



ADVANCED GCE
CHEMISTRY
 Biochemistry

2815/02

Candidates answer on the question paper

OCR Supplied Materials:

- *Data Sheet for Chemistry* (Inserted)

Other Materials Required:

- Scientific calculator

Thursday 18 June 2009
Morning

Duration: 50 minutes



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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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 calculations.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	15	
2	9	
3	14	
4	7	
TOTAL	45	

Answer **all** the questions.

1 This question is about two proteins that contain haem groups, haemoglobin and catalase.

(a) Haemoglobin has a **quaternary** structure composed of four protein sub-units each containing a haem group. Each of the protein sub-units has areas of α -helical structure.

(i) Explain what holds a secondary structure such as an α -helix together. Your answer should include a diagram showing the interactions between the atoms involved.

.....

 [2]

(ii) A quaternary structure is held together by attractions between R groups on different protein sub-units.

Suggest and explain **two** types of interaction that can be involved, other than that mentioned in your answer to (i).

.....

 [2]

(b) (i) Give the formula of the **ion** found at the centre of the haem **group** in haemoglobin.

..... [1]

(ii) What is the role of this ion in the function of haemoglobin?

.....
 [1]

- (c) Catalase is an enzyme that contains haem groups. Catalase is involved in the catalysis of the reaction below.



- (i) Use oxidation numbers to show that this reaction involves both oxidation and reduction.

.....

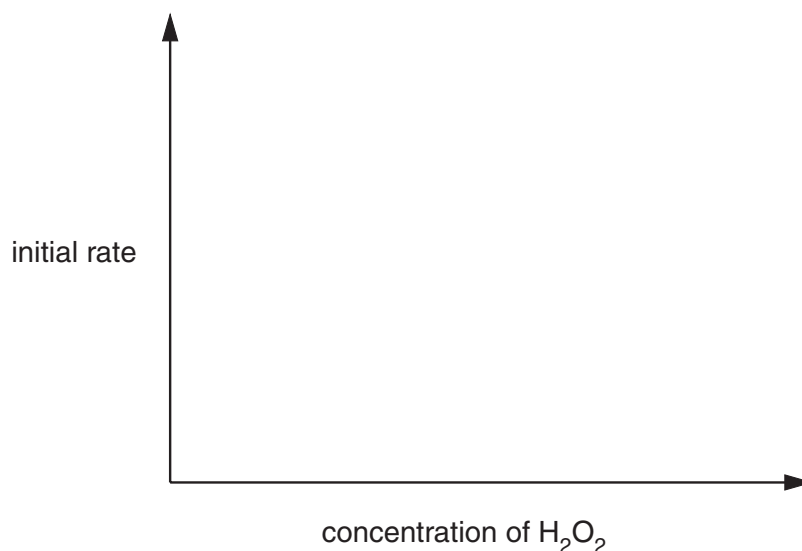
 [2]

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

A in the absence of an inhibitor;

B in the presence of a **non-competitive** inhibitor such as $\text{Cu}^{2+}(\text{aq})$.

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



[2]

- (iii) Suggest how $\text{Cu}^{2+}(\text{aq})$ acts as a non-competitive inhibitor.

.....

 [2]

(d) Hydrogen peroxide has been used for the sterilisation of milk. Excess hydrogen peroxide can be removed from the milk using catalase that has been immobilised on a support.

(i) Suggest and explain **two** advantages of using an immobilised enzyme for this purpose.

.....

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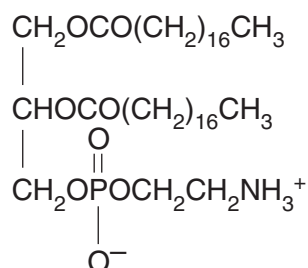
..... [2]

(ii) State **one other** commercial use of enzymes.

..... [1]

[Total: 15]

- 2 This question is about phospholipid bilayers which form cell membranes. A typical phospholipid is shown below.



- (a) (i) Ring an ester group in this structure. [1]

- (ii) State **two** functions of the phospholipid bilayers that form cell membranes.

.....

..... [2]

- (iii) State the main interaction that holds phospholipid bilayers together.

..... [1]

- (b) The phospholipids in the cell membranes of some cold-resistant organisms have adapted to allow the membranes to remain flexible and effective at low temperatures.

Suggest and explain **one** adaptation of the hydrocarbon chains in the phospholipids which could allow the membranes to remain flexible at low temperatures.

.....

.....

..... [2]

- (c) The formula of a lipid can be simplified as $(\text{CH}_2)_n$.
 The formula of a carbohydrate can be simplified to $(\text{CH}_2\text{O})_n$.
 Lipids are a more concentrated energy store than carbohydrates.
 Explain why.

.....

.....

.....

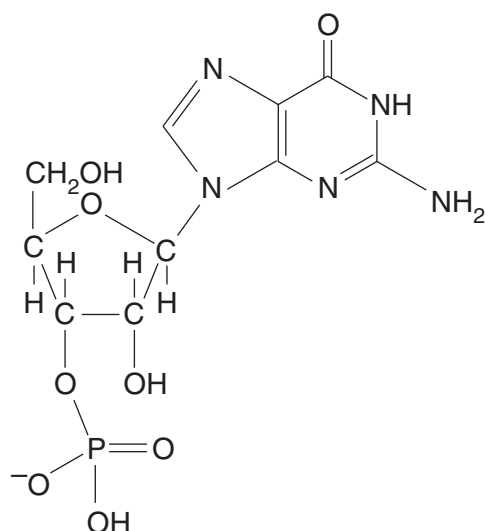
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.....

..... [3]

[Total: 9]

- 3 This question is about nucleotides and nucleic acids. The structure of a nucleotide is shown below.



- (a) In the nucleotide above, D-ribose is bonded to a nitrogen atom in a base by a β -glycosidic link.

- (i) Explain the significance of the term β in β -glycosidic link.

.....
 [1]

- (ii) Suggest **one** way in which the glycosidic link between D-ribose and the base may be hydrolysed.

.....
 [1]

- (b) Draw the structure of D-ribose in its ring form and open-chain form.

Ring form

Open-chain form

[2]

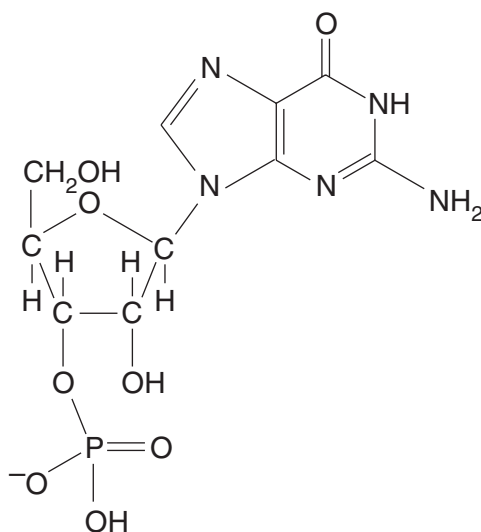
(c) In m-RNA the ribose units are linked through phosphate groups to form the polymer.

(i) Explain why m-RNA is referred to as a **condensation** polymer.

.....

 [1]

(ii) On the ribose structure below put an asterisk (*) by the atom to which the next phosphate group will attach as the polymer forms.



[1]

(d) DNA codes for m-RNA by **transcription**.

(i) State **two** ways in which the structures of m-RNA and DNA differ.

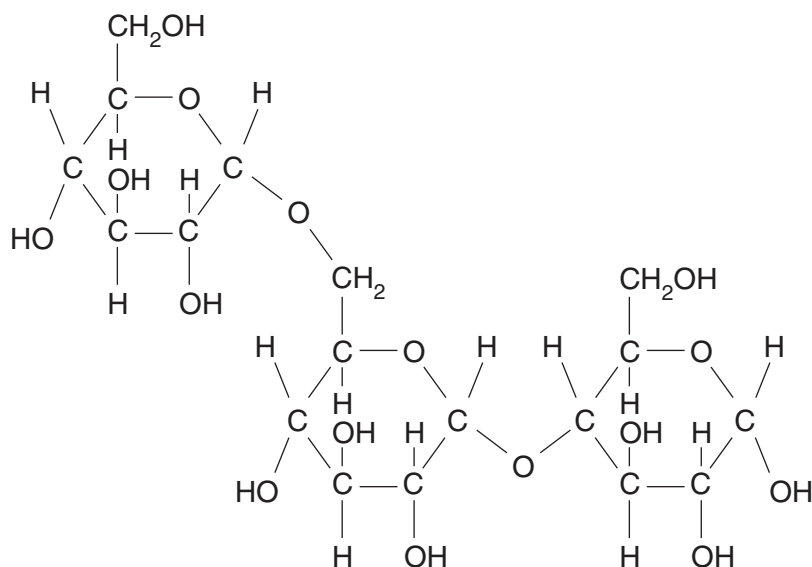
.....
 [2]

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

[5]

[Total: 14]

- 4 A polysaccharide, **C**, can be partially hydrolysed to produce a mixture containing the compound shown below.



- (a) Identify the polysaccharide **C** which produced the compound above.
Give **two** reasons for your choice.

.....

 [3]

- (b) Polysaccharide **C** is insoluble in water, whereas glucose is soluble.
Explain this difference. Your answer should include a diagram.

.....

 [4]

[Total: 7]

END OF QUESTION PAPER

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