InkChemistry

QUESTION WORKBOOK

Putting the analysis together: structure from spectra

Organic synthesis · Unit C22

AQA 3.3.15 · OCR A 4.2.4, 6.3.2

11 questions · 33 marks

PRINT EDITION

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SECTION A · Short, 1 to 2 marks

A1 PAT-Q17

Explain why an infrared breathalyser measures the ethanol in a driver's breath by its absorption near 2950 cm^{-1} rather than at the O–H absorption near 3300 cm^{-1}. [2]

A2 PAT-Q19

Suggest why an external calibration graph is used to find a concentration from gas chromatography, rather than the peak area alone. [2]

SECTION B · Standard, 3 to 5 marks

B1 PAT-Q12

Deduce the number of peaks in the carbon-13 and in the proton NMR spectra of 1,4-dimethylbenzene and of 1,2-dimethylbenzene, explaining the symmetry in each. [4]

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B2 PAT-Q15 Evaluate a student's conclusion that compound K, $C_5H_{10}O$, is pentan-2-one because it absorbs strongly at 1715 cm^{-1} and its carbon-13 spectrum has five peaks, one of them at 209 ppm. [4]

B3 PAT-Q3 Calculate the degree of unsaturation of $C_8H_8O_2$ and of C_4H_7N, and state what the first value suggests about the structure. [3]

B4 PAT-Q4 Explain how shaking a sample of propan-1-ol with D_2O identifies which peak in its proton NMR spectrum belongs to the O–H, and why the other peaks are unchanged. [3]

B5 PAT-Q5 Explain why ethoxyethane, $CH_3CH_2OCH_2CH_3$, gives two peaks in its carbon-13 NMR spectrum, while its isomer butan-1-ol gives four. [3]

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B6 PAT-Q8 Explain why the molecular formula is found before any spectrum is interpreted when identifying an unknown compound. [3]

B7 PAT-Q11 Suggest how proton NMR alone distinguishes butanone, $CH_3COCH_2CH_3$, from butanal, $CH_3CH_2CH_2CHO$. [3]

B8 PAT-Q14 Compare the information given by a carbon-13 NMR spectrum with that given by a proton NMR spectrum of the same compound. [3]

B9 PAT-Q16 Describe what an infrared spectrum can show about an unknown compound, and one thing it cannot show. [3]

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