Cambridge (CIE) A Level Chemistry

Your notes

Gas/Liquid Chromatography

Contents

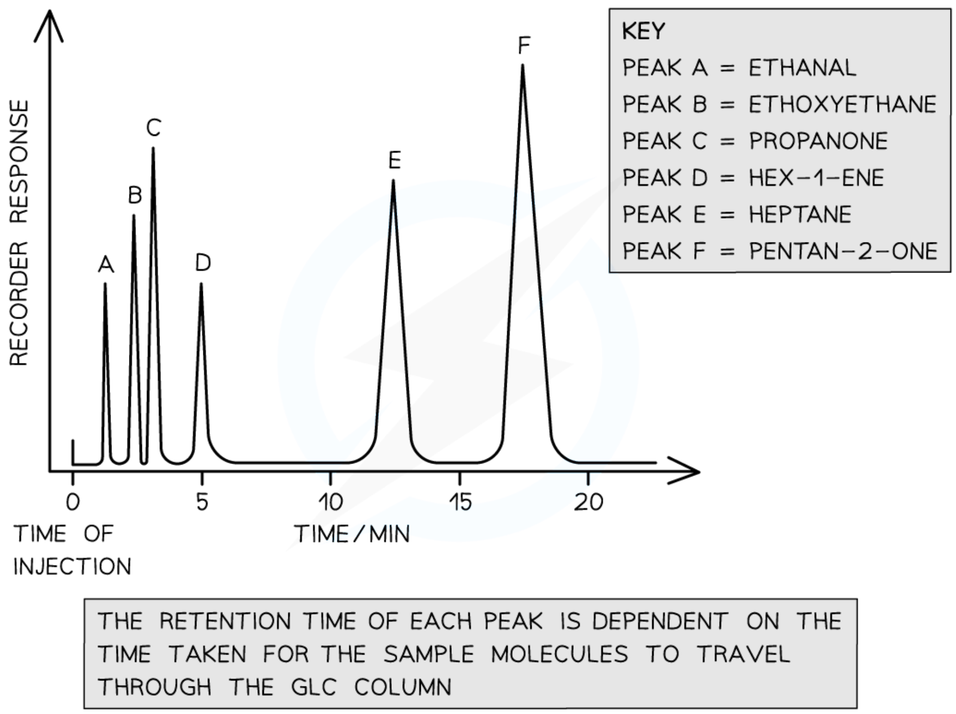
Gas/Liquid Chromatography Terminology

- Gas-Liquid Chromatography (GLC) is used for analysing:
  - Gases
  - Volatile liquids
  - Solids in their vapour form
- The stationary phase:
  - This method uses a column for the stationary phase
  - A non-polar, long-chain, non-volatile hydrocarbon with a high boiling point is mounted onto a solid support
  - Small silica particles can be packed into a glass column to offer a large surface area
  - Sample gas particles travel through this phase and are able to separate well due to the large surface area
- The Mobile phase
  - An **inert** carrier gas (eg. Helium, Nitrogen) moves the sample molecules through the stationary phase

Retention times

- Once sample molecules reach the detector, their **retention times** are recorded
  - This is the time taken for a component to travel through the column
- The retention times are recorded on a chromatogram where each peak represents a volatile compound in the analysed sample
- Retention times are then compared with data book values to identify unknown molecules

An example gas chromatogram



A gas chromatogram of a volatile sample compound has six peaks. Depending on each molecule's interaction with the stationary phase, each peak has its own retention time

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Interpreting Rf Values in GL Chromatography

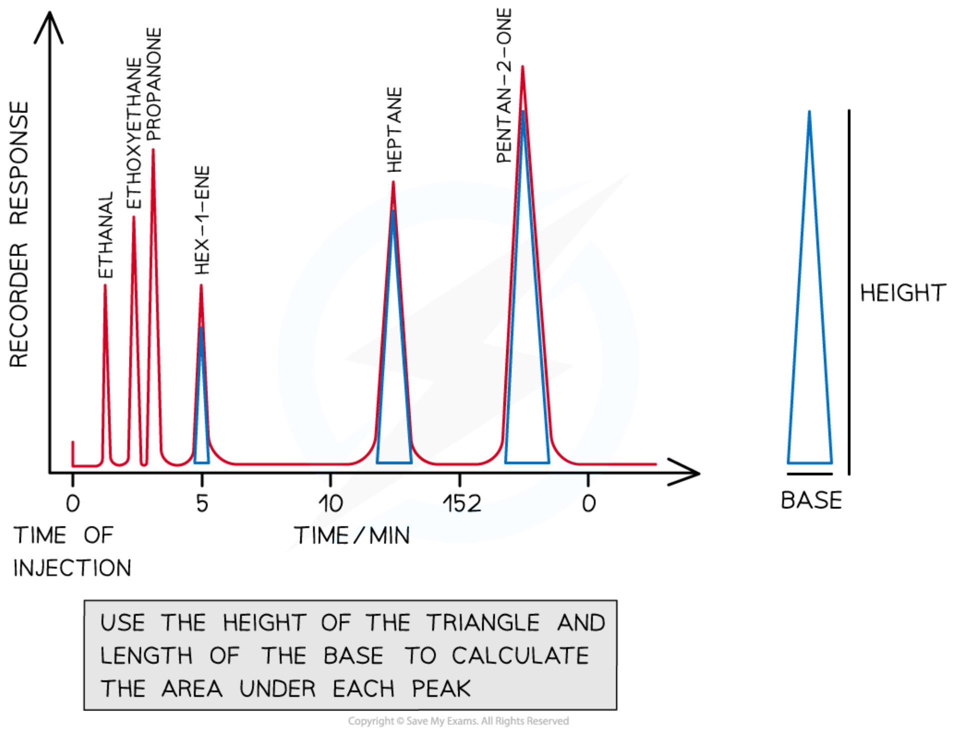
Features of a gas-liquid chromatogram

- Peaks represent different molecules from the sample - each roughly taking the shape of a triangle
- The area under each peak is the relative concentration of each component (the peak integration value)

Area under the peak = ½ x base x height

- If the area under each peak is very small or too difficult to decipher, the height of the peaks are used for further analysis

Calculating areas under curves on a gas chromatogram



To find the area under each peak, treat each peak as a triangle - see the examples shown using blue triangles in the diagram

Percentage composition of a mixture

- We can calculate the amount of a particular molecule in a sample by using an expression

- If a chromatogram shows peaks for alcohols A, B, C and D, to calculate the % composition of alcohol C, use this expression:

$$(\text{Approx.})\ \%\ \text{of alcohol C} = \frac{\text{peak area (or height) of C}}{\text{sum of peak areas (or heights) of A, B, C and D}} \times 100$$

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Explaining Retention Times

- Retention time is the time taken for a sample molecule to travel through the column, from the time it is inserted into the machine to the time it is detected
- Molecules in the gaseous mixture travel at different rates, therefore giving rise to different retention times
- **Longer retention times** are associated with:
  - **Non-polar components** in the mixture
  - They are more attracted to the non-polar liquid in the stationary phase
  - So non-polar molecules travel slower through the column
- **Shorter retention times** are associated with:
  - **Polar components** in the mixture that prefer to interact with the carrier gas
  - They are less attracted to the non-polar liquid in the stationary phase
  - So polar molecules travel faster through the column
  - These molecules may have lower boiling points and, therefore, are vapourised more readily