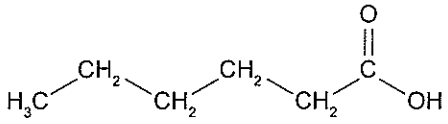
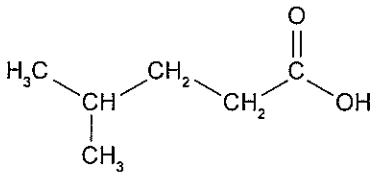
a. Label **three** structures as either X, Y or Z.

i.



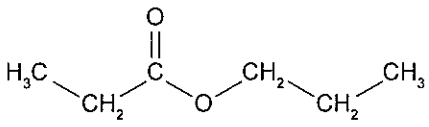
Spectra: _____

ii.



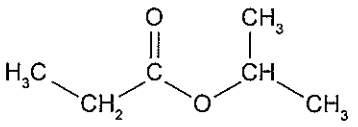
Spectra: Y

iii.



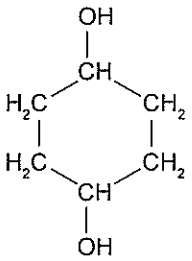
Spectra: Z

iv.



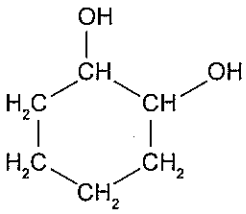
Spectra: _____

v.



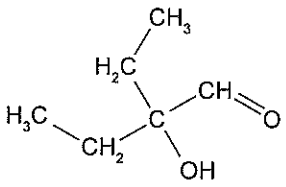
Spectra: X

vi.



Spectra: _____

vii.



Spectra: _____

b. Justify your choices in a. Your answer should include reference to both the number of chemical environments and the chemical shifts of these environments.

X is highly symmetric with only two signals. As both signals are below 100 ppm there is no carbonyl group present. v and vii do not have carbonyl groups but vi has three chemical environments and v has only two making v the structure for X.

Y has a carbonyl group and 5 signals, which means there are five chemical environments not six. ii and iv are the only two structures with five chemical environments. If we consult the data table, a C-O present in an ester (iv) but not an acid (ii) would be in the 50-70 range. As there is no such peak, we can conclude that Y is ii.

Z has a carbonyl group and 6 signals, which means there are six chemical environments with no symmetry. i and iii are both appropriate but there is a signal at 67 ppm which indicates the presence of a C-O (or a C≡C, but that is not possible for this structure) and therefore Z is an ester and is therefore structure iii.