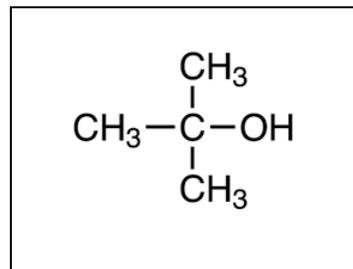


Video worksheet  $^1\text{H-NMR}$

- Consider the molecule shown on the right.
  - How many signals will its  $^1\text{H-NMR}$  spectrum have?
  - What will be the splitting pattern?



- Consider the two  $^1\text{H-NMR}$  spectra shown below. Three molecules were isolated in a forensic investigation of illicit drug manufacture. They were propan-1-ol, propan-2-ol and the ester ethyl ethanoate.

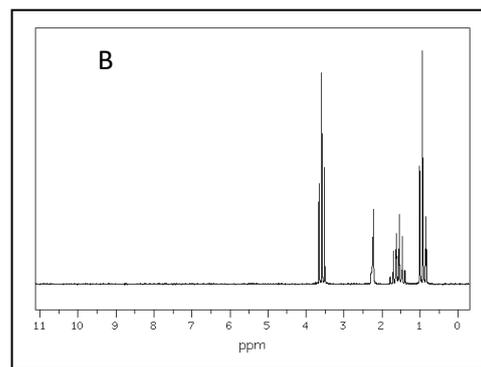
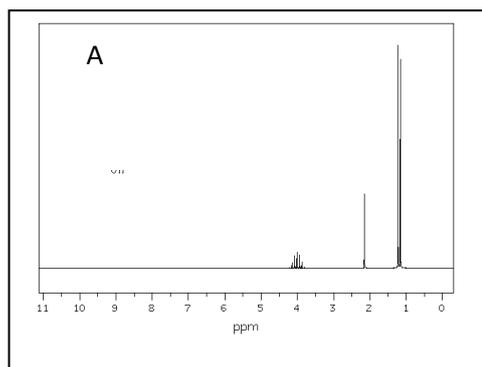
- Draw the structural formula of each molecule.

Propan-1-ol

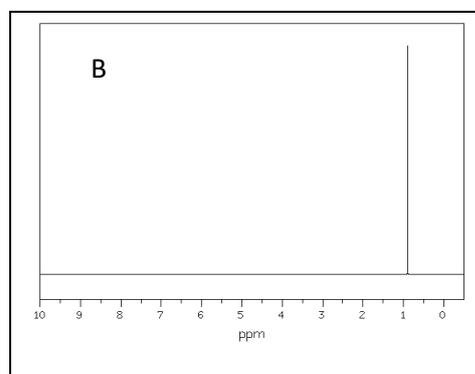
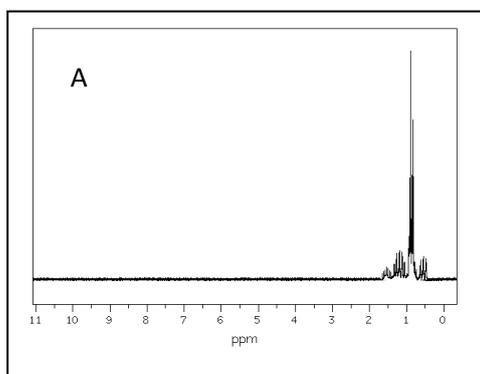
Propan-2-ol

Ethyl ethanoate

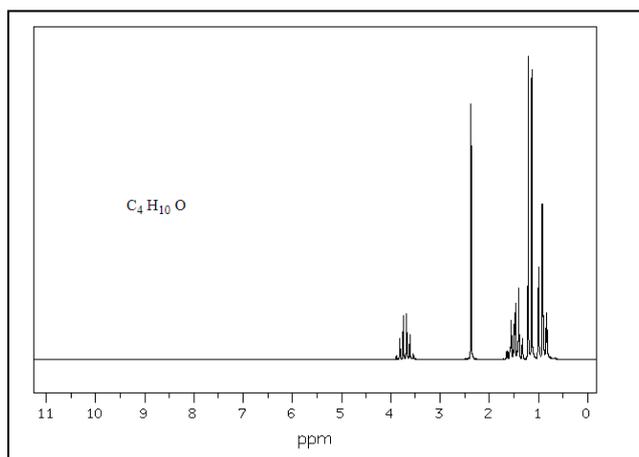
- Identify the substance A and B using the spectra below.



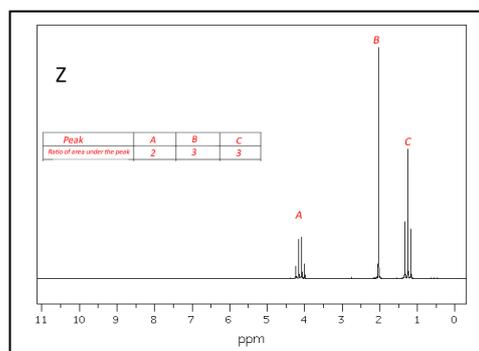
- An alkane has the molecular formula  $\text{C}_5\text{H}_{12}$ . The  $^1\text{H-NMR}$  spectra of two isomers A and B are shown below. Using the  $n+1$  rule and the data-booklet identify the two isomers and draw their structural formulae.



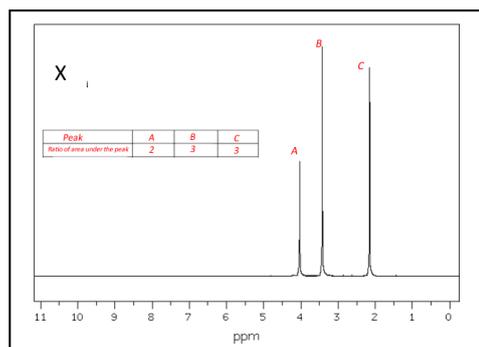
4. Consider a compound with molecular formula  $C_4H_{10}O$ .
- Draw the structural formula for each of the alcohol isomers.
  - Name each isomer.
  - The  $^1H$ -NMR of one of these isomers is given below. Identify the isomer.



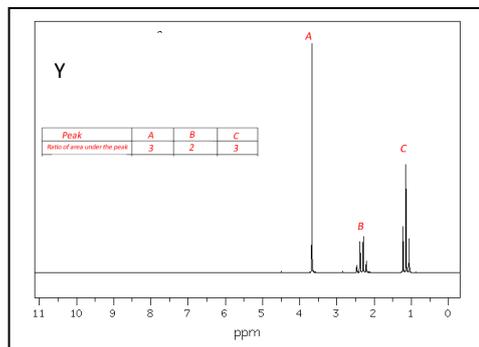
5. Consider the  $^1H$ -NMR spectrum of an organic molecule, "Z", with the chemical formula  $C_4H_8O_2$ , as shown below.
- Provide a reasonable structural formula for the compound. You may use the information from the Data-booklet shown below.



- The  $^1H$ -NMR spectrum of a second organic molecule also with the same molecular formula,  $C_4H_8O_2$  is shown below. Give a reasonable structure for this molecule based on the spectrum given. You may use the Data-booklet.



- c. Yet another  $^1\text{H-NMR}$  spectrum of a second organic molecule also with the same molecular formula,  $\text{C}_4\text{H}_8\text{O}_2$  is shown below. Give a reasonable structure for this molecule based on the spectrum given. You may use the Data-booklet.



6. a) Looking to identify a signal from a proton of an  $-\text{OH}$  group using data provided in the data-booklet can be problematic due to a wide range of values possible from 1-6 ppm. Describe a quick way of identifying a peak due to an  $-\text{OH}$ .

b) Consider the organic molecules named below. For each molecule:

- draw the structural formula for each molecule
- give the number of signals expected in the  $^1\text{H-NMR}$  spectrum of each molecule
- and describe the splitting patterns you would expect to see using the simple  $n+1$  rule.

i. 1,4-dichlorobutane

ii. 1,3-dichlorobutane

iii. 2-chloro-2-methylbutane