OCR
RECOGNISING ACHIEVEMENT

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

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	
TOTAL	45	

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.

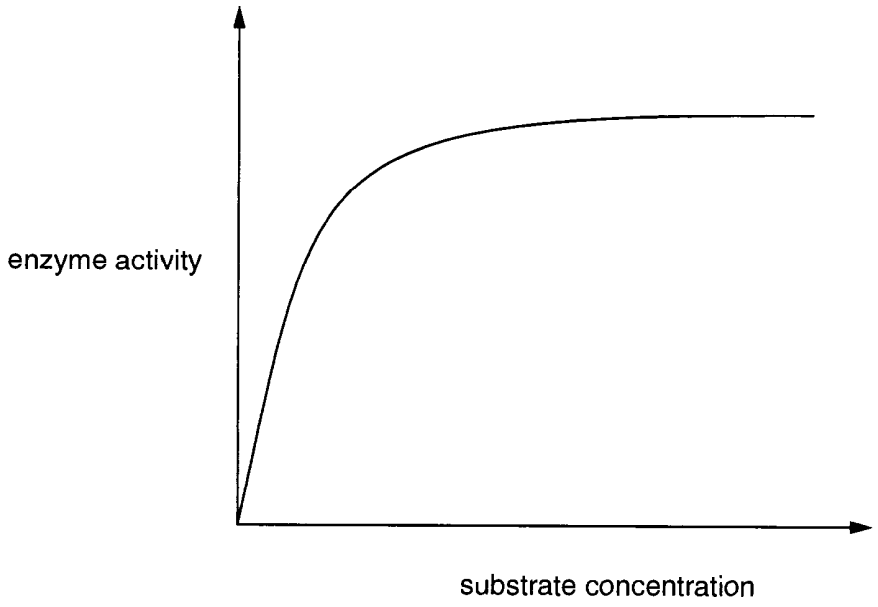

Fig. 1.1

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

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.....[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^{-1}	$\Delta H_c^{\ominus}$ / kJ mol^{-1}
glucose	$C_6H_{12}O_6$	182	−2 800
stearic acid	$C_{18}H_{36}O_2$		−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: ΔH = ...kJ g^{-1}

stearic acid

answer: ΔH = ...kJ g^{-1} [2]

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

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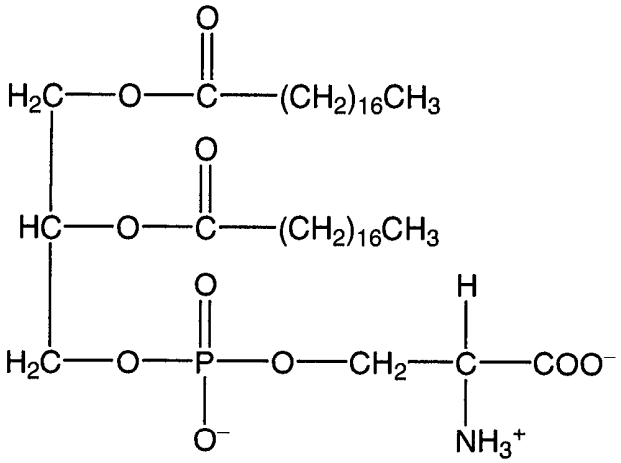
.....[3]

[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.

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.....[2]

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

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.....[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.

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.....[2]

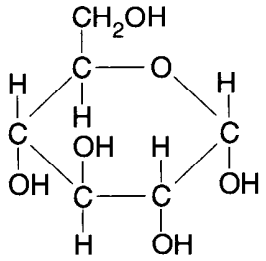
[Total: 12]

For Examiner's Use

4 In this question, one mark is available for the quality of written communication.

Describe the different structures of cellulose and starch, and account for the different properties and functions of these polymers in the light of their structures. You may find the structure of α-D-glucose, shown in the diagram, helpful.

α-D-glucose



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Quality of Written Communication [1]

[Total: 9]

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.

.....

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.....[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 $H_2NCH(CH_3)COOH$.

[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?

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.....[2]

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

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

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.....[2]

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

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.....[2]

[Total: 8]