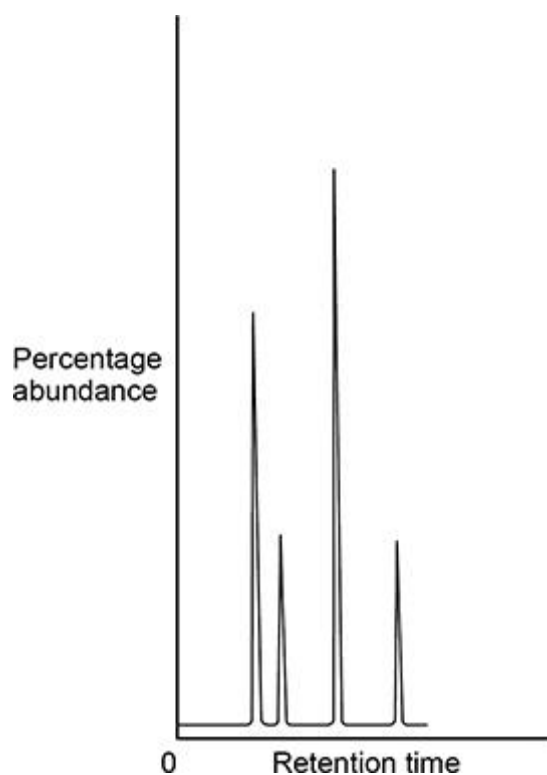


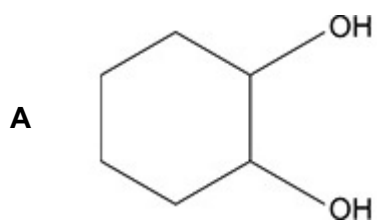
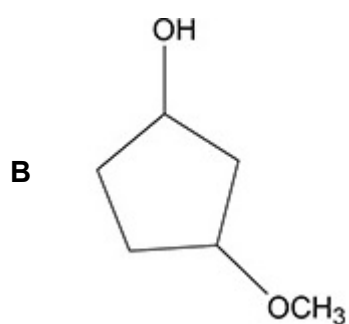
**Q1.**

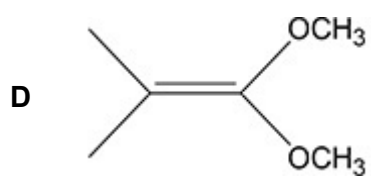
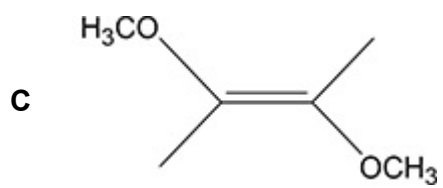
The diagram below shows a gas chromatogram for a sample containing four isomers with the molecular formula  $C_6H_{12}O_2$

The carrier gas is nitrogen and the stationary phase is polar.



Which of the four isomers in this sample is the most abundant?

☐☐



(Total 1 mark)

**Q2.**

Endomorphin-2 is a peptide with the amino acid sequence shown.

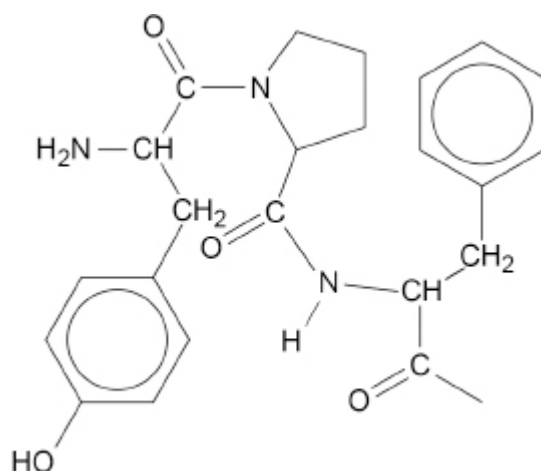


Each amino acid is represented by a three-letter abbreviation.

Tyr = tyrosine Pro = proline Phe = phenylalanine

**Figure 1** shows part of the structure of endomorphin-2, showing the Tyr-Pro-Phe- part of the molecule.

**Figure 1**



- (a) The  $\text{-NH}_2$  at the end of the amino acid sequence of endomorphin-2 shows that the terminal functional group is an amide, not an acid.

Complete the structure of endomorphin-2 in **Figure 1**.

(2)

- (b) Use the structure in **Figure 1** to draw the skeletal formula of proline, Pro.

(1)

A student hydrolyses a sample of endomorphin-2 to break it down into its constituent amino acids.

The student analyses the resulting mixture by thin-layer chromatography, TLC.

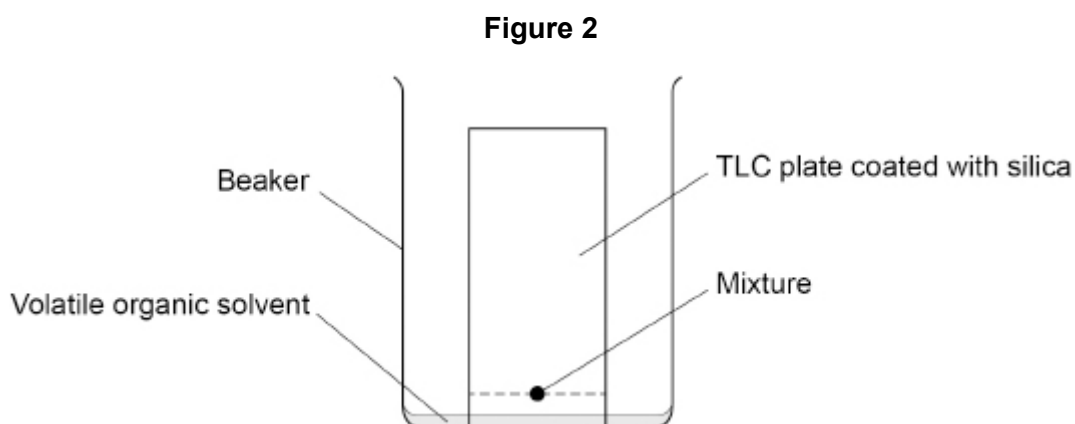
- (c) State a reagent and the conditions needed for the hydrolysis.

Reagent \_\_\_\_\_

Conditions \_\_\_\_\_

(2)

- (d) **Figure 2** shows the apparatus used for the TLC.



There is a piece of the apparatus missing from **Figure 2**. This omission will result in an inaccurate chromatogram.

Identify the missing piece of the apparatus.

State and explain why this piece of the apparatus is needed.

Missing piece \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(3)

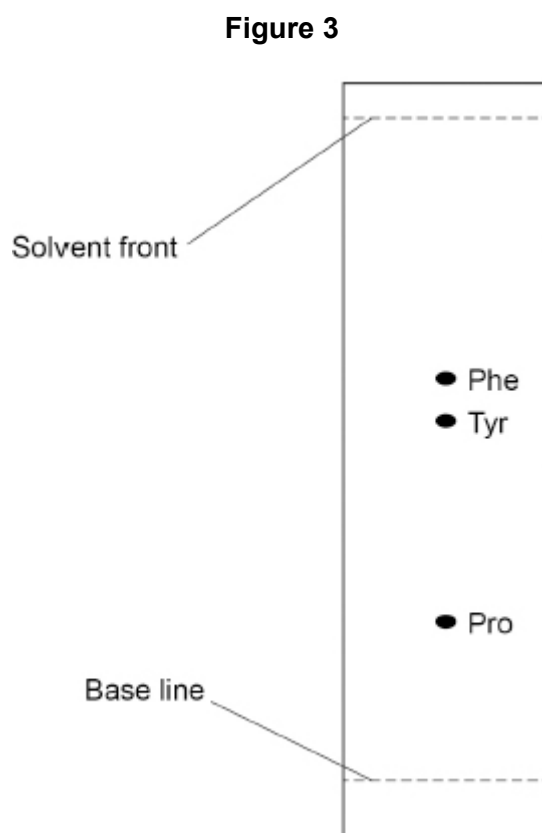
- (e) State why the amino acids separate on the TLC plate.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(1)

When the solvent has risen up the TLC plate, the student removes the plate from the beaker and sprays it with a developing agent.

**Figure 3** shows the result.



- (f) Name a suitable developing agent.

State why the developing agent is needed.

Name \_\_\_\_\_

Why needed \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2)

- (g) Determine the  $R_f$  value for Tyr.

$R_f$  \_\_\_\_\_

(1)

(Total 12 marks)