



## Chemical Shift Problems

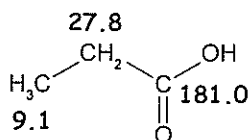
### Student NMR Table

The following data table may aid you in your answers:

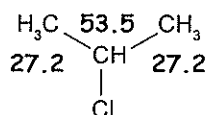
$\delta$ (ppm)	Carbons Associated With This Region
0-15	$\text{CH}_3\text{CH}_2-$
15-30	$\text{CH}_3-$
20-35	$-\text{CH}_2-$
30-60	C-N, C-Cl, C-Br, C-C=O
50-70	C-O
60-90	$\text{C}\equiv\text{C}$
100-150	$\text{C}=\text{C}$
160-185	C=O present in carboxylic acids, esters, acyl chlorides and amides
180-220	C=O present in aldehydes and ketones

1. Use the data tables and what you have learnt about chemical environments to assign the chemical shifts supplied to the carbons of the following substances.

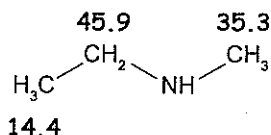
a. 9.1, 27.8, 181.0



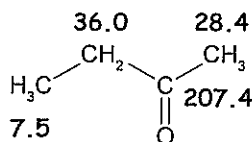
b. 27.2, 53.5



c. 14.4, 35.3, 45.9



d. 7.5, 28.4, 36.0, 207.4



2. A student has four samples (a-d), that are either: an **aldehyde**, an **ester**, a **chloroalkane** or an **alkene**. Use the characteristic (distinct) shifts given for a-d to work out which is which.

a. 170.0 ester

b. 55.8 chloroalkane

c. 143.1 alkene

d. 202.8 aldehyde

3. A student analyses four samples and gets the following characteristic peaks:

206.7      172.2      47.4      90.1

Which peak is likely to belong to the following compounds?

a. bromoalkane 47.4

b. alkyne 90.1

c. ketone 206.7

d. amide 172.7