InkChemistry

QUESTION WORKBOOK

Infrared spectroscopy

Organic analysis · Unit C19

AQA 3.3.6.3 · OCR A 4.2.4

13 questions · 42 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 IN-Q7

Identify whether compound S, $C_3H_6O_2$, is a carboxylic acid or an ester, given that it absorbs strongly at 1750 cm^{-1} and at 1210 cm^{-1} and has nothing between 2500 and 3550 cm^{-1} except C–H near 2960 cm^{-1}. [2]

A2 IN-Q8

Give two absorptions above 1500 cm^{-1} in the infrared spectrum of ethanol, with the bond responsible for each. [2]

SECTION B · Standard, 3 to 5 marks

B1 IN-Q2

Explain what happens when a covalent bond absorbs infrared radiation, and why nitrogen and oxygen, which make up most of the atmosphere, absorb none. [4]

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B2 IN-Q4 Explain how carbon dioxide, a non-polar molecule, absorbs infrared radiation, and how that absorption contributes to global warming. [4]

B3 IN-Q9 Calculate the wavenumber, in cm^{-1}, of infrared radiation of wavelength 5.80×10^{-6} m, naming the bond that absorbs it, and the wavelength, in μm, of radiation absorbed at 3000 cm^{-1}. [4]

B4 IN-Q14 Compare the infrared spectra of ethanoic acid and ethyl ethanoate above 1500 cm^{-1}. [4]

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B5 IN-Q15 Evaluate a student's claim that the ethyl ethanoate she made from ethanol and ethanoic acid is pure because its infrared spectrum shows a strong absorption at 1745 cm^{-1}. [4]

B6 IN-Q3 Explain why the O–H absorption in the infrared spectrum of an alcohol is broad. [3]

B7 IN-Q10 Suggest the structure of a compound of carbon, hydrogen and oxygen with a molecular ion at m/z 60, whose infrared spectrum shows a very broad absorption from 2500 to 3000 cm^{-1} and a strong absorption at 1715 cm^{-1}. [3]

B8 IN-Q11 Suggest how infrared spectra could show that propan-2-ol has been completely oxidised to propanone. [3]

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B9 IN-Q12 Suggest why an evidential breathalyser measures infrared absorption near 1050 cm^{-1} as well as near 2950 cm^{-1} when the breath of a diabetic person may contain propanone. [3]

B10 IN-Q13 Explain why infrared spectroscopy read from the data-sheet table cannot distinguish propanone from propanal, and how the fingerprint region can. [3]

B11 IN-Q17 Explain how infrared spectroscopy is used to measure the concentration of carbon monoxide in the exhaust gas of a car. [3]

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