

Edexcel Chemistry A-level

Topic 7 - Modern Analytical Techniques I

Flashcards

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What happens when a molecule absorbs infrared radiation?



What happens when a molecule absorbs infrared radiation?

It makes the covalent bond vibrate more in a stretching or bending motion



What factors affect the amount of vibration of a bond?



What factors affect the amount of vibration of a bond?

- Bond strength
- Bond length
- Mass of each atom in the bond



How does infrared spectroscopy work?



How does infrared spectroscopy work?

Every bond has a unique vibration frequency in the infrared region of the EM spectrum

Bonds absorb radiation that has the same frequency as their frequency of vibration

Infrared radiation emerged from a sample is missing the frequencies that have been absorbed → this information can be used to identify the compound's functional group



What do the peaks on an infrared spectrum represent?



What do the peaks on an infrared spectrum represent?

Absorbance of energy from the infrared radiation



What are the 2 peaks that must be present to identify a substance as carboxylic acid?



What are the 2 peaks that must be present to identify a substance as carboxylic acid?

- Very broad peak at $2500 - 3300 \text{ cm}^{-1}$
→ O-H group
- Sharp peak at $1680 - 1750 \text{ cm}^{-1}$ →
C=O group



What happens inside a mass spectrometer?



What happens inside a mass spectrometer?

- Organic compound is vaporised and passed through the spectrometer
- Some molecules lose an electron and forms molecular ions
- Excess energy from the ionisation makes the bonds vibrate more
- Vibration causes bond to weaken
- Molecular ion splits by fragmentation



What is the symbol of
molecular ion?



What is the symbol of molecular ion?

M^+



Is fragmentation predictable? Why?



Is fragmentation predictable? Why?

No, because it can happen anywhere in the molecule



In a mass spectrometry how is a molecular ion represented?



In a mass spectrometry how is a molecular ion represented?

It is the peak with the highest
mass/charge ratio



The molecular mass of the
molecular ion is equal to
what?



The molecular mass of the molecular ions is equal to what?

Relative molecular mass of the
compound



Will the molecular ion peaks of two isomers of the same compound be same or different?



Will the molecular ion peaks of two isomers of the same compound be same or different?

Same



What is the m/z value of
 CH_3^+ ?



What is the m/z value of CH_3^+ ?

15



What is the m/z value of OH^-
from alcohol?



What is the m/z value of OH^- from alcohol?

17



What is the m/z value of C_2H_5^+ ?



What is the m/z value of $C_2H_5^+$?

29



What is the m/z value of
 $C_3H_7^+$?



What is the m/z value of $C_3H_7^+$?

43



What is the m/z value of
 $C_4H_9^+$?



What is the m/z value of $C_4H_9^+$?

57



What are the advantages of using mass spectrometry? (2)



What are the advantages of using mass spectrometry? (2)

- Cheap
- Small quantities of samples required



What is the main disadvantage of using mass spectrometry?



What is the main disadvantage of using mass spectrometry?

The sample is completely destroyed



How does infrared spectroscopy work?



How does infrared spectroscopy work?

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Infrared radiation emerged from a sample is missing the frequencies that have been absorbed → this information can be used to identify the compound's functional group



What do the troughs on an infrared spectrum show?



What do the troughs on an infrared spectrum show?

The frequencies where radiation has been absorbed - match to table to find out which bonds they represent



What is the fingerprint region?



What is the fingerprint region?

Area of the infrared spectrum below wavenumber of 1500cm^{-1}

Many peaks, caused by complex vibrations of the whole molecule. Unique to every compound, so can be used to identify compounds



How is the fingerprint region used to identify compounds?

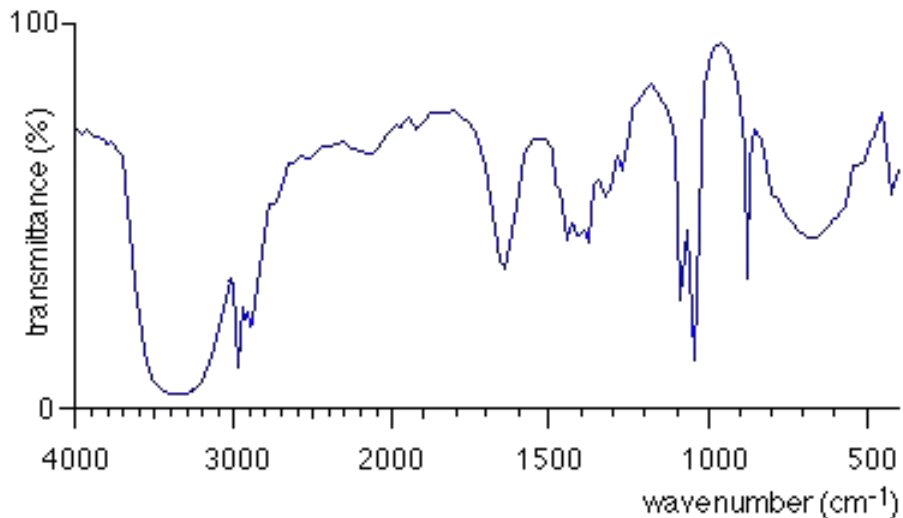


How is the fingerprint region used to identify compounds?

The fingerprint region's pattern is matched to a database on a computer to identify the compound accurately



What functional group/(s) can be identified in this spectra?

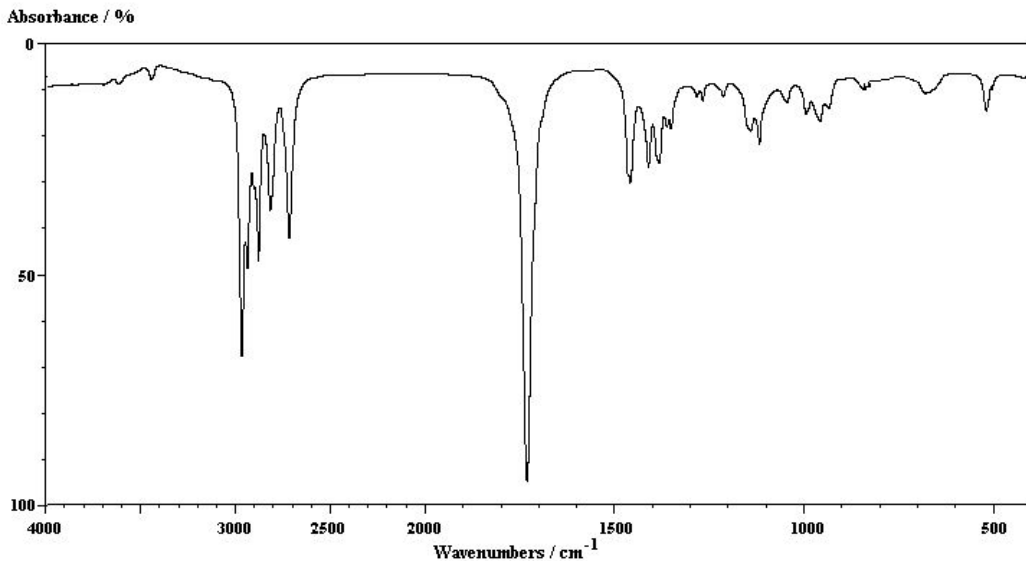


What functional group/(s) can be identified in this spectra?

O-H group: Alcohol



What functional group/(s) can be identified in this spectra?

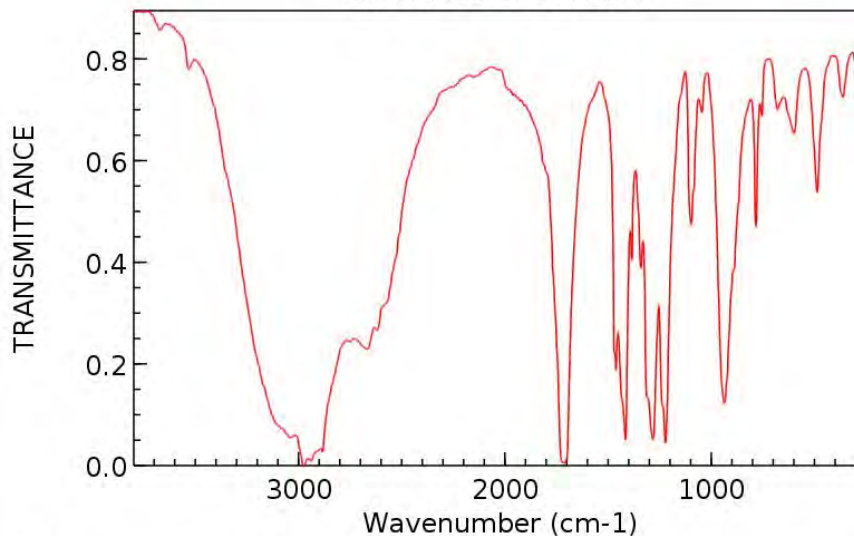


What functional group/(s) can be identified in this spectra?

C=O group: Carbonyl



What functional group/(s) can be identified in this spectra?



What functional group/(s) can be identified in this spectra?

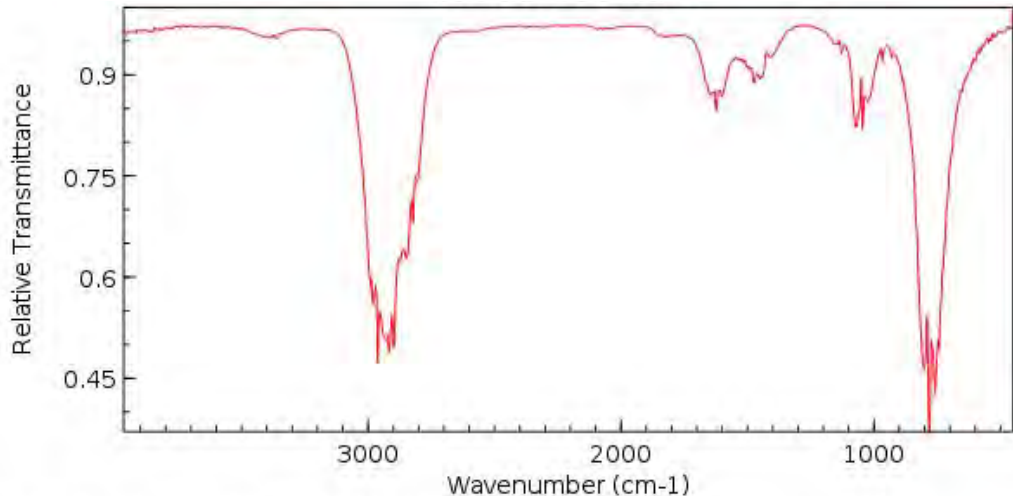
O-H group (of carboxylic acid)

C=O group

Therefore this substance must be a carboxylic acid



What functional group/(s) can be identified in this spectra?



What functional group/(s) can be identified in this spectra?

N-H group : Amine

