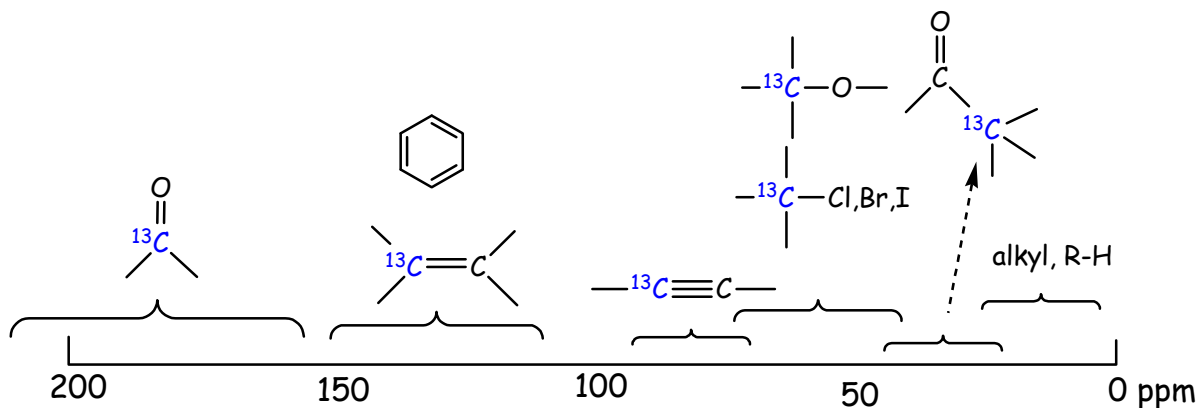
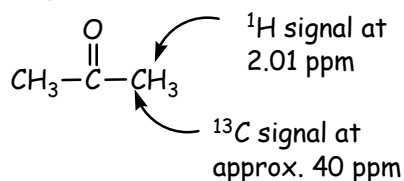


Correlation Table for ^{13}C chemical shifts:



Helpful observation: The chemical shifts for ^{13}C nuclei are 15-20 times larger than the corresponding ^1H nuclei frequencies. Example: acetone. Protons next to the carbonyl observed at 2.01 ppm. The ^{13}C signal for the carbon next to the carbonyl is $2.01 \times 20 = 40$ ppm.

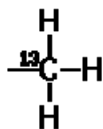


Chemical shifts for carbonyl functional groups (ppm)

ketones	220-200	amides	180-160
α,β -unsaturated ketones	210-190	acid chlorides	180-160
aldehydes	205-190	anhydrides	175-150
carboxylic acids	185-165	nitriles	120-115
esters	185-160		

Spectra which show the spin-spin splitting, or coupling, between carbon-13 and the protons directly attached to it are called **proton-coupled spectra** or **nondecoupled spectra**.

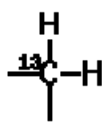
3 protons



$$n + 1 = 4$$



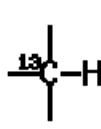
2 protons



$$n + 1 = 3$$



1 protons



$$n + 1 = 2$$



0 protons



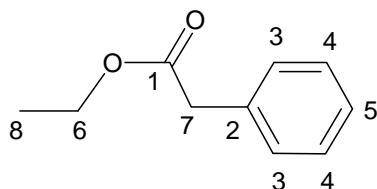
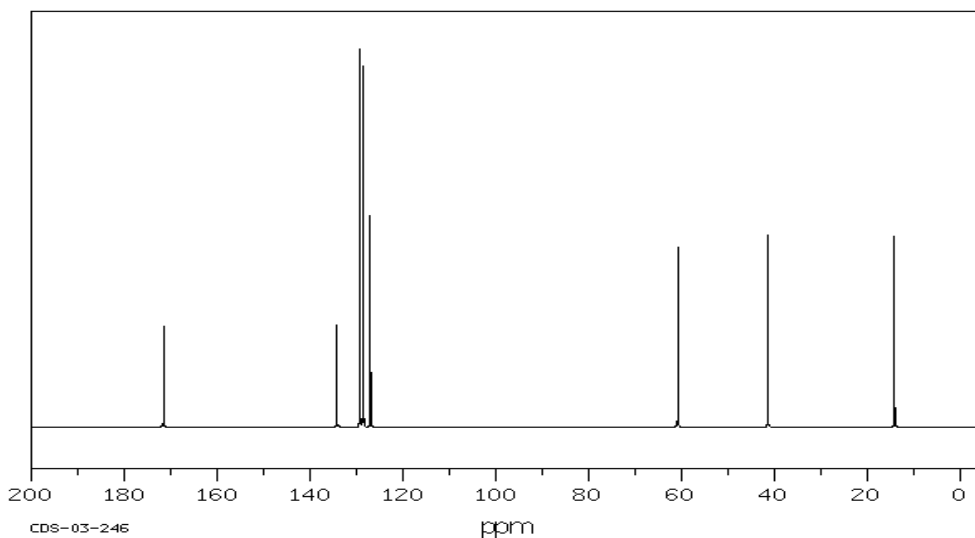
$$n + 1 = 1$$



Coupled and decoupled Spectra

Spectra in which the protons are decoupled from the C-13 nuclei are called **proton-decoupled** spectra or simply **decoupled spectra**. Decoupled spectra show singlets for each non-equivalent carbon-13 nucleus.

Here is the **proton-decoupled spectrum** of ethyl phenyl acetate. Nice and clean!



1	171.5 ppm
2	134.3
3	129.3
4	128.5
5	127.0
6	60.8
7	41.4
8	14.2

Here is the **proton-coupled spectrum** for the same compound, ethyl phenyl acetate. Notice the two triplets and a quartet for the sp^3 carbons, whereas the aromatic carbons show non-first order splitting. Also, the carbonyl carbon and the **ipso** ring carbon both have a low intensity in both spectra (no hydrogens attached to these carbons).

