



ADVANCED GCE
CHEMISTRY
 Biochemistry

2815/02

Candidates answer on the question paper
 A calculator may be used for this paper

OCR Supplied Materials:

- Data Sheet for Chemistry (inserted)

Other Materials Required:

- Scientific calculator

Friday 23 January 2009
Morning

Duration: 50 minutes



Candidate Forename		Candidate Surname	
--------------------	--	-------------------	--

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

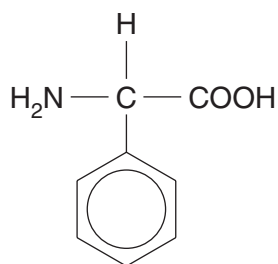
INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **45**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculation.
- This document consists of **12** pages. Any blank pages are indicated.

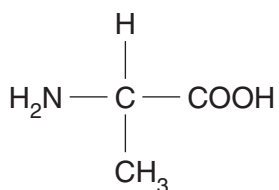
FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	11	
2	6	
3	10	
4	11	
5	7	
TOTAL	45	

Answer **all** the questions.

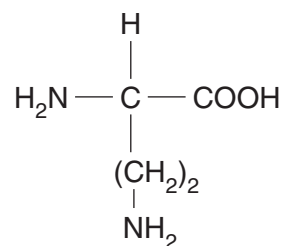
- 1 This question is about the structure of proteins. Five amino acids are shown below.



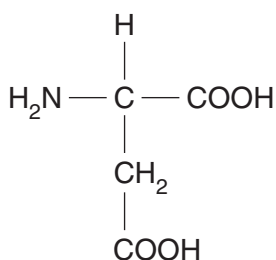
phenylalanine



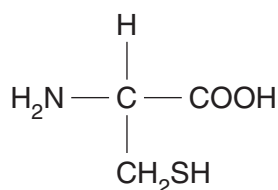
alanine



lysine



aspartic acid



cysteine

- (a) Amino acids link together to form the primary structure of a protein.
- (i) Draw a diagram to show how alanine and lysine are linked in the primary structure of the protein. Name the link involved.

name of link: [2]

- (ii) A dipeptide has the molecular formula $\text{C}_{11}\text{H}_{14}\text{N}_2\text{O}_3$.

Deduce which **two** of the amino acids above could form this dipeptide.
Explain your reasoning.

.....

.....

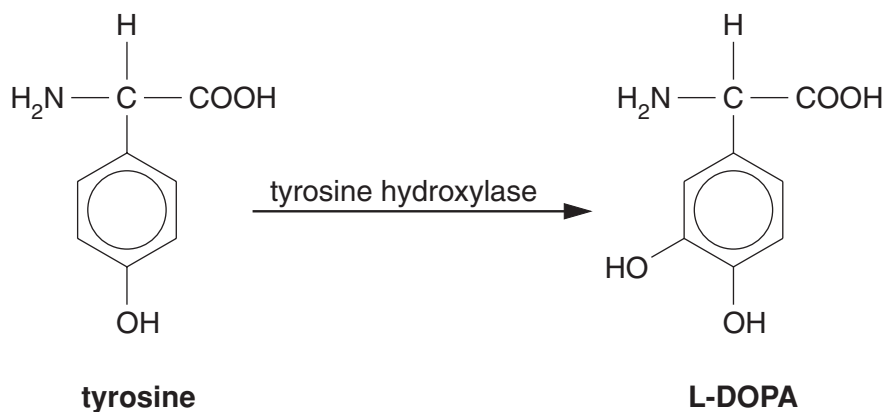
..... [2]

Using the amino acids opposite, describe **three** types of R group interactions that can help to stabilise the tertiary structure of a protein.

..... [6

Turn over

- 2 L-DOPA is used in the body to make adrenaline.
 L-DOPA is formed from the amino acid tyrosine.
 The reaction is catalysed by the enzyme tyrosine hydroxylase.



- (a) (i) Suggest why the enzyme is specific for only one optical isomer of tyrosine.

.....
 [1]

- (ii) Draw the structure of the zwitterion of tyrosine.

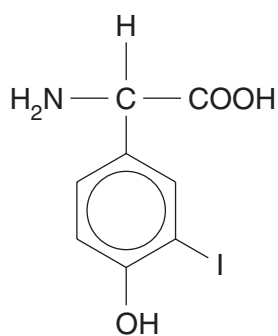
[1]

- (iii) At a pH of 7, a particular $-\text{NH}_3^+$ group on the enzyme bonds to the zwitterion of tyrosine.

Suggest why an increase in pH would prevent this binding.

.....
 [1]

(b) The compound 3-iodotyrosine is a competitive inhibitor of the enzyme tyrosine hydroxylase.



3-iodotyrosine

(i) Suggest how 3-iodotyrosine acts as a competitive inhibitor of the enzyme.

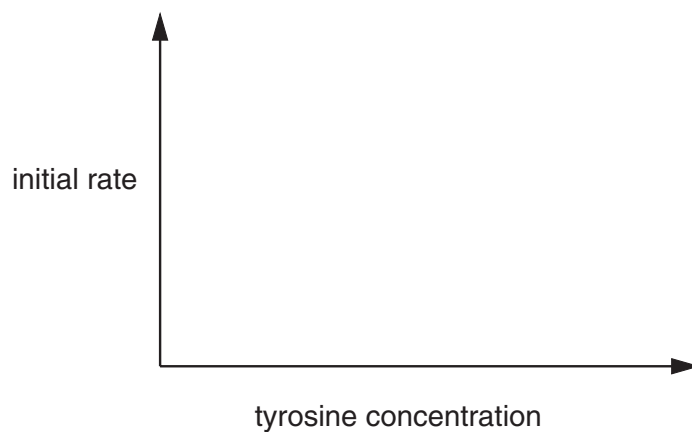
.....

 [1]

(ii) Draw graphs on the axes below to show how the initial rate of the enzyme-catalysed reaction varies with tyrosine concentration:

- in the absence of 3-iodotyrosine (**A**);
- in the presence of 3-iodotyrosine (**B**).

Label your graphs **A** and **B**.



[2]

[Total: 6]

3 (a) DNA is double stranded.

Deduce the base sequence that is complementary to the fragment of DNA strand shown below.

Fragment of DNA strand: GATACG

Complementary base sequence: [1]

(b) One complementary pair of bases in DNA is held together by two hydrogen bonds, the other pair by three.

Deduce the total number of hydrogen bonds that would link the bases of the DNA fragment in **(a)** to its complementary bases.

.....

..... [2]

(c) In the process of translation, m-RNA directs the synthesis of a protein chain.

The DNA fragment shown below is transcribed.

Deduce the base sequence of the m-RNA fragment that is formed.

Base sequence of DNA fragment: GATACG

Base sequence of m-RNA fragment: [1]

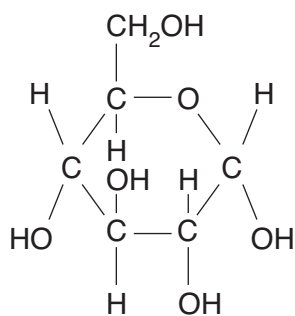
Describe the process of translation.

Your answer should include details of the bond-breaking, bond-making and intermolecular forces involved.

..... [6]

[Total: 10]

- 4 The diagram shows the structure of a molecule of α -D-glucose.



- (a) This structure of α -D-glucose is described as α -pyranose.

- (i) Explain the terms:

α -

pyranose [2]

- (ii) Draw the open-chain structure of α -D-glucose.

[1]

(b) A disaccharide can be formed from two D-glucose molecules connected by a $1\alpha-4$ glycosidic link.

(i) Draw a diagram showing this disaccharide.

Show the $1\alpha-4$ glycosidic link clearly.

[2]

(ii) Name this disaccharide.

..... [1]

(c) $1\beta-4$ glycosidic links are found in cellulose.

(i) Explain why cellulose is insoluble in water.

.....
.....
.....
..... [2]

(ii) Apart from solubility, explain how the bonding and structure of cellulose makes it suitable as a structural polymer for plants.

.....
.....
.....
..... [3]

[Total: 11]

- 5 Punicic acid, $C_{17}H_{29}COOH$, is the main carboxylic acid found in pomegranate seeds. It is an unsaturated straight chain compound.

(a) Deduce the number of carbon to carbon double bonds in punicic acid.

..... [1]

(b) A triglyceride can be made from punicic acid and glycerol (propane-1,2,3-triol).

(i) Draw the structure of this triglyceride.

You should represent the hydrocarbon chains in punicic acid as $C_{17}H_{29}$.

[2]

(ii) Name **two** types of functional groups found in the triglyceride in (i).

.....

..... [2]

(iii) Explain why this triglyceride is soluble in non-polar solvents such as hexane.

.....

.....

..... [2]

[Total: 7]

END OF QUESTION PAPER

11
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE