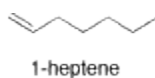


CARBON-CARBON MULTIPLE BONDS

Unsaturated hydrocarbons contain only carbon and hydrogen, but also have some multiple bonds between carbons. One type of unsaturated hydrocarbon is an olefin, also known as an alkene. Alkenes contain double bonds between carbons. One example of an alkene is 1-heptene. It looks similar to hexane, except for the double bond from the first carbon to the second.



Look at the IR spectrum of 1-heptene. You should see:

- a set of peaks dipping down from the baseline at about 2900 cm^{-1} .
- another set of peaks dipping down from the baseline at about 1500 cm^{-1} .

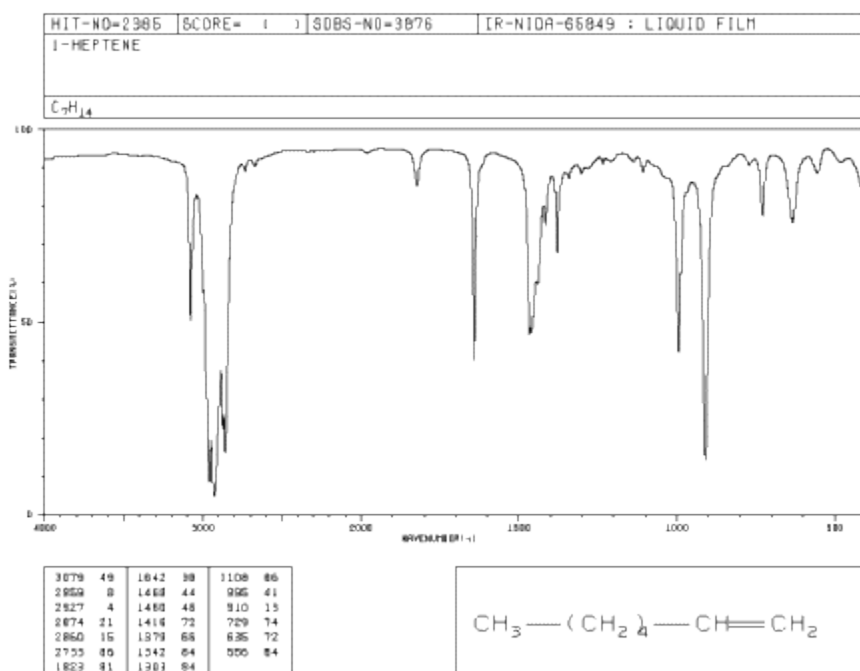


Figure IR4.1. IR spectrum of 1-heptene.

Source: SDBSWeb : <http://riodb01.ibase.aist.go.jp/sdbs/> (National Institute of Advanced Industrial Science and Technology of Japan, 14 July 2008)

So far, these peaks are the same as the ones seen for hexane. We can assign them as the C-H stretching and bending frequencies, respectively.

Looking further, you will also see:

- a small peak around 3100 cm^{-1} .
- a small peak near 1650 cm^{-1} .
- medium peaks near 800 and 1000 cm^{-1} .

The peak at 3100 cm^{-1} hardly seems different from the C-H stretch seen before. It is also a C-H stretch, but from a different type of carbon. This stretch involves the sp^2 or trigonal planar carbon of the double bond, whereas the peak at 2900 involves an sp^3 or tetrahedral carbon.

The peak at 1650 cm^{-1} can be identified via computational methods as arising from a carbon-carbon double bond stretch. It is a weak stretch because this bond is not very polar. Sometimes it is obscured by other, larger peaks.

The larger peaks near 800 and 1000 cm^{-1} are bending vibrations. They are due to a C=C-H bond angle that bends **out of the plane** of the double bond (remember that the carbons on either end of the double bond are trigonal planar). They are called oop bends. Oop bends are often prominent in alkenes and are easier to spot than an sp^2 C-H stretching mode or a C=C stretching mode.

Source : <http://employees.csbsju.edu/cschaller/Principles%20Chem/structure%20determination/IRolefin.htm>