F324: Rings, Polymers & Analysis
4.3.1 - Chromatography

1. α-Amino acids are found in human sweat. A student had read that chromatography could be used to separate and identify the amino acids present in human sweat.

The student used Thin-Layer Chromatography (TLC) to separate the α-amino acids in a sample of human sweat and discovered that three different α-amino acids were present.

(i) Name the process by which TLC separates α-amino acids.

.....

[1]

(ii) The chromatogram was treated to show the positions of the separated α-amino acids.

Explain how the student could analyse the chromatogram to identify the three α-amino acids that were present.

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.....

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[2]

(iii) Several α-amino acids have structures that are very similar.

Suggest why this could cause problems when using TLC to analyse mixtures of α-amino acids.

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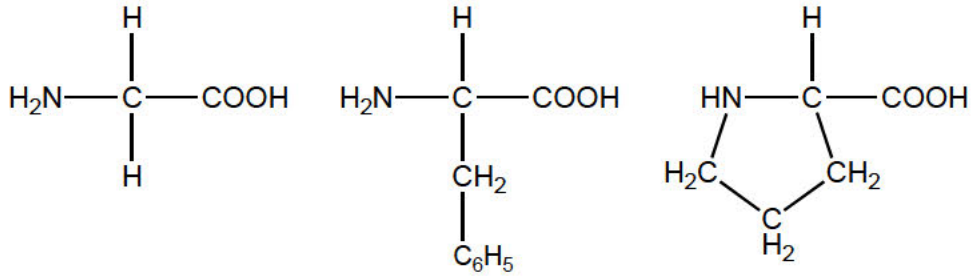
[1]

[Total 4 marks]

2. Amino acids can act as monomers in the formation of polypeptides and proteins. The structures below show three amino acids, glycine, phenylalanine and proline.



glycine **phenylalanine** **proline**

Glycine, phenylalanine and proline can react together to form a mixture of tripeptides.

(i) Draw the structure of the **tri**peptide formed in the order glycine, phenylalanine and proline.

[3]

(ii) How many different **tri**petides could have been formed containing glycine, phenylalanine and proline?

.....

[1]

(iii) The mixture of tripeptides can be analysed by using gas chromatography, coupled with mass spectrometry.

Summarise how each method contributes to the analysis.

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[3]

[Total 7 marks]

3. Chromatography is an important analytical technique used to separate mixtures into their individual components.

(a) Define the following terms used in chromatography.

R_f value .....

.....

retention time .....

.....

[2]

(b) Volatile organic compounds that enter soil via waste disposal sites affect the quality of the soil.

A preliminary step in analysing soil quality involves separation of these volatile components using gas/liquid chromatography.

(i) What name is given to the process by which components in a mixture are separated during gas/liquid chromatography?

.....

[1]

(ii) What are the roles of the gas and liquid in gas/liquid chromatography?

role of gas .....

.....

role of liquid .....

.....

[2]

(iii) Draw a diagram of a gas/liquid chromatogram for a mixture containing two components.

[1]

(iv) Explain how the gas/liquid chromatogram could be used to determine the **percentage** composition of each component in the mixture.

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[3]

[Total 9 marks]

4. Chromatography is a versatile technique that may be used to separate and identify compounds.

(i) Name a type of chromatography that is used to separate and identify dissolved substances.

.....

[1]

(ii) State what quantitative value may be determined from the chromatogram to identify the substances present in the solution.

.....

[1]

(iii) Sketch a chromatogram to show how the value in (ii) is determined.

[1]

[Total 3 marks]

5. (a) Gas-liquid chromatography is used to separate and identify gases and liquids.

(i) State what quantitative value is normally used to identify the components in this type of chromatography.

.....

[1]

(ii) Sketch the chromatogram to show how the value in (i) is determined.

[1]

(b) State the physical process on which the separation used in gas-liquid chromatography depends.

.....

[1]

[Total 3 marks]