

- 8 Asparagine and aspartic acid are two naturally occurring amino acids. Their structures and isoelectric points are shown in Table 8.1.

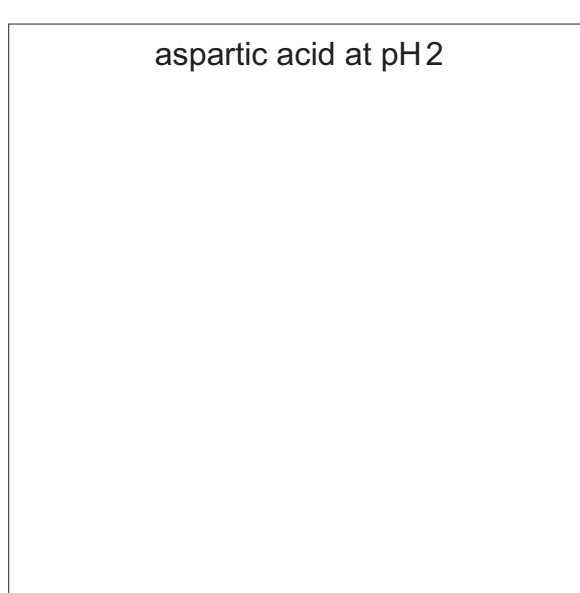
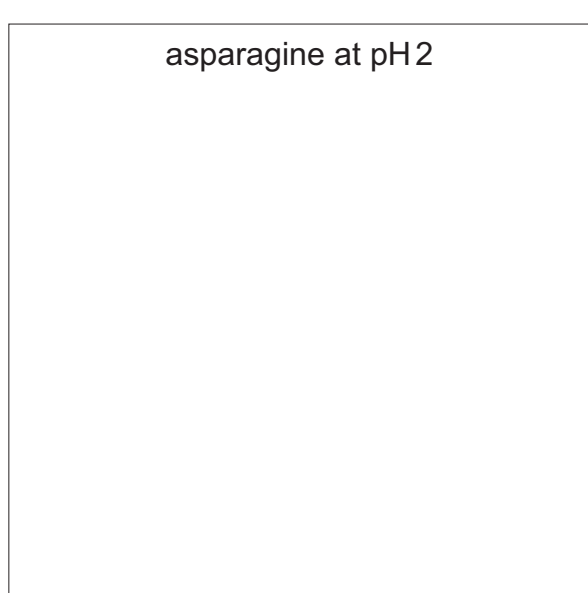
Table 8.1

amino acid	structure	isoelectric point
asparagine	$\text{HOOCCH}(\text{NH}_2)\text{CH}_2\text{CONH}_2$	5.41
aspartic acid	$\text{HOOCCH}(\text{NH}_2)\text{CH}_2\text{COOH}$	2.77

- (a) Define isoelectric point.

.....
 [1]

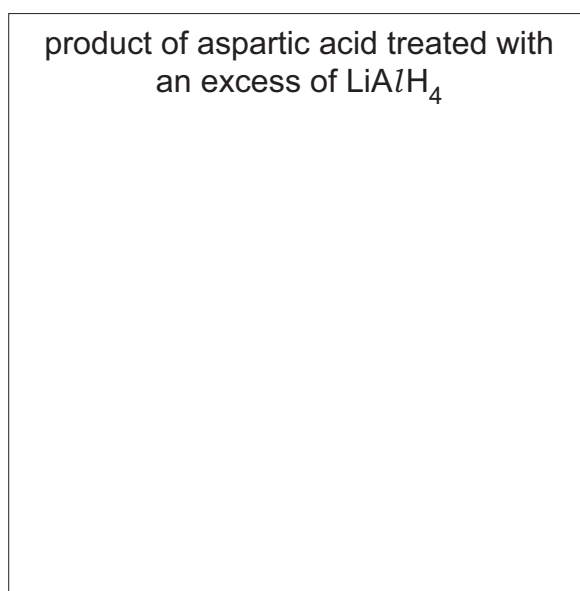
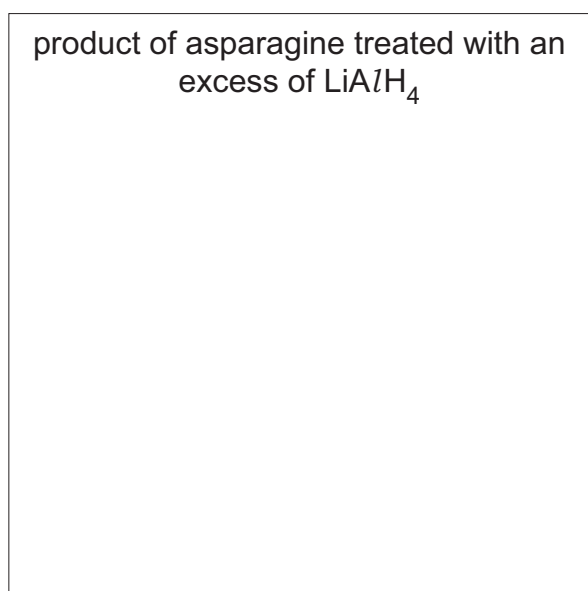
- (b) Draw the structures of asparagine and aspartic acid at pH2.



[2]

- (c) Asparagine and aspartic acid are treated separately with an excess of LiAlH_4 .

Draw the structures of the organic products of these reactions.



[2]

- (d) Propanedioic acid, $\text{HOOCCH}_2\text{COOH}$, is treated with an excess of thionyl chloride, SOCl_2 . Propanedioyl chloride, $\text{ClOCCH}_2\text{COCl}$, is formed.

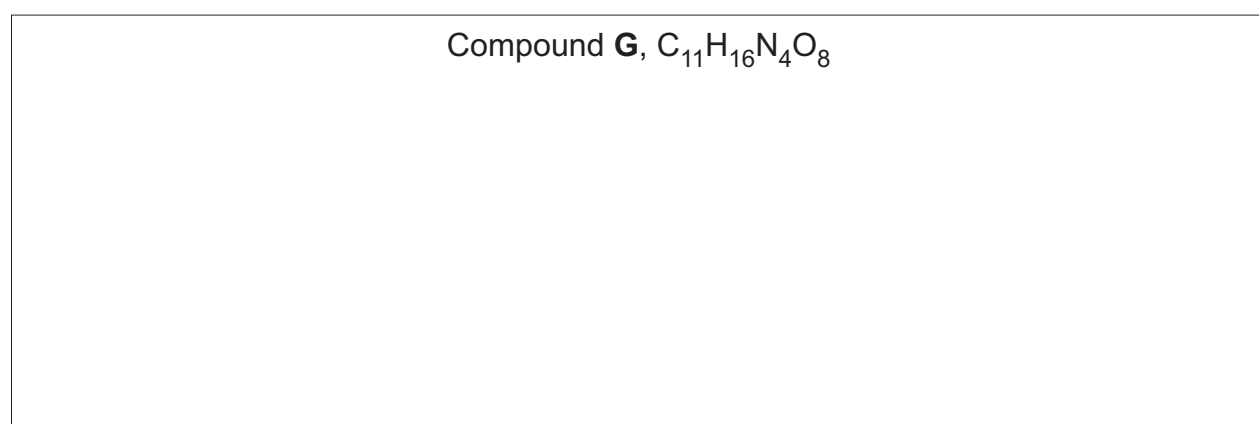
- (i) Write an equation for this reaction.

..... [1]

- (ii) Propanedioyl chloride reacts with an excess of asparagine to form compound **G** with molecular formula $\text{C}_{11}\text{H}_{16}\text{N}_4\text{O}_8$.

Each molecule of compound **G** has four amide groups.

Draw the structure of compound **G**.



[2]

- (e) Asparagine is hydrolysed with an excess of hot $\text{NaOH}(\text{aq})$.

Draw the structure of the organic product of this reaction.

[2]

- (f) A polymer can form from asparagine, $\text{HOOCCH}(\text{NH}_2)\text{CH}_2\text{CONH}_2$, as the only monomer.

Draw a length of the polymer chain containing **three** monomer residues.

Clearly label the repeat unit of the polymer on your diagram.

[3]

- (g) Aspartic acid exists in two optically active forms.

- (i) Plane polarised light is passed through pure samples of these two optically active forms in solutions of the same concentration.

Describe **two** similarities and **one** difference in their effect on the plane polarised light.

similarities

.....

difference

.....

[2]

- (ii) Give the term used to describe a mixture of equal amounts of the two optically active forms.

..... [1]

[Total: 16]