of the hydrogens of 2,5-dimethylhexane with the chlorine to get one of the monochloro derivatives. Then, starting again with 2,5-dimethylhexane, we have to replace a different hydrogen with the chlorine *in such a way that we get a different constitutional isomer from the one we already have*. We continue in this way until we have all the different constitutional isomers. It is a trial and error process. Note that not every hydrogen we could replace will lead to a new constitutional isomer. This will be explained more fully below.



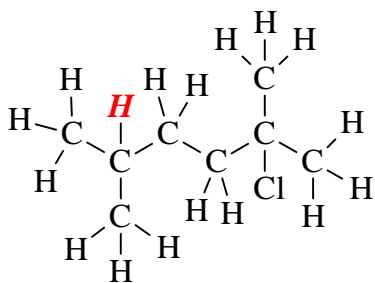
This is 2,5-dimethylhexane. Twelve of the hydrogens have been emphasized in the drawing. Replacement of any one of these will result in the same monochloro derivative, which is shown below. If this is not obvious to you, try replacing another of these hydrogens with chlorine and then name the resulting compound. You should come up with the same name since it is the same compound. Alternatively, you might see this better by making a model.



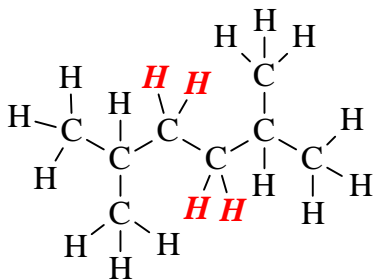
1-chloro-2,5-dimethylhexane



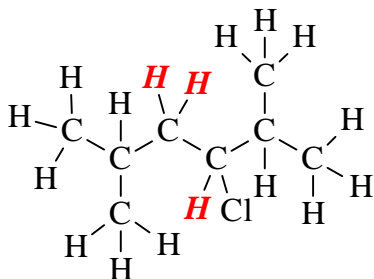
This, again, is 2,5-dimethylhexane. Two of the hydrogens have been emphasized in the drawing. Replacement of any one of these will result in the same monochloro derivative, which is shown below. If this is not obvious to you, try replacing one, then the other, of these hydrogens with chlorine and then name the resulting compound. You should come up with the same name since it is the same compound. Alternatively, you might see this better by making a model.



2-chloro-2,5-dimethylhexane



This, again, is 2,5-dimethylhexane. Four of the hydrogens have been emphasized in the drawing. Replacement of any one of these will result in the same monochloro derivative, which is shown below. If this is not obvious to you, try replacing one, then another, of these hydrogens with chlorine and then name the resulting compound. You should come up with the same name since it is the same compound. Alternatively, you might see this better by making a model.

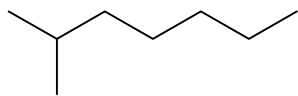


3-chloro-2,5-dimethylhexane

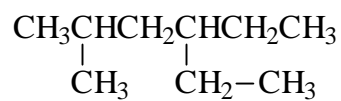
33. Which of the structures in each of the following sets represent the same compound and which represent different compounds?
- (a) The first two are butane; four carbons are attached in a row. The third structure is different. It is isobutane or 2-methylpropane; three carbons are attached in a row with a carbon branch at the second carbon.
- (b) All three of these structures are of the same molecule: 2-bromobutane.
- (c) The first two structures are the same: 2-bromo-3-methylbutane. The third is different; it is 3-bromo-2-methylpentane.
- (d) The first and third structures are the same; rotate the first structure counterclockwise 120 degrees to get the third structure.

34. Draw the structural formulas for the following substances.

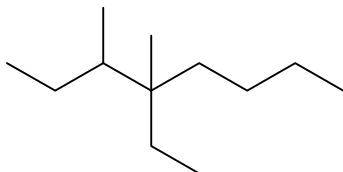
(a) 2-methylheptane



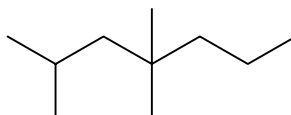
(b) 4-ethyl-2-methylhexane



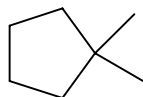
(c) 4-ethyl-3,4-dimethyloctane



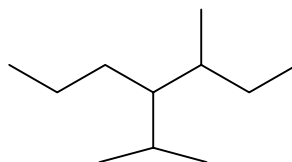
(d) 2,4,4-trimethylheptane



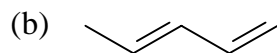
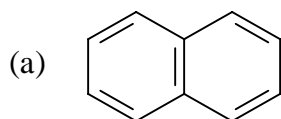
(e) 1,1-dimethylcyclopentane



(f) 4-isopropyl-3-methylheptane

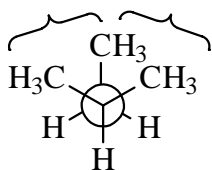


36. Convert the following line-bond structures into skeletal drawings.

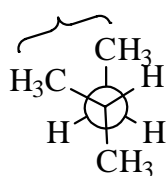


38. Sighting along the C2-C3 bond of 2-methylbutane, there are two different staggered conformation. Draw them both in Newman projections, tell which is more stable, and explain your choice.

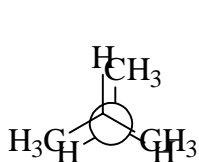
Less stable:  
two steric  
interactions



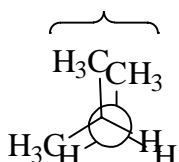
More stable:  
one steric  
interaction



39. Sighting along the C2-C3 bond of 2-methylbutane (see problem 38), there are also two possible eclipsed conformations. Draw them both in Newman projections, tell which you think is lower in energy, and explain.

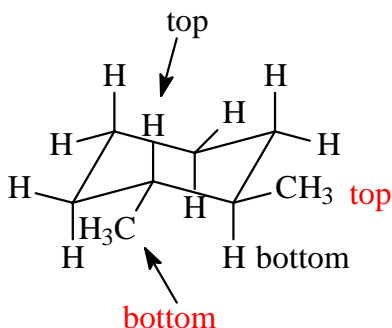


More  
stable.



Less stable.  
This conformation has  
an unfavorable methyl-methyl  
steric interaction.

41. Give the IUPAC names for the following compounds.
- (a) methylcycloheptane, (b) *cis*-1,3-dimethylcyclopentane, (c) *trans*-1,2-dimethylcyclohexane, (d) *trans*-1-isopropyl-2-methylcyclobutane, (e) 1,1,4-trimethylcyclohexane
53. Draw *trans*-1,2-dimethylcyclohexane in its more stable chair conformation. Are the methyl groups axial or equatorial?

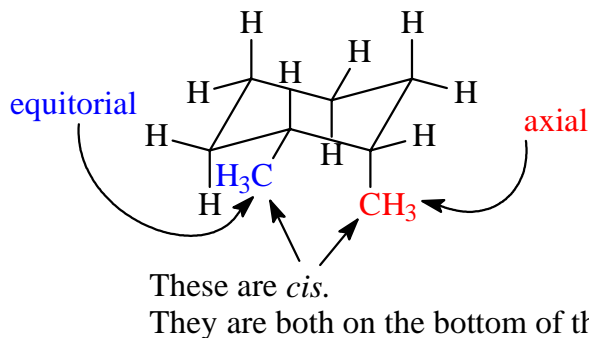


We know that the methyl groups are *trans* here because one of them is the bottom group attached to its ring-carbon, while the other one is the top group attached to its ring-carbon.

Both of the methyls are in an equatorial position.

If you “flip” the ring, both the methyl groups will become axial. The diaxial conformation is less stable than the diequatorial owing to the 1,3-diaxial steric interactions in the diaxial form.

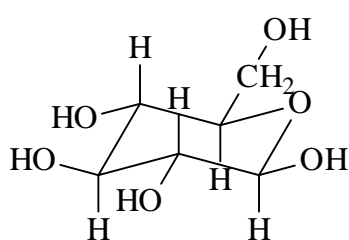
54. Draw *cis*-1,2-dimethylcyclohexane in its more stable chair conformation. Are the methyl groups axial or equatorial? Which is more stable, *cis*-1,2-dimethylcyclohexane or *trans*-1,2-dimethylcyclohexane (problem 53)? Explain.



In this case one of the methyls is equatorial and the other is axial. If the ring is flipped the equatorial one will become axial and the axial one will become equatorial. So, there will always be one axial methyl group here and this group will have 1,3-diaxial interactions. The trans isomer has a conformation in which both the methyls are equatorial – no 1,3-diaxial

interactions. So, the trans isomer is more stable.

57. Glucose contains a six-membered ring in which all the substituents are equatorial. Draw glucose in its more stable chair conformation.



Depending on your viewpoint this may turn out looking differently. The drawing here is the classic one – the one you usually see in textbooks.

61. Draw the three cis-trans isomers of menthol.

