

Question 3

This question carries 30 per cent of the marks for this assignment, and tests Learning Outcome 1 of Book 8 Part 1 and Learning Outcomes 10–13 of Book 8 Part 2 (the Spectroscopy CD-ROM).

Compound A ($C_4H_8O_2$) can be reduced to compound B ($C_4H_{10}O_2$), and can be oxidized to compound C ($C_4H_6O_2$). Figures 1, 2 and 3 show the infrared spectra of compounds A, B and C, respectively. The ^{13}C NMR spectra of compounds A, B and C have peaks at the positions indicated in Table 1.

Table 1 ^{13}C NMR spectral data for compounds A, B and C

Compound A	$\delta = 19$ p.p.m. (q)	CH_3
	$\delta = 24$ p.p.m. (q)	CH_3
	$\delta = 73$ p.p.m. (d)	CH_2-O
	$\delta = 211$ p.p.m. (s)	$C=O$
Compound B	$\delta = 20$ p.p.m. (q)	CH_3
	$\delta = 68$ p.p.m. (d)	$C-O$
Compound C	$\delta = 22$ p.p.m. (q)	CH_3
	$\delta = 197$ p.p.m. (s)	$C=O$

(s = single, d = doublet, q = quartet)

(a) (3 marks) From the molecular formulae, calculate the number of double-bond equivalents in each molecule.

(b) (21 marks) Interpret the infrared and ^{13}C NMR spectral data as fully as you can.

(c) (6 marks) Suggest possible structures for compounds A, B and C. Remember that negative evidence (for example, the absence of an infrared peak for a functional group) is also important in spectral interpretation.

Question 4

This question carries 20 per cent of the marks for this assignment, and tests Learning Outcome 14 of Book 9.

Discuss the chemistry of the halogens in no more than 600 words by giving special attention to the following features of their chemistry and properties:

- the variation in their physical state at room temperature and pressure, together with trends in colour, ionic radius and electronegativity;
- the preparation of fluorine from hydrogen fluoride, illustrating your discussion with appropriate diagrams and chemical equations;
- the exceptional behaviour of fluorine in bringing out the highest oxidation number of the elements with which it combines;
- the synthesis of interhalogen compounds.

[3 marks will be awarded for the clarity and presentation of your answer. For guidance on how to structure a descriptive answer such as this, refer to *The Sciences Good Study Guide*, Chapter 9.]

carbin lights, new lights, horn, w/h,

- A) $C_4H_8O_2$ $C_4H_{10}O_2$ comp. well C_6H_4 1 double bond
 B) $C_4H_{10}O_2$ $C_4H_6O_2$ C_6H_4 no double bonds
 C) $C_4H_6O_2$ C_6H_{10} 2 double bonds.