Friday Worksheet **Name: …….**

Analytical chemistry revision 6

1) A mixture of 6 compounds was run through a GLC. Three different chromatograms were obtained under different temperatures. All other conditions were kept constant.

a) Which one of the chromatograms was developed using very high temperatures? Explain

B

Each compound has a lower retention time. High temperatures move the compounds quickly through the column minimising their interaction with the stationary phase and reducing the retention times.

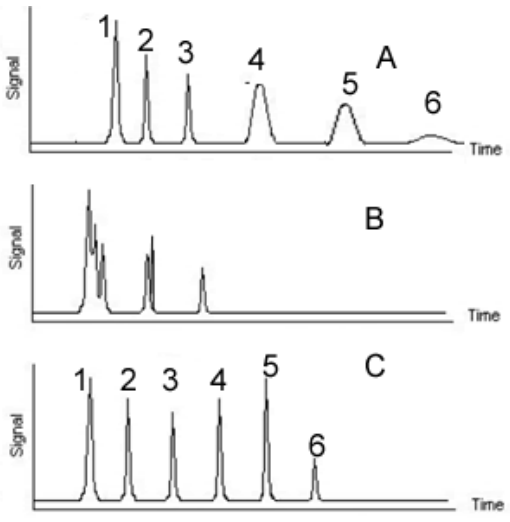


Fig 1

2) b) Which one of the chromatograms was developed using low temperatures? Explain

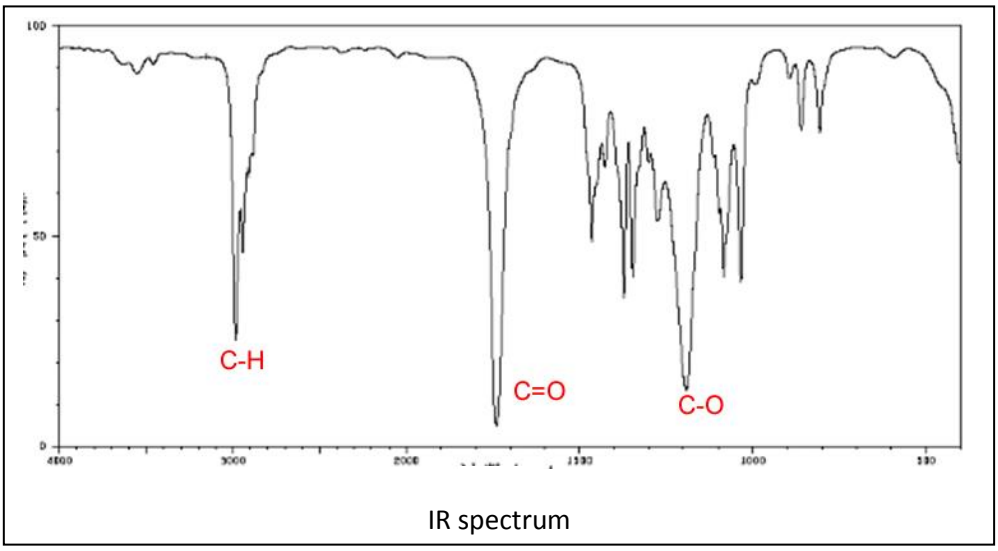
A

Each compound has a higher retention time. This can be due to a lowering in temperature, since temperature is the only variable. Compounds 1, 2 and 3 have a lower boiling temperature than 4, 5 and 6 since they separate out well with forming broad peaks.

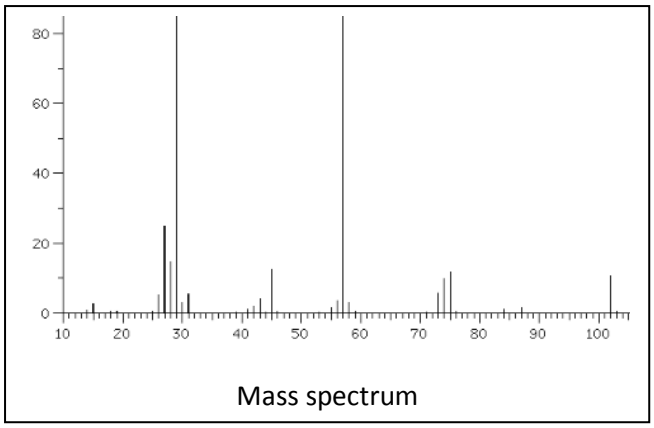
c) What can you say about the molar mass of compounds 1, 2 and 3 compared to 4, 5 and 6? Explain

Compounds 1, 2 and 3 have a lower retention time than 4, 5 and 6. Since they belong to the same homologous group they must differ in molar mass. Compound 1, 2 and 3 are smaller than 4, 5 and 6 since the vapourise at lower temperatures and remain in the gas phase longer thus interacting less with the stationary phase than the bigger molecules which will spend more time in the liquid state since they have a higher boiling temperature.

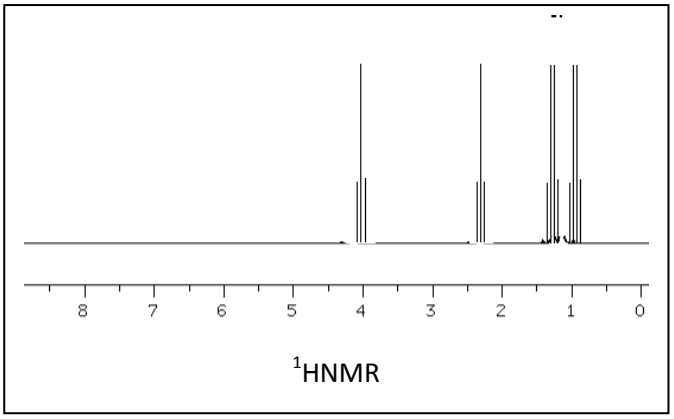
3) Compound 6, shown in fig 1, has the empirical formula $C_5H_{10}O_2$. Its IR, Mass and ^{1}HNMR spectra are shown below.



IR spectrum



Mass spectrum



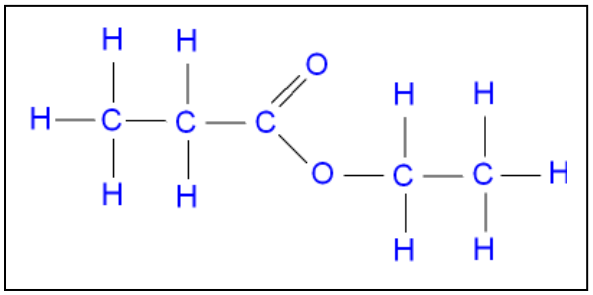
^{1}HNMR

a) What information can the mass spectrum provide?
The mass of the parent ion

b) What fragment formed the peak at m/z 57?
$CH_3CH_2CO^+$

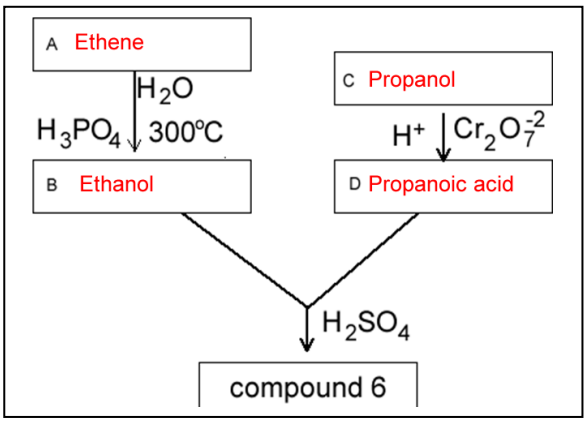
c) What is the molecular formula of compound 6?
Same as the empirical formula $C_5H_{10}O_2$

d) Draw the structural formula of compound 6.



e) What type of reaction forms compound 6?
Condensation reaction

f) Label the diagram below.



g) What can you say about the difference between the boiling temperature of compound 6 when compared to compound 1?
Compound 1 has a lower boiling temperature than compound. The fact that compound 1 has a lower retention time than compound 6 indicates that it moves through the column faster. It spends more time in the gas phase being swept along by the carrier gas.

What factors contribute to this difference?
Polarity of the molecule and the mass of the molecule contribute to the intermolecular forces holding the molecules together. The more polar the molecule and the greater the mass of the molecule the greater the intermolecular forces and hence the boiling temperature.