

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY

Biochemistry

2815/02

Tuesday

29 JUNE 2004

Morning

50 minutes

Candidates answer on the question paper.

Additional materials:

Data Sheet for Chemistry

Scientific calculator

Candidate Name	Centre Number	Candidate Number										
	<table border="1" style="display: inline-table;"> <tr> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> </tr> </table>						<table border="1" style="display: inline-table;"> <tr> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> </tr> </table>					

TIME 50 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

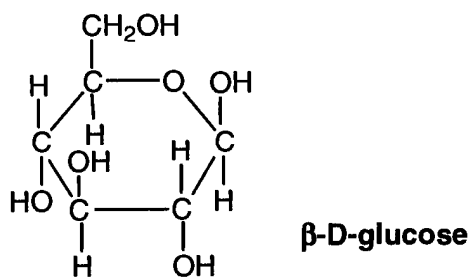
- The number of marks is given in brackets [] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- You may use the *Data Sheet for Chemistry*.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	16	
2	11	
3	11	
4	7	
TOTAL	45	

This question paper consists of 10 printed pages and 2 blank pages.

Answer **all** the questions.

- 1 This question is about cellulose, a polymer of β -D-glucose.



- (a) (i) Draw a diagram showing how two molecules of β -D-glucose are linked in a cellulose chain.

[2]

(ii) Explain, with a diagram, why glucose is soluble in water, whilst cellulose is not.

[4]

(iii) What is the main function of cellulose in plants?

.....[1]

(iv) Suggest why the enzyme amylase is able to catalyse the hydrolysis of starch but not that of cellulose.

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

(b) Cellulose can be used as a support to immobilise enzymes, for example, glucose oxidase and peroxidase in the Clinistix test for the presence of glucose in urine.

(i) Suggest **two** ways in which the enzyme could be bonded to the cellulose support.

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

(ii) Glucose oxidase is inhibited non-competitively by heavy metal ions such as Hg²⁺. Explain the meaning of this statement and suggest how the inhibition could arise.

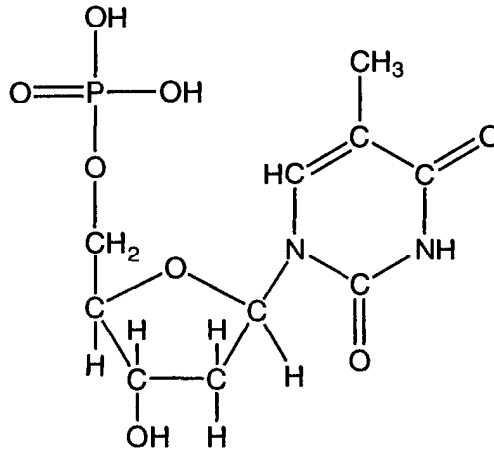
.....
.....
.....
.....[3]

(c) State **two** advantages of immobilising enzymes for industrial use.

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

[Total: 16]

- 2 (a) The diagram below shows the structure of the nucleotide thymidine-5'-monophosphate, which includes the base thymine.



- (i) On the structure of the nucleotide above, indicate **two** points where the monomer would be linked to other nucleotides in a nucleic acid chain. [2]
- (ii) Would a residue of this monomer be found in DNA or RNA? Give **two** reasons for your choice.

.....

.....

.....[2]

- (iii) Outline the way in which base pairing allows DNA to survive undamaged for long periods of time.

.....

.....

.....

.....[3]

- (b) Part of the base sequence in m-RNA which directs the synthesis of a particular enzyme is shown below.

5' – ACGGCAUUCGCUG – 3'

The first 12 bases, from the left, code for this chain of amino acids:

Thr Ala Phe Ala

Use the table showing the genetic code when answering the following questions.

first base in triplet	second base in triplet				third base in triplet
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop	Stop	A
	Leu	Ser	Stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met/Start	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

- (i) What chain of amino acids would result if the third base, from the left, was changed from G to C?

.....[1]

- (ii) What chain of amino acids would result if the third base was deleted altogether?

.....[1]

- (iii) Which of the base alterations above is likely to affect the structure and function of the enzyme produced? Explain your answer.

.....

.....

.....[2]

[Total: 11]

[Turn over

3 This question is about protein structure.

With only its primary structure in place, a particular protein would have a length of 300 nm (3×10^{-7} m) when stretched out. With its secondary structure in place as well, the same protein would have a length of 45 nm. With both secondary and tertiary structures in place, its length is further reduced to 8.6 nm.

(a) Explain the term *primary structure* for a protein.

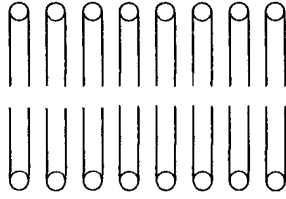
.....
.....[1]


(b) In this question, one mark is available for the quality of written communication.

Explain fully the types of interaction involved in the secondary and tertiary structure that cause the changes in length. You should include diagrams in your answer.

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

- 4 This question is about the phosphoglyceride bilayers found in membranes, shown below.



- (a) (i) What is represented chemically by the head and tail of each  in the diagram?

head

tail[2]

- (ii) What holds these molecules together in the bilayer?

.....[1]

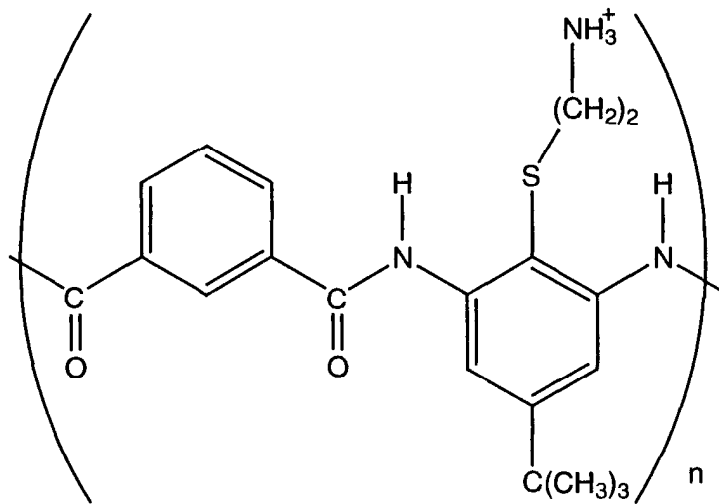
- (iii) What is the structural difference between a triglyceride and a phosphoglyceride?

.....

.....

.....[1]

- (b) The structure shows part of an antibacterial peptide polymer which acts by inserting itself into a bacterial cell membrane, making it leak.



- (i) Circle the peptide link in the diagram.

[1]

- (ii) Suggest structural features of the polymer which might allow it to be attracted to, and disrupt, the phosphoglyceride bilayer. Explain your answer.

.....

.....

.....

.....[2]

[Total: 7]

END OF QUESTION PAPER