

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS****Advanced GCE****CHEMISTRY****2815/02**

Biochemistry

Wednesday

**29 JANUARY 2003**

Afternoon

50 minutes

Candidates answer on the question paper.

Additional materials:

*Data Sheet for Chemistry*

Scientific calculator

Candidate Name

Centre Number

Candidate  
Number

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**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 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.

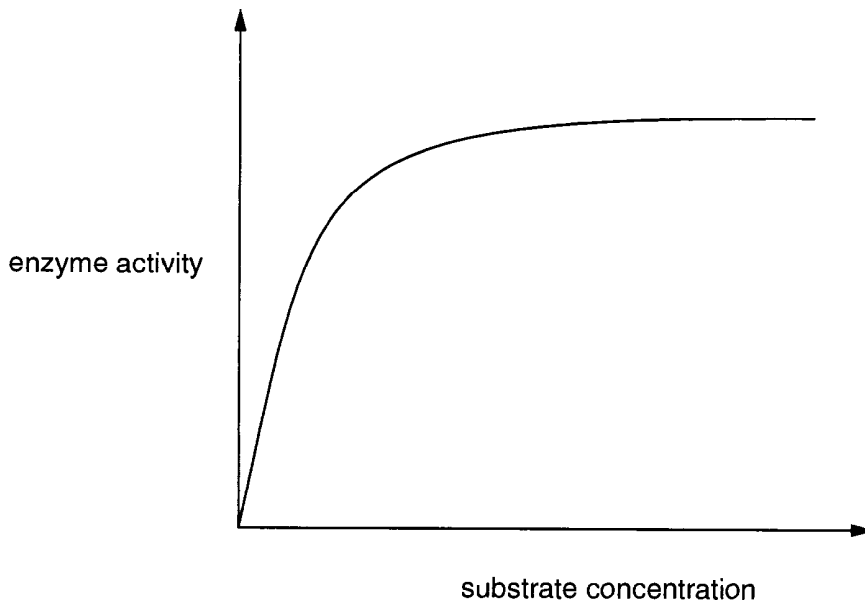
FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	4	
2	6	
3	12	
4	9	
5	6	
6	8	
<b>TOTAL</b>	<b>45</b>	

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**This question paper consists of 11 printed pages and 1 blank page.**

Answer **all** the questions.

1 Fig. 1.1 shows how the activity of an enzyme varies with substrate concentration.



**Fig. 1.1**

(a) Explain why the curve reaches a maximum value.

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

(b) On Fig. 1.1 draw the curve you would expect if a non-competitive inhibitor were present. [2]

[Total: 4]

- 2 The table below shows values for the enthalpy changes of combustion of glucose and stearic acid, together with their formulae and molar masses.

compound	molecular formula	molar mass /g mol <sup>-1</sup>	$\Delta H_c^\ominus$ / kJ mol <sup>-1</sup>
glucose	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>	182	-2 800
stearic acid	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>		-11 080

- (a) Calculate the molar mass of stearic acid.

[1]

- (b) (i) Calculate the enthalpy change per gram for each of these compounds.

glucose

answer:  $\Delta H = \dots\dots\dots$  kJ g<sup>-1</sup>

stearic acid

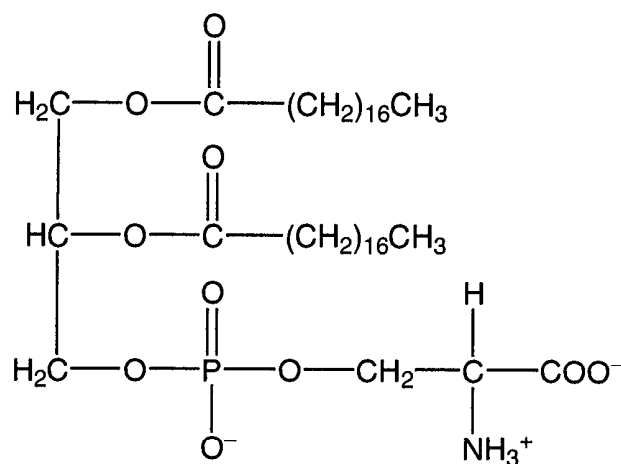
answer:  $\Delta H = \dots\dots\dots$  kJ g<sup>-1</sup> [2]

- (ii) Explain why the value for stearic acid is so much more exothermic than that for glucose.

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

[Total: 6]

- 3 This question is about the phospholipid shown below.



- (a) (i) On the diagram draw a ring around an ester group. [1]
- (ii) On the diagram indicate, with asterisks\*, **two** chiral (asymmetric) carbon atoms. [2]
- (iii) What is the overall charge on this phospholipid?  
 ..... [1]
- (b) Show with a diagram how phospholipids are assembled into bimolecular layers. [2]

(c) Some viruses consist of a protein capsule containing strands of genetic material.

These viruses can attach themselves to a cell membrane.

(i) Suggest **two** charged functional groups that might be found on the side-chains of the protein at pH 7.

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

(ii) How might the protein become attached to the bimolecular layer on the surface of a cell membrane?

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

(iii) Dilute solutions of alkali were used at disinfection points during the 2001 Foot and Mouth epidemic.

Suggest how this solution might interfere with the binding of a virus to a cell membrane.

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

[Total: 12]





- 5 This question is about nucleic acids.

The sequence of twelve bases below is a portion of a single stranded RNA found in a virus. It can be directly translated by protein synthesis inside an invaded cell.

5'---UUCCCGAAAGGU---3'

- (a) (i) How can you tell that this fragment is a portion of RNA and not DNA?

.....[1]

- (ii) State **two** other ways in which DNA usually differs from RNA.

.....

.....

.....[2]

- (b) Use the table to work out the amino acid sequence coded by this portion of RNA.

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	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

answer .....[2]



- (c) Some viruses contain double stranded RNA. Write down the complementary strand of the fragment shown above.

.....

.....[1]

[Total: 6]

6 This question is about amino acids and proteins.

(a) (i) Draw the structural formula of the dipeptide that can be made from two molecules of the amino acid alanine  $\text{H}_2\text{NCH}(\text{CH}_3)\text{COOH}$ .

[1]

(ii) Draw the structural formula of the compound that would be obtained by treating alanine with aqueous hydrochloric acid.

[1]

(b) What is the difference between the two types of **secondary structure** to be found in proteins?

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

(c) Haemoglobin is an important protein found in red blood cells.

(i) What is the role of  $\text{Fe}^{2+}$  in haemoglobin?

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

(ii) Describe the **quaternary structure** of haemoglobin.

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

[Total: 8]