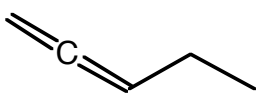
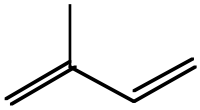
Answers to Problem 23, Chemistry 301X, 2006

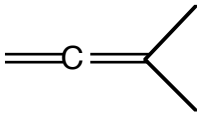
First determine the number of degrees of unsaturation. For C5, the saturated alkane would have 12 hydrogens. Application of the formula leads to:

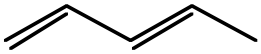
12 – 8 = 4/2 = two degrees of unsaturation. There must be a total of two π bonds or rings in these molecules.

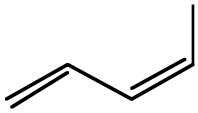
Here are the acyclic molecules that fit:



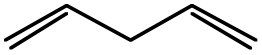


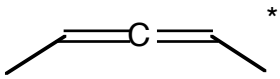




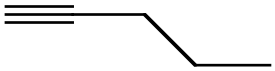


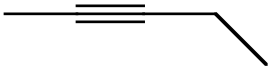
a cis/trans pair

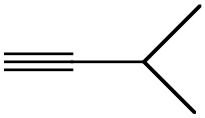




NO cis/trans - why not?
it's chiral, though



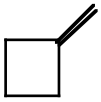




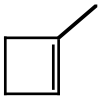
Here are the cyclic molecules - tougher, probably.

First, find the compounds containing five- and four-membered rings. One is chiral.

cyclopentene



methylenecyclobutane



1-methylcyclobutene

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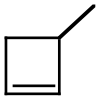
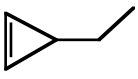


3-methylcyclobutene

Now find the cyclopropenes. There are five, and one is chiral.

3,3-dimethylcyclopropene



3-ethylcyclopropene

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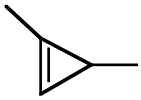
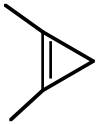


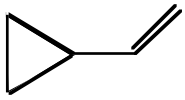
1,3-dimethylcyclopropene



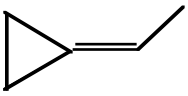
1,2-dimethylcyclopropene

1-ethylcyclopropene

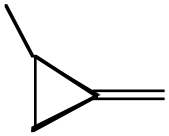
Now find the cyclopropanes. There are only three and one is chiral.



vinylcyclopropane



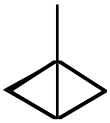
ethylidenecyclopropane



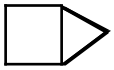
* 2-methylmethylenecyclopropane

Finally, and most difficult, find the spiro and bicyclic isomers: There are five, one of which can exist in two forms called exo and endo. If you got these, you are really sharp.

spiropentane

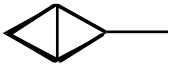


1-methylbicyclo[1.1.0]butane



bicyclo[2.1.0]pentane

bicyclo[1.1.1]pentane



2-methylbicyclo[1.1.0]butane

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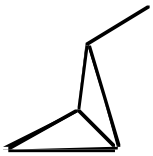

exo isomer

endo isomer