

1. Nov/2022/Paper_42/No.9

Tyrosine and lysine, shown in Fig. 9.1, are naturally occurring amino acids found in proteins.

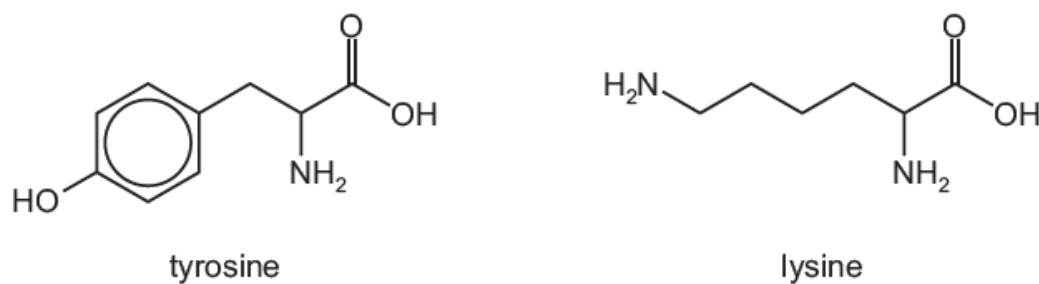
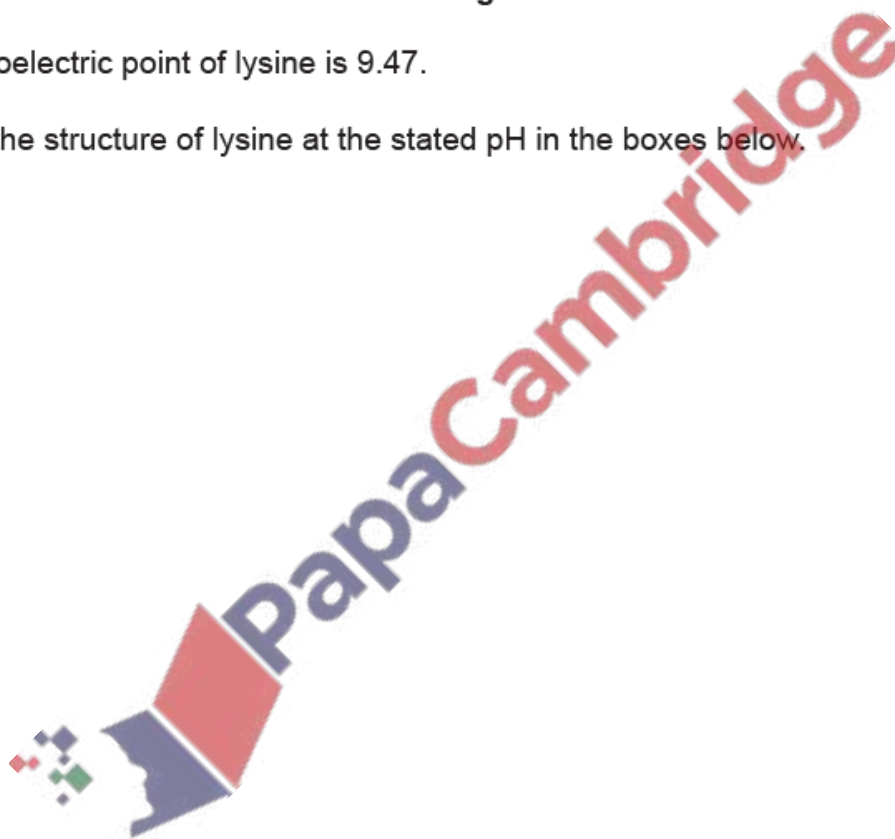


Fig. 9.1

(a) The isoelectric point of lysine is 9.47.

Draw the structure of lysine at the stated pH in the boxes below.



lysine at pH 7.00



lysine at pH 9.47



lysine at pH 12.00



[2]

(b) When ethanoic acid is treated with PCl_5 product **D** is formed.

When **D** is added to tyrosine two different isomeric products, **E** and **F**, are formed.

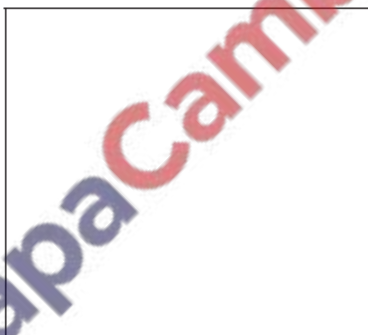
E has an ester linkage, **F** does not.

Draw the structures of **D**, **E** and **F** in the boxes below.

D



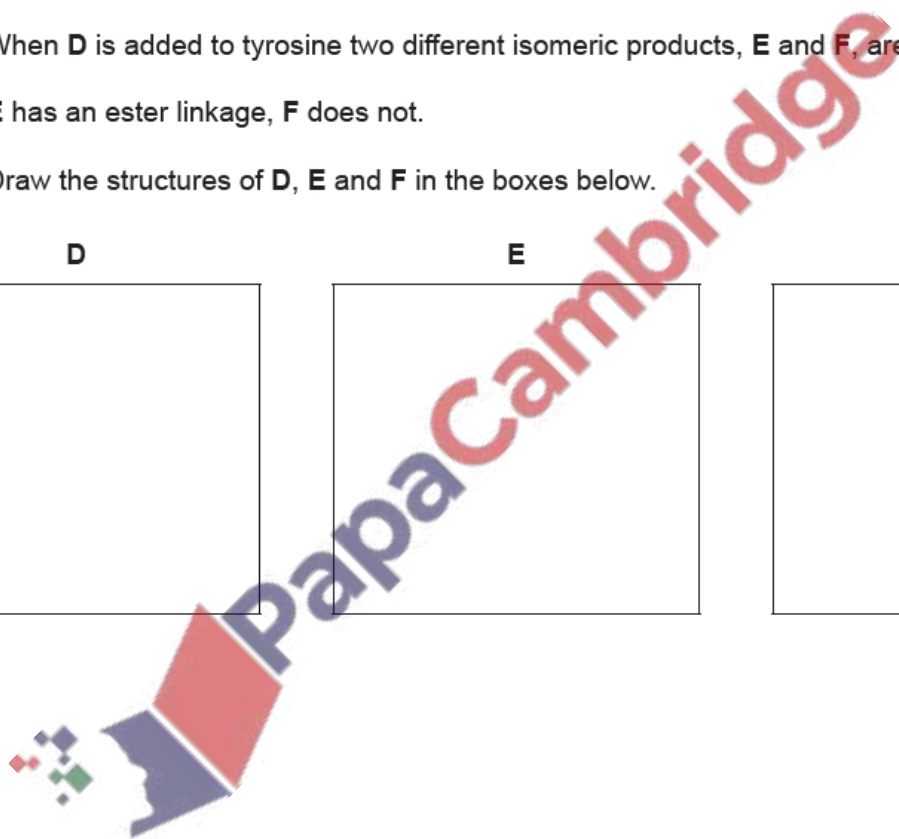
E



F



[3]



- (c) Complete Table 9.1 by drawing the structure of the organic product formed when tyrosine reacts with each named reagent.

Ignore the directing effect of the $-\text{CH}_2\text{CHNH}_2\text{COOH}$ substituent.

Table 9.1

reagent	structure
an excess of $\text{Br}_2(\text{aq})$	
an excess of $\text{NaOH}(\text{aq})$	
an excess of $\text{HNO}_3(\text{aq})$	

[3]

- (d) A mixture of tyrosine and lysine can be separated by thin-layer chromatography. Under certain conditions the R_f value of lysine is 0.14 and the R_f value of tyrosine is 0.45.

- (i) Explain what is meant by R_f value.

.....
..... [1]

- (ii) Suggest an explanation for the difference in R_f values.

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..... [1]

[Total: 10]