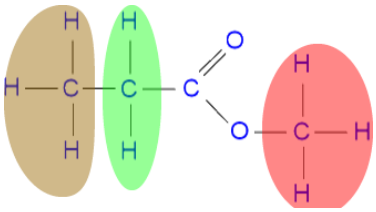
Friday Worksheet **Name: …….**
^{1}HNMR spectroscopy 1

BACKGROUND ON NMR:

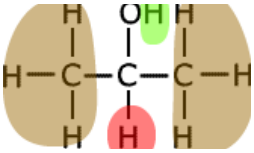
1) How many signals are expected in the ^{1}HNMR spectrum of the following molecules? Draw the structure of each molecule.
Each hydrogen that is chemically different has its own signal The chemically different hydrogen atoms are shown in each diagram coloured.
a) $CH_3CH_2CH_2COO H$
Four signals

b) Methyl propanoate
Three signals



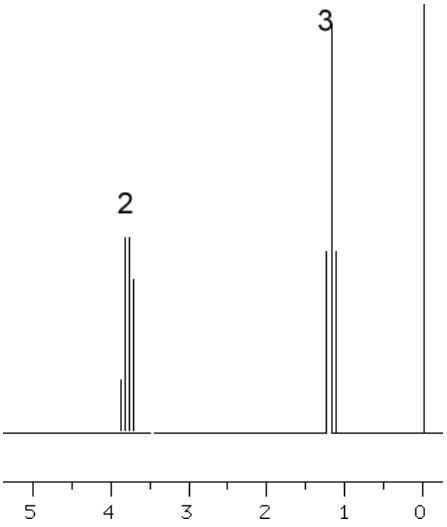
c) Propan-2-ol

Three signals

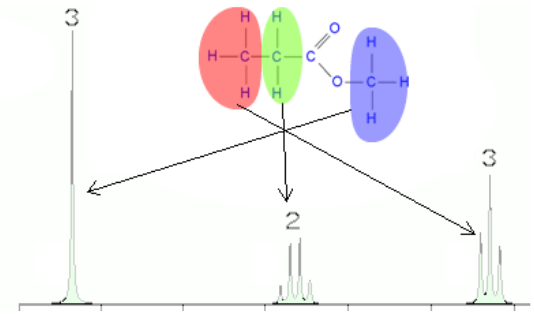


2) Draw the ^{1}HNMR spectrum of each of the compounds below. Clearly show the signal splitting and the relative intensity of each signal.

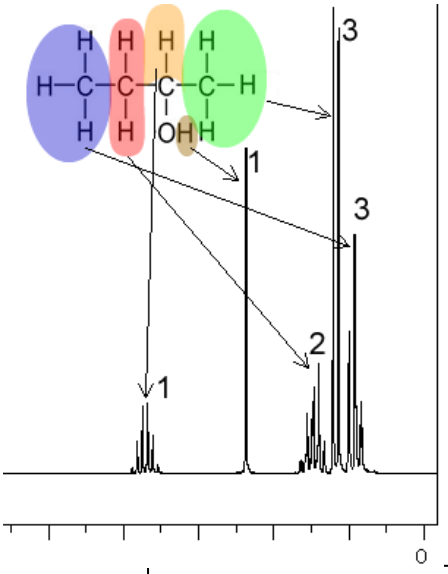
a) $CH_3CH_2OCH_2CH_3$



b) $CH_3CH_2COOCH_3$



c) Butan-2-ol



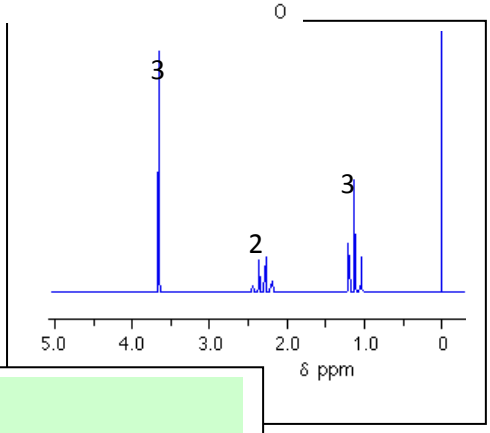
3) Consider the ^{1}HNMR spectrum on the right.

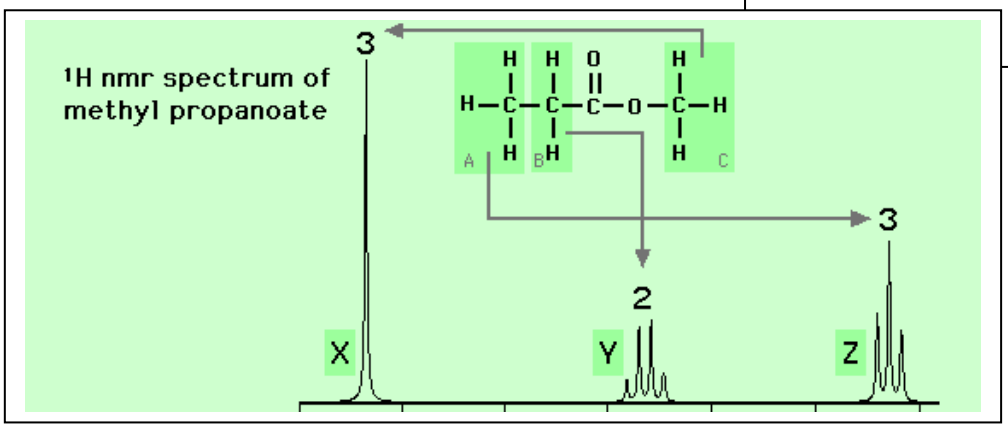
a) What is the signal at 0 ppm?

It is the TMS signal that all other signals are compared to.

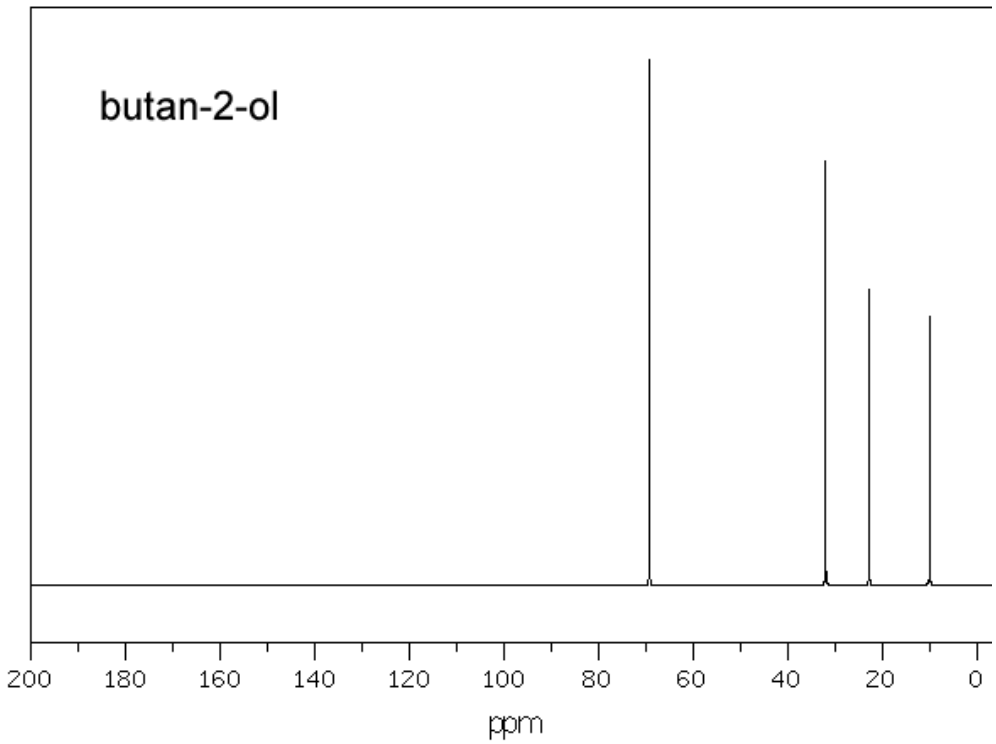
b) Which of the following molecules is likely to be represented by this spectrum? Explain.

methyl propanoate





4) Below is the ^{13}CNMR for butan-2-ol



a) How many chemically different carbon environments exist?
4

b) Why is there no signal splitting in ^{13}CNMR but there is in ^{1}HNMR?
The natural abundance of ^{13}C is very low and so the chances of having two ^{13}C atoms next to each other in a molecule are very low and so no splitting is seen in ^{13}CNMR.

c) Why ^{13}C is used for analysis and not ^{12}C, which is the more abundant isotope of carbon
The ^{12}C isotope is not magnetically active and therefore not detectable by NMR. Only nuclei with an odd number of nucleons can be detected in NMR.