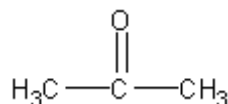


## Topic 12a –Analytical Techniques Revision Notes

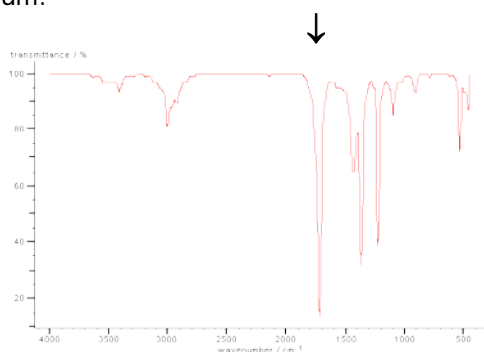
### 1) Infrared spectroscopy

- Absorption of infrared radiation causes covalent bonds to vibrate
- The frequencies that are absorbed can be used to identify the presence of certain bonds
- The absorptions you need to know are:
  - a) C=O 1680 - 1750  $\text{cm}^{-1}$
  - b) -OH in alcohols 3230 - 3550  $\text{cm}^{-1}$
  - c) -OH in carboxylic acids 2500 - 3300  $\text{cm}^{-1}$  (broad peak)
  - d) C=C 1620 - 1680  $\text{cm}^{-1}$
- The section of the spectrum below 1500  $\text{cm}^{-1}$  is known as the fingerprint region
- This allows identification of a molecule by finding a match with a spectrum in a database

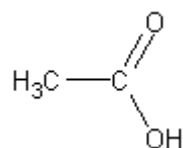
#### Example 1 – propanone



Of the absorptions mentioned above, only the C=O peak will be present in propanone's IR spectrum:

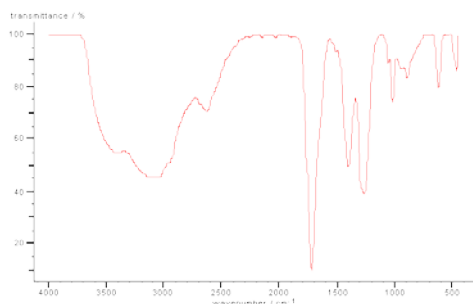


#### Example 2 – Ethanoic acid

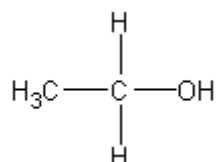


Of the peaks mentioned above, the -OH in acids and the C=O peaks will be present in ethanoic acid's IR spectrum:

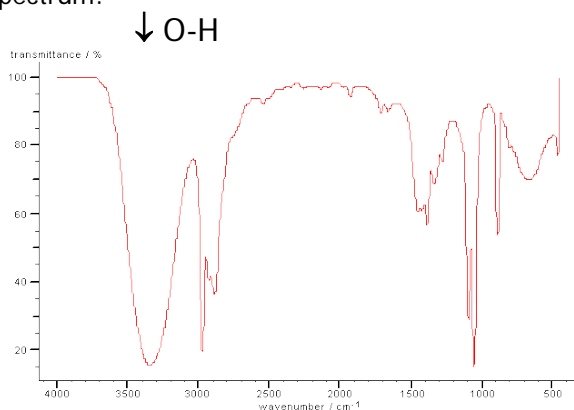
↓ O-H      ↓ C=O



### Example 3 – ethanol



Of the absorptions mentioned above, the –OH in alcohols peak will be present in ethanol's IR spectrum:



### a) Global Warming

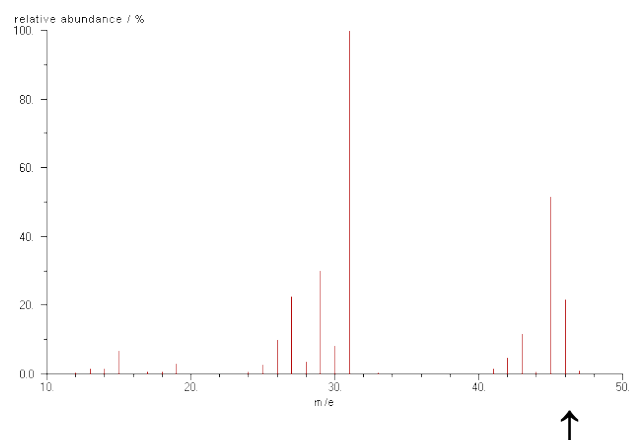
- In the troposphere, various gases absorb infrared radiation and keep the atmosphere warm
- Infrared radiation is absorbed by C=O bonds in CO<sub>2</sub>, O-H bonds in H<sub>2</sub>O and C-H bonds in methane
- The warming effect (or 'Greenhouse Effect') of a given gas depends on its concentration in the atmosphere, its ability to absorb infrared radiation and the time taken for it to break down
- Increased concentrations of greenhouse gases, like CO<sub>2</sub>, contributes global warming because of the increased absorption of IR radiation
- Global warming has undesirable effects such as climate change and the melting of polar ice-caps and consequent rise in sea level which could flood low-lying areas. It is, therefore, important to control global warming resulting from increased concentrations of greenhouse gases

## 2) Mass spectrometry

- Mass spectrometry is a technique for measuring the masses of particles accurately
- In a mass spectrometer an electron is knocked off an organic molecule to create a molecular ion
- The molecular ion produces the peak furthest to the right (or highest m/z) in the spectrum

- The accurate mass of the molecular ion can be used to determine the molecular formula of an unknown compound

### Example – ethanol



- The molar mass of ethanol is 46.0 The molecular ion peak is indicated by the arrow