Spectrum 1 is compound D as it has an N-H/O-H absorption (3000-3500 cm^{-1}) but no carbonyl absorption.

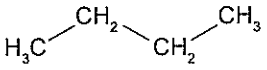
Spectrum 2 is compound C as it has both a carbonyl absorption (1600-1800 cm^{-1}) and an O-H/N-H absorption (3000-3500 cm^{-1}).

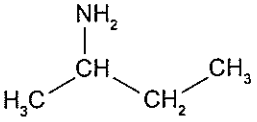
Spectrum 3 is compound B as it has a carbonyl absorption (1600-1800 cm^{-1}) but not an N-H/O-H absorption.

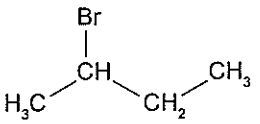
6. IR spectroscopy can readily distinguish tertiary amides from primary and secondary amides. Discuss why this is true and what you would find in an IR spectrum for a primary or secondary amide compared to a tertiary amide.

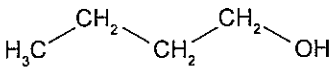
All amides have a carbonyl group and will have an intense absorption around 1600-1800 cm^{-1}. Primary and secondary amides both have N-H bonds but tertiary amides do not. Consequently, primary and secondary amides will have a broad absorption around 3000-3500 cm^{-1} whereas a tertiary amide will not.

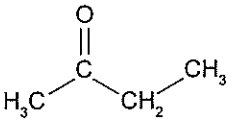
7. Group the following compounds into four groups based on which will have similar IR spectra. Give a brief reason for each grouping.

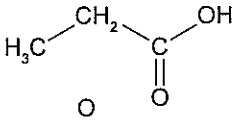
A 

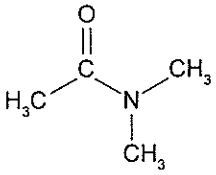
B 

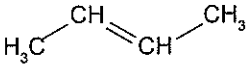
C 

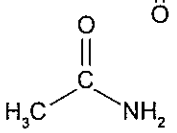
D 

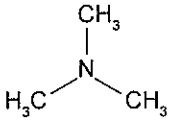
E 

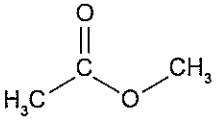
F 

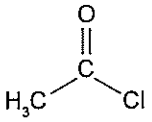
G 

H 

I 

J 

K 

L 

A, C, H and J do not have any N-H, O-H or C=O and therefore will have similar looking IR spectra.

B and D have an O-H or N-H but no C=O and therefore will have similar looking IR spectra.

E, G, K and L all have C=O but no O-H or N-H and therefore will have similar looking IR spectra.

F and I have both C=O and an O-H or N-H and therefore will have similar looking IR spectra.