CHEMISTRY ONLINE
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CHEMISTRY

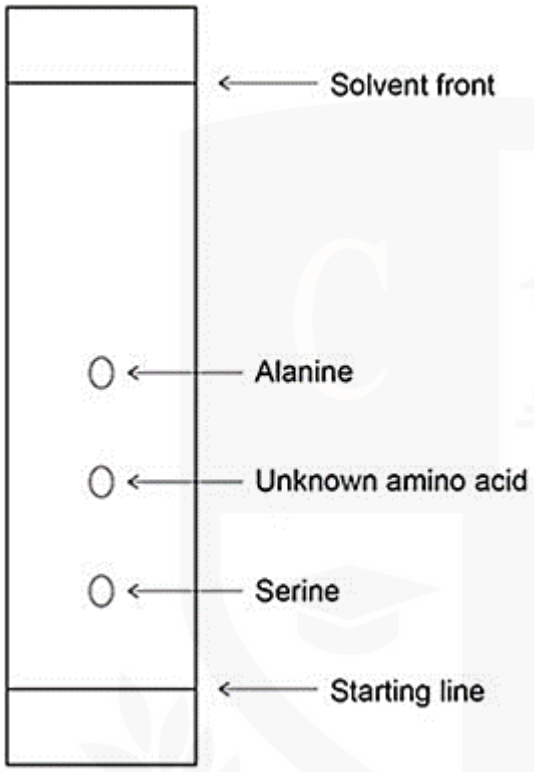
INORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	AMINO ACIDS, PROTEIN & DNA
PAPER TYPE:	SOLUTION - 4
TOTAL QUESTIONS	10
TOTAL MARKS	50

Amino Acids, Protein and DNA - 4

1.

(a)



Amino acid	Rf value
tyrosine	0.25
glycine	0.34
valine	0.64
leucine	0.73

$$Rf = \frac{distance\ traveled\ by\ solute}{distance\ traveled\ by\ solvent}$$

$$Rf = \frac{27}{80} \qquad = 0.34$$

Unknown amino acid:

Glycine

(2)

(b)

The amino acids can be made visible at the end of the experiment by using either a UV lamp or ninhydrin staining.

Alternatively, a developing agent such as iodine can be used to locate the amino acids on the TLC plate.

(1)

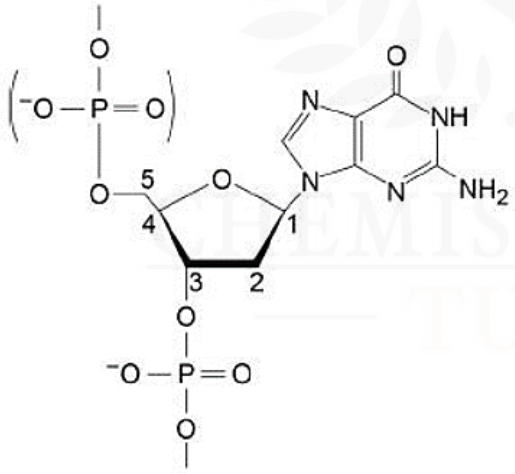
(c)

Each amino acid has a different Rf value due to its varying affinity for the stationary and mobile phases in the TLC system.

(1)

2.

Following structure shows the nucleotide that contains guanine:

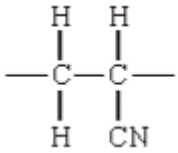


(3)

3.

(a)

Repeating unit of the polymer:



(1)

(b)

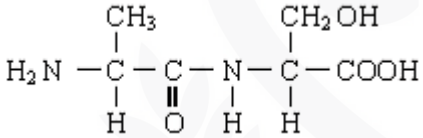
Type of polymerization:

Addition or radical

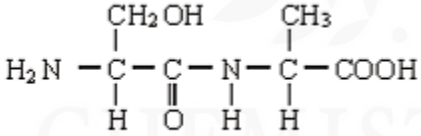
(1)

4.

Structure 1



Structure 2



(2)

5.

(a)

$CH_3CH_2CH_2Br$ is a compound which can undergo nucleophilic substitution to form propylamine.

(1)

(b)

CH_3CH_2CN can be reduced to form propylamine.

(1)

(c)

In the route to propylamine via nucleophilic substitution from $CH_3CH_2CH_2Br$, further substitution or reaction can occur, leading to the formation of secondary amines or other products.

One potential impurity that can form is secondary butylamine ($CH_3CH_2CH(NH_2)CH_3$).

Additionally, other products such as diisopropylamine ($(CH_3CH_2CH_2)_2NH$), triisopropylamine ($(CH_3CH_2CH_2)_3N$), or quarternary ammonium salt ($(CH_3CH_2CH_2)4N^+Br^-$) may also be formed.

Therefore, this route tends to yield a less pure product due to the possibility of various byproducts forming.

(3)

6.

(a)

Suitable reagent for the hydrolysis of a protein:

Conc. HCl or conc. sulfuric acid

(1)

(b)

The positions of the amino acids on the TLC plate were located using either ninhydrin reagent or ultraviolet (UV) light. Additionally, iodine vapor could have been used for visualization.

I am Sorry !!!!!

(1)

(c)

Seven of amino acids were present in the original mixture.

(1)

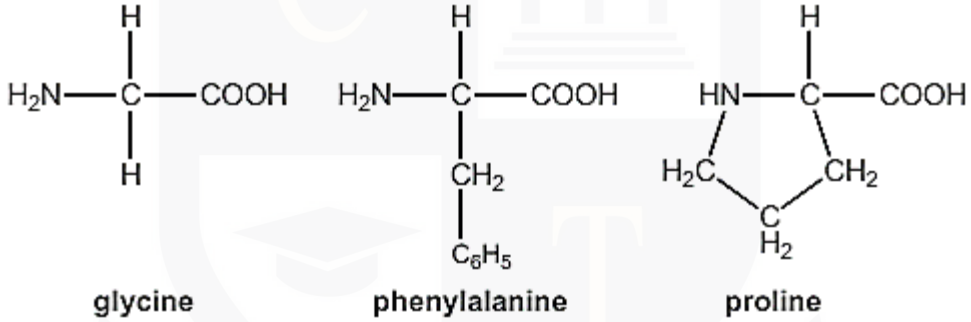
(d)

Using two solvents was necessary because some amino acids either didn't separate well or had similar behaviors, such as sharing the same Rf value, with the first solvent.

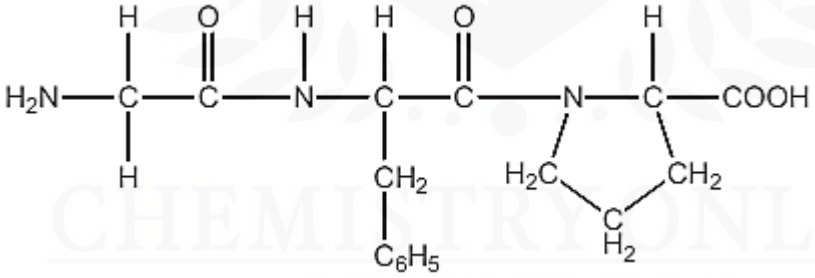
(1)

7.

(a)



Following is the structure of the tripeptide formed in the order glycine, phenylalanine and proline:



(3)

(b)

There could be six different tripetides can be formed containing glycine, phenylalanine and proline.

(1)

(c)

Gas/Liquid Chromatograph Separation:

The gas or liquid chromatograph separates the tripeptides based on their physical and chemical properties such as size, polarity, and volatility.

This process effectively resolves individual components from the mixture, facilitating further analysis.

Mass Spectrometer Fragmentation:

The mass spectrometer subjects the separated tripeptides to ionization and fragmentation, producing a distinctive fragmentation pattern for each molecule.
This pattern serves as a unique fingerprint, providing information about the molecular structure and mass of the tripeptides.

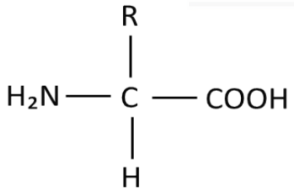
Identification Using Spectral Database:

The distinctive fragmentation patterns generated by the mass spectrometer are compared to a spectral database using computer software.
This comparison allows for the identification of the tripeptides present in the mixture by matching the experimental spectra with those stored in the database, enabling accurate identification and quantification of the components.

(3)

8.

Following is the general formula of an α-amino acid:



(2)

9.

(a)

Stereoisomers are molecules with the same structural formula but different spatial arrangements of atoms or groups in three dimensional space.

(2)

(b)

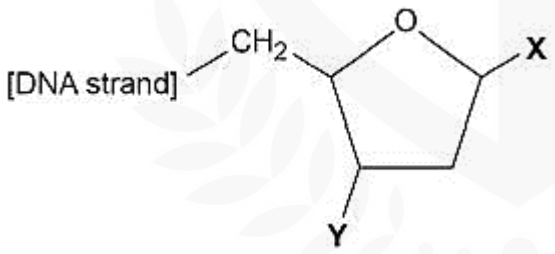
Stereoisomers can be distinguished by observing how they rotate plane-polarized light.

One may rotate it clockwise, while the other rotates it counterclockwise.

This phenomenon, known as optical activity, allows for differentiation between stereoisomers based on the direction and magnitude of rotation

(2)

10.



Name:
X – Base
Y – Phosphate

(2)

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