Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Chromatography

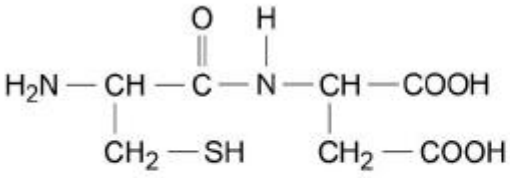
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Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

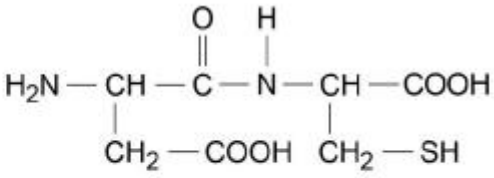
Q1.

Chromatography is used to identify amino acid sequences in compounds.

The dipeptide cysteine-aspartic acid (cys-asp), **J**, and the dipeptide aspartic acid-cysteine (asp-cys), **K**, are shown.



J (cys–asp)



K (asp–cys)

(a) A mixture of the two dipeptides **J** and **K** is analysed by gas chromatography followed by mass spectrometry (GC-MS).

Explain why **J** and **K** can be separated by gas chromatography and why mass spectrometry using electrospray ionisation does **not** enable you to identify them.

Gas chromatography explanation _____

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Mass spectrometry explanation _____

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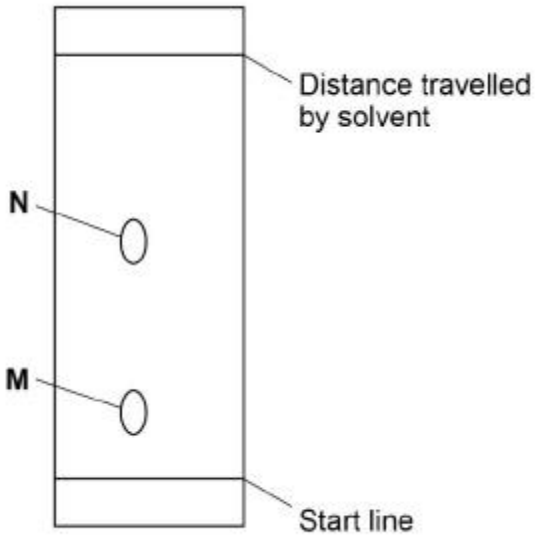
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(4)

(b) A tripeptide, **L**, is partially hydrolysed with concentrated hydrochloric acid to produce two dipeptides and the amino acids alanine (ala), lysine (lys) and serine (ser).

The two dipeptides are separated by chromatography. The diagram below shows the chromatogram.



The table below contains the R_f values of some dipeptides.

Dipeptide	ala-lys	ala-ser	lys-ser	lys-ala	ser-ala	ser-lys
R_f value	0.55	0.85	0.10	0.20	0.15	0.45

Use the chromatogram in the diagram above and the R_f values in the table to identify the two dipeptides present in spots **M** and **N**.

Use your answers to deduce the order of the amino acids in the tripeptide **L**.

Dipeptide responsible for spot **M** _____

_____

Dipeptide responsible for spot **N** _____

_____

Order of amino acids in tripeptide **L** _____

_____

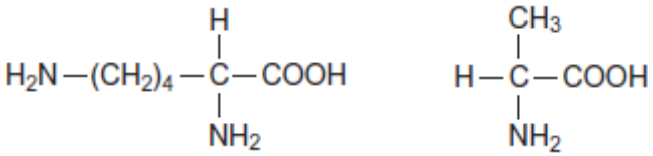
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(Total 7 marks)

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Q2.

Lysine and alanine are two amino acids.



lysine

alanine

(a) Give the IUPAC name of lysine.

_____

(1)

(b) Draw structures to show the product formed in each case when lysine reacts with

(i) an excess of aqueous HCl

(1)

(ii) an excess of aqueous NaOH

(1)

(iii) methanol in the presence of a small amount of concentrated H_2SO_4

(1)

(c) The mass spectrum of alanine gives a major peak at $m / z = 44$

Write an equation for the fragmentation of the molecular ion of alanine to give an ion that produces this peak.
In your answer, draw the displayed formula for this fragment ion.

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(2)

(d) Draw a dipeptide formed from one molecule of lysine and one molecule of alanine.

(1)

(e) The dipeptide in part (d) is hydrolysed in acid conditions and the mixture produced is analysed by column chromatography. The column is packed with a resin which acts as a polar stationary phase.

Suggest why lysine leaves the column after alanine.

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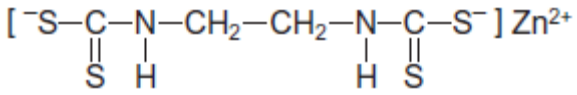
(2)

(Total 9 marks)

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Q3.

(a) Because of the toxic nature of the copper(II) ion, a wide range of alternative anti-fungal drugs has been developed for use in agriculture. One example is Zineb.



Zineb

(i) The negative ion in Zineb could act as a bidentate ligand.

On the structure above, draw a ring around each of **two** atoms that could provide the lone pairs of electrons when this ion acts as a bidentate ligand.

(1)

(ii) Calculate the M_r of Zineb. Give your answer to the appropriate precision.

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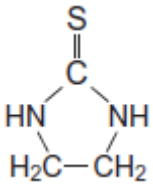
(1)

(iii) Name the functional group formed at each end of the negative ion when all the sulfur atoms in the structure of Zineb are replaced by oxygen atoms.

_____

(1)

(b) Zineb has been investigated for harmful effects. Generally, Zineb has been found to be safe to use in agriculture. It is only slightly soluble in water and is sprayed onto plants. A breakdown product of Zineb is ethylene thiourea (ETU), which is very soluble in water. The structure of ETU is shown below.



Determine the percentage, by mass, of sulfur in ETU (M_r = 102.1).

_____

_____

_____

(1)

(c) Chromatography is a technique used to show the presence of a small amount of ETU in Zineb.

Outline how this technique is used to separate and identify ETU from a sample of Zineb powder.

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(4)

(Total 8 marks)

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