37.2 GAS/LIQUID CHROMATOGRAPHY

Learning outcomes

Candidates should be able to:

1. describe and understand the terms
   (a) stationary phase; a high boiling point non-polar liquid (on a solid support)
   (b) mobile phase; an unreactive gas
   (c) retention time
2. interpret gas/liquid chromatograms in terms of the percentage composition of a mixture
3. explain retention times in terms of interaction with the stationary phase

Introduction

https://www.youtube.com/watch?v=uSG8ANBTaN0

https://www.youtube.com/watch?v=ZpPzImDSfqc

1. Thin-layer and gas / liquid chromatography can be used to separate mixtures into their individual components.

   Each type of chromatography makes use of a stationary phase and a mobile phase.
   Complete Table 6.1 with a description of each of these.

Table 6.1

	stationary phase	mobile phase
thin-layer chromatography		
gas / liquid chromatography		

[1]

2. Gas-liquid chromatography involves a stationary phase and a mobile phase.
   Name, or describe in detail, a suitable substance that could be used for each phase.

   stationary .....

   mobile ..... [1]

3. An impure sample of $CH_3CH(OH)COOH$ contains pentan-3-one as the only contaminant. The mixture is analysed using gas/liquid chromatography. The pentan-3-one is found to have a longer retention time than the lactic acid.
   (i) Explain what is meant by retention time.

   .....

   ..... [1]

   (ii) Suggest suitable substances, or types of substances, that could be used as the mobile and stationary phases.

   mobile phase .....

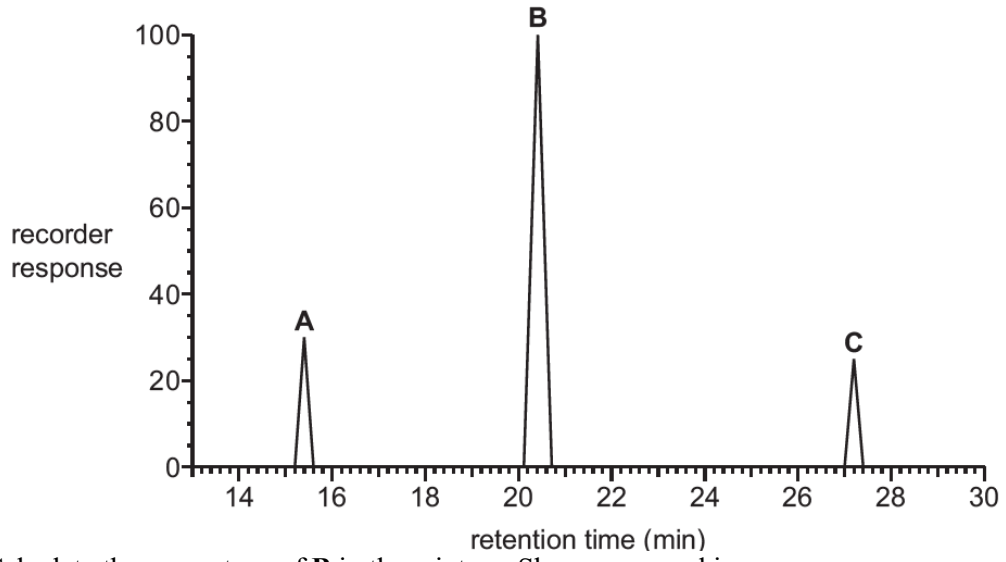
   stationary phase ..... [1]

   (iii) Describe how the percentage composition of the mixture can be determined from the gas/liquid chromatogram.

   .....

   ..... [1]

4. A mixture of three organic compounds is separated by gas-liquid chromatography. The chromatogram obtained is shown in Fig. 9.1. The amount of each substance is proportional to the area under its peak.



Calculate the percentage of **B** in the mixture. Show your working.

percentage of **B** = ... % [2]

5. Thin-layer and gas-liquid chromatography can be used to analyse mixtures of substances.
Each type of chromatography makes use of a stationary phase and a mobile phase.
An unknown amino acid is analysed using thin-layer chromatography. Two chromatographs of the unknown amino acid and four reference amino acids, **P**, **Q**, **R** and **S**, are obtained using two different solvents.

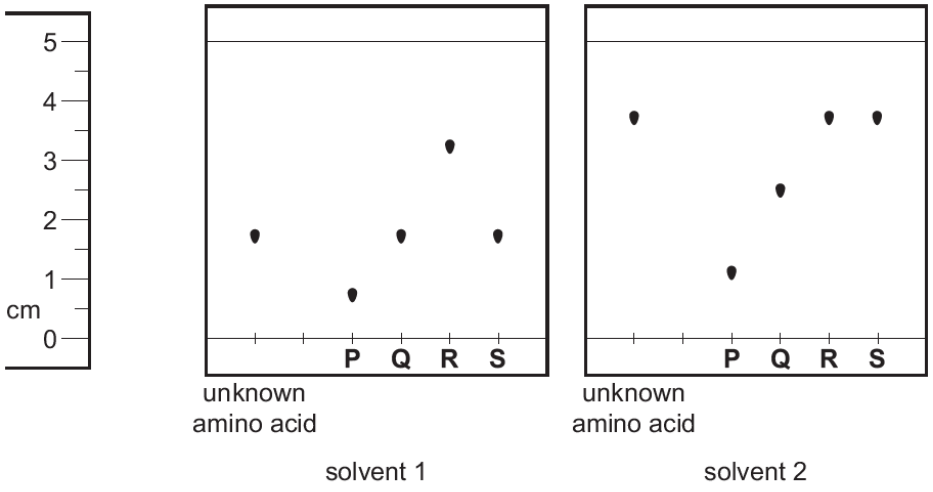


Fig. 6.4

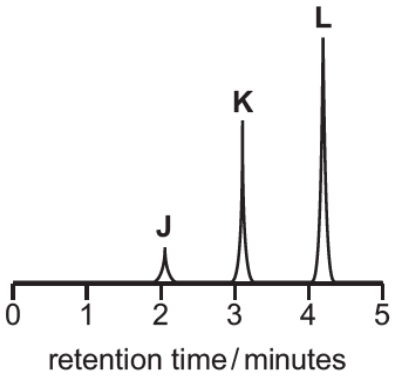
Identify the unknown amino acid. Justify your answer.

.....

.....

..... [1]

6. A mixture containing three organic compounds is analysed by gas chromatography and mass spectrometry. The gas chromatogram is shown.



peak	J	K	L
area / mm^2	8	44	58

Fig. 6.5

The area underneath each peak is proportional to the mass of the respective compound in the mixture.
The concentration of **K** in the mixture is 5.52×10^{-2} g dm^{-3}.
Calculate the concentration, in mol dm–3, of compound **L** in the mixture.
[*M*r: **L**, 116]

concentration of **L** = ... mol dm^{-3} [1]

7. Four esters, **A**, **B**, **C** and **D**, with the molecular formula $C_6H_{12}O_2$, are shown in Fig. 7.1.

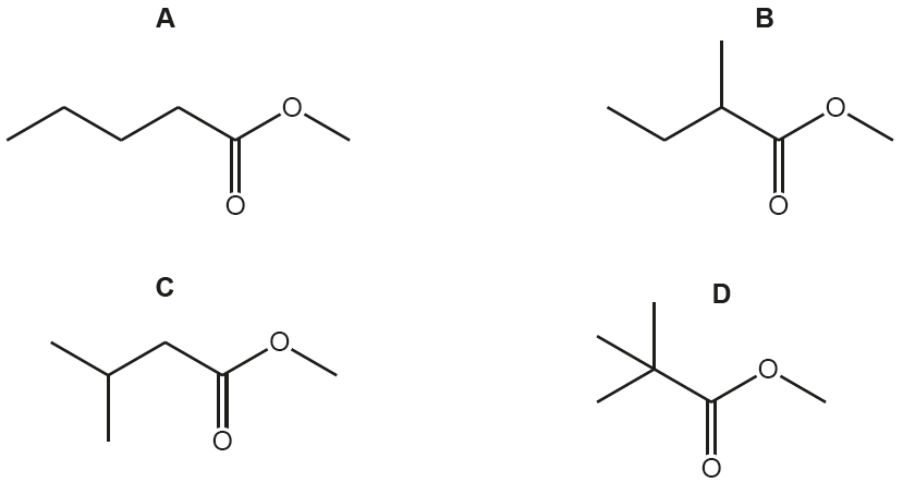


Fig. 7.1

A mixture of these esters, **A**, **B**, **C** and **D**, is analysed by gas–liquid chromatography.
The chromatogram produced is shown in Fig. 7.2. The number above each peak represents the area under the peak.
The area under each peak is proportional to the mass of the respective ester in the mixture.

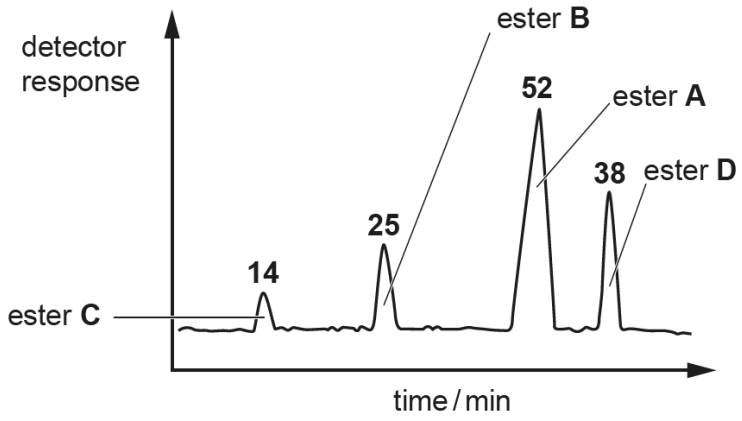


Fig. 7.2

(ii) Calculate the percentage by mass of ester **D** in the original mixture.

percentage by mass of ester **D** = ... %

8. A polypeptide formed from four amino acids, A, B, C and D, is completely hydrolysed and then analysed by gas–liquid chromatography.
The chromatogram produced is shown in Fig. 8.2.

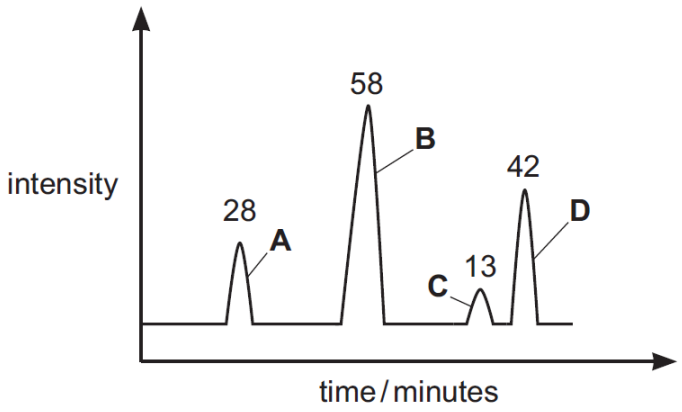


Fig. 8.2

The number above each peak represents the area under the peak.
The area under each peak is proportional to the mass of the respective amino acid in the mixture.
(i) Calculate the percentage by mass of amino acid A in the original mixture.

percentage by mass of amino acid A = ... [1]

(ii) The retention time for amino acid D is the longest.

Explain why D has a longer retention time than the other amino acids A, B and C.

.....

.....

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..... [1]

*****This is not a complete note. It is just to guide you. It is recommended to study the prescribed textbooks along with this material. *****