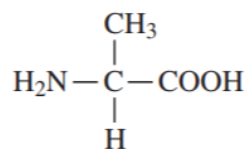


CHAPTER 30 AMINO ACIDS, PROTEINS & DNA

1

(a) The structure of the amino acid *alanine* is shown below.



(i) Draw the structure of the zwitterion formed by *alanine*.

(ii) Draw the structure of the organic product formed in each case from *alanine* when it reacts with:

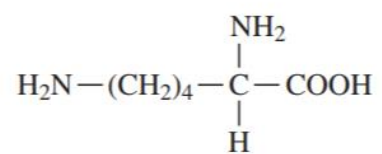
CH₃OH in the presence of a small amount of concentrated sulphuric acid

Na₂CO₃

CH₃Cl in a 1:1 mole ratio

(4 marks)

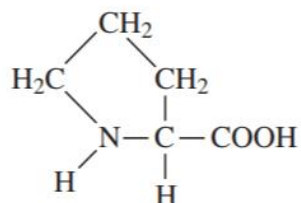
(b) The amino acid *lysine* is shown below.



Draw the structure of the *lysine* species present in a solution at low pH.

(1 mark)

(c) The amino acid *proline* is shown below.

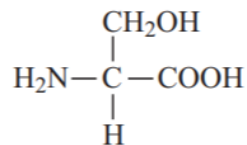
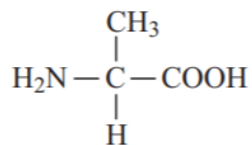


Draw the structure of the dipeptide formed from two *proline* molecules.

(1 mark)

2

Draw the structures of the **two** dipeptides which can form when one of the amino acids shown below reacts with the other.



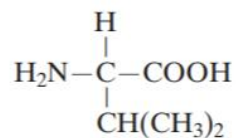
Structure 1

Structure 2

(2 marks)

3

Consider the following amino acid.



- (i) Draw the structure of the amino acid species present in a solution at pH 12.
- (ii) Draw the structure of the dipeptide formed from two molecules of this amino acid.
- (iii) Protein chains are often arranged in the shape of a helix. Name the type of interaction that is responsible for holding the protein chain in this shape.

.....
(3 marks)

4

The structures of the amino acids *alanine* and *glycine* are shown below.

Alanine exists as a pair of stereoisomers.

(i) Explain the meaning of the term *stereoisomers*.

.....

.....

.....

(ii) State how you could distinguish between the stereoisomers.

.....

.....

.....

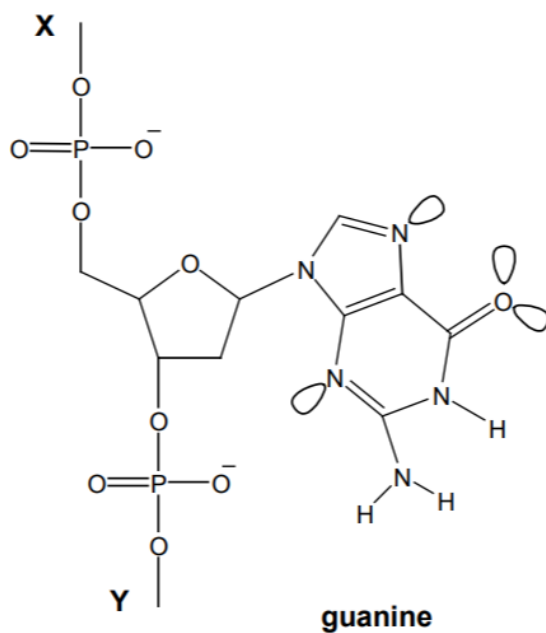
(4 marks)

5

The anticancer drug cisplatin operates by reacting with the guanine in DNA.

Figure 6 shows a small part of a single strand of DNA. Some lone pairs are shown.

Figure 6

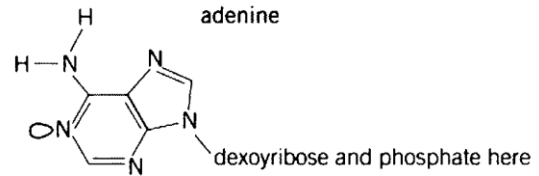
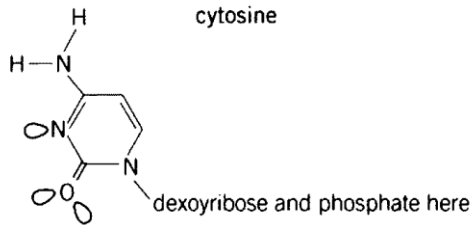


(a) The DNA chain continues with bonds at **X** and **Y**.

State the name of the sugar molecule that is attached to the bond at **X**.

.....
(1 mark)

Figure 2 shows two more bases found in DNA.



(b) State which of these two bases, cytosine or adenine, pairs with the guanine in Figure 1 when two separate strands of DNA form a double helix.

.....
(1 mark)

(c) Explain how the base that you have chosen forms a base pair with guanine.

.....
.....
.....
.....
.....
.....

(3 marks)

- (d) Cisplatin works because one of the atoms on guanine can form a co-ordinate bond with platinum, replacing one of the ammonia or chloride ligands. Another atom on another guanine can also form a co-ordinate bond with the same platinum by replacing another ligand.

Explain how the action of cisplatin is able to stop the growth of cancer cells.

.....

.....

.....

.....

.....

.....

(3 marks)