

1. June/2022/Paper_41/No.6(a, c, d, e,)

(a) Describe what is meant by a racemic mixture.

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

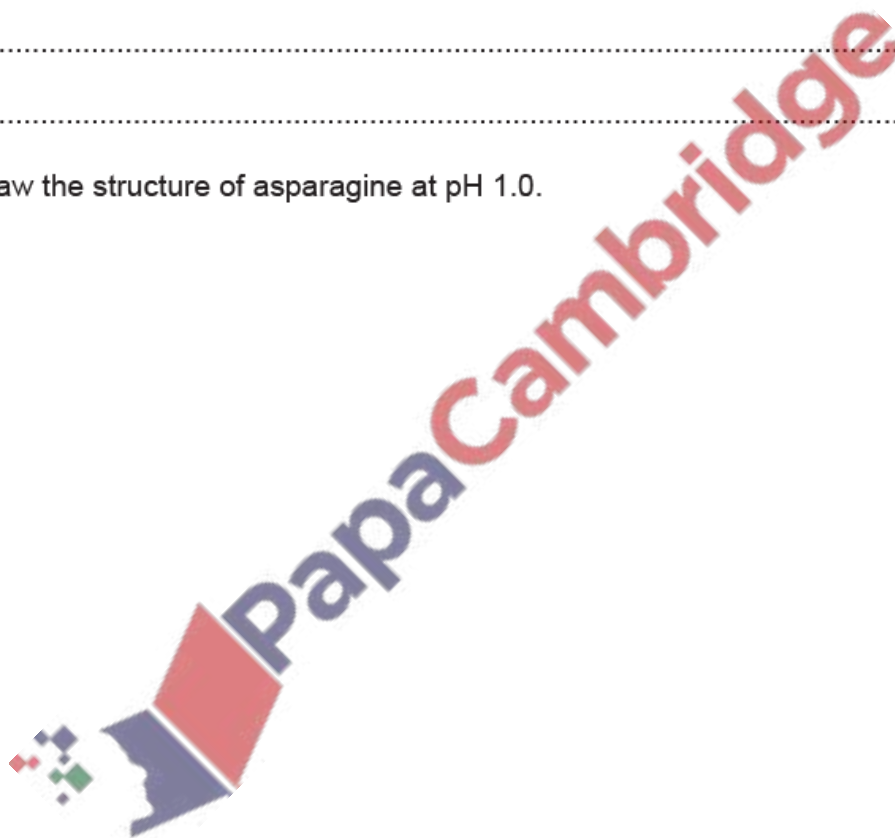
(c) The isoelectric point of asparagine, asn, is at pH 5.4.

(i) Describe the meaning of the term isoelectric point.

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

(ii) Draw the structure of asparagine at pH 1.0.

[1]



(d) Asparagine can polymerise to form poly(asparagine).

Draw the structure of poly(asparagine), showing **two** repeat units. The peptide linkage should be shown displayed.

[2]

(e) The isoelectric point of lysine, lys, is at pH 9.8.

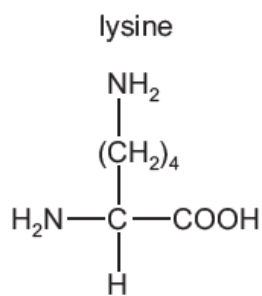


Fig. 6.2

A mixture of the dipeptide lys-asn and its two constituent amino acids, asparagine and lysine, is analysed by electrophoresis using a buffer at pH 5.0. The results obtained are shown in Fig. 6.3.

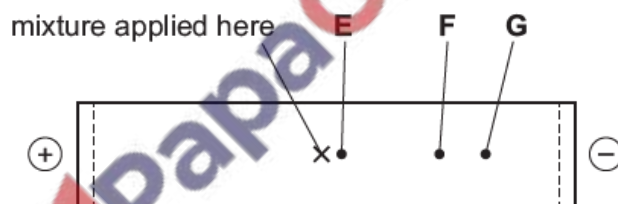


Fig. 6.3

Suggest identities for the species responsible for spots **E**, **F** and **G**. Explain your answers.

spot	identity
E	
F	
G	

.....

.....

.....

[3]

- (d) The azo compound Congo Red is used as an acid–base indicator and can be made by the route shown in Fig. 6.2.

In step 3 of this synthesis, compound **Y** reacts with compound **Z**. Compound **Z** is made from compound **X**. Assume that the $-\text{SO}_3^-\text{Na}^+$ groups do not react.

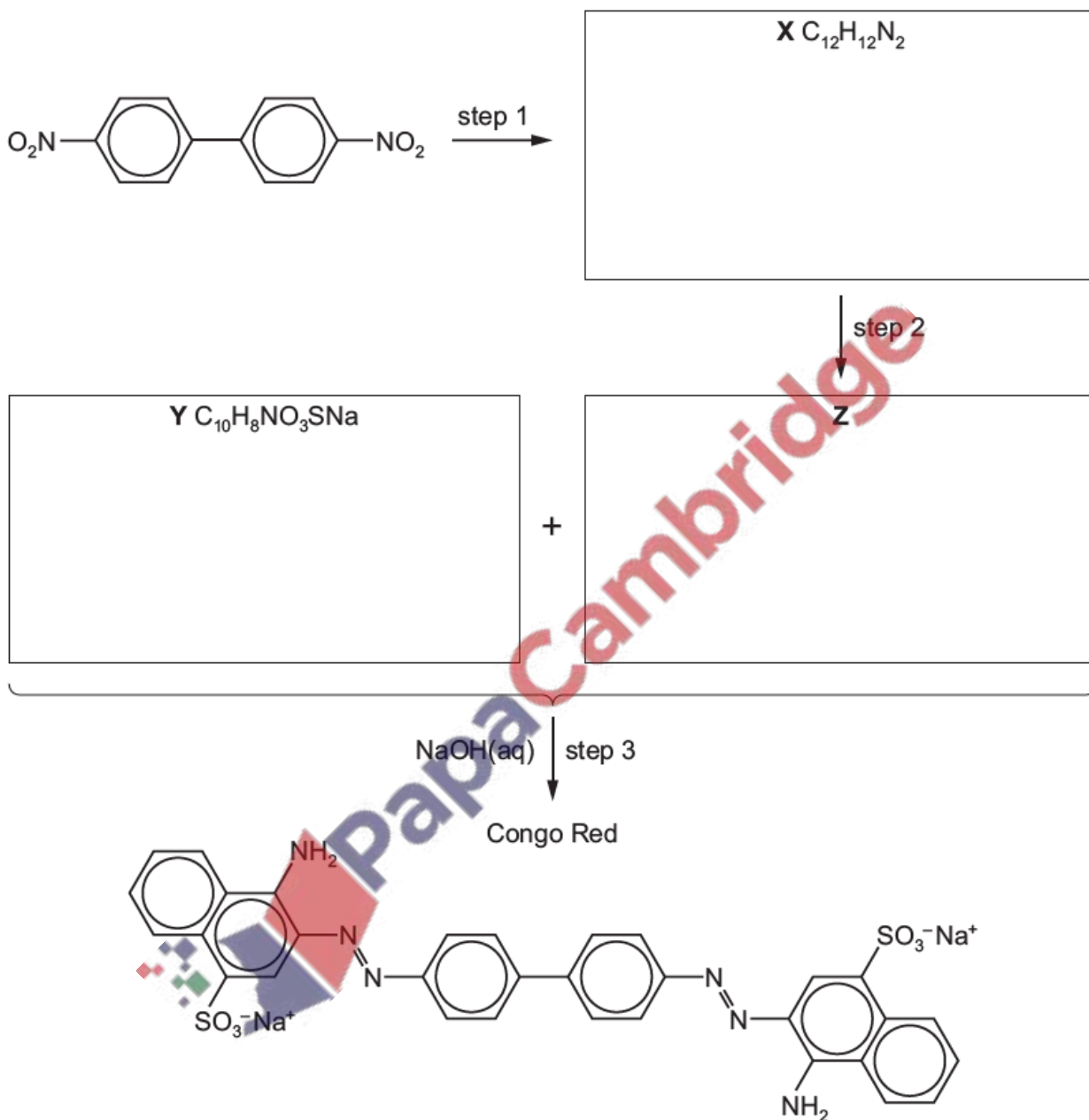


Fig. 6.2

- (i) Suggest structures for compounds **X**, **Y** and **Z** and draw them in the boxes in Fig. 6.2. [3]
- (ii) Give the reagents and conditions for step 1 and step 2.

step 1

step 2

[3]

(b) Cyclohexylamine reacts with ethanoyl chloride to form the corresponding amide, L.

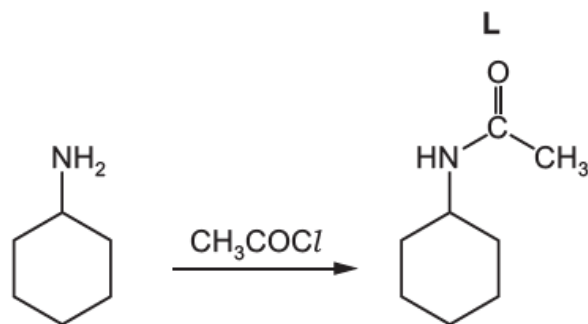


Fig. 9.2

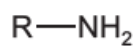
(i) Name the mechanism for the reaction shown in Fig. 9.2.

..... [1]

(ii) Complete the mechanism of the reaction between cyclohexylamine and CH_3COCl .

R-NH_2 is used to represent cyclohexylamine.

Include all relevant lone pairs of electrons, curly arrows, charges and partial charges.



[4]

(iii) The reaction between cyclohexylamine and an excess of CH_3COCl forms compound M. Compound M has the molecular formula $\text{C}_{10}\text{H}_{17}\text{NO}_2$.

Suggest and draw the structure of M.

[1]

[Total: 9]