Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Level

BIOLOGY **9700/04**

Paper 4 Structured Questions A2 Core

May/June 2004

1 hour 15 minutes

Candidates answer on the Question Paper.
Additional Materials: Answer Paper should be available on request.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in Section A and **one** question from Section B.
Circle the number of the Section B question you have answered in the grid below.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
1	
2	
3	
4	
5	
Section A	
6 or 7	
Total	

This document consists of **10** printed pages and **2** lined pages.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

1 Factor VIII is a glycoprotein synthesised in liver cells. Many haemophiliacs, who are deficient in Factor VIII, are now treated by regular injections of genetically engineered Factor VIII. Fig. 1.1 shows the molecular structure of Factor VIII.

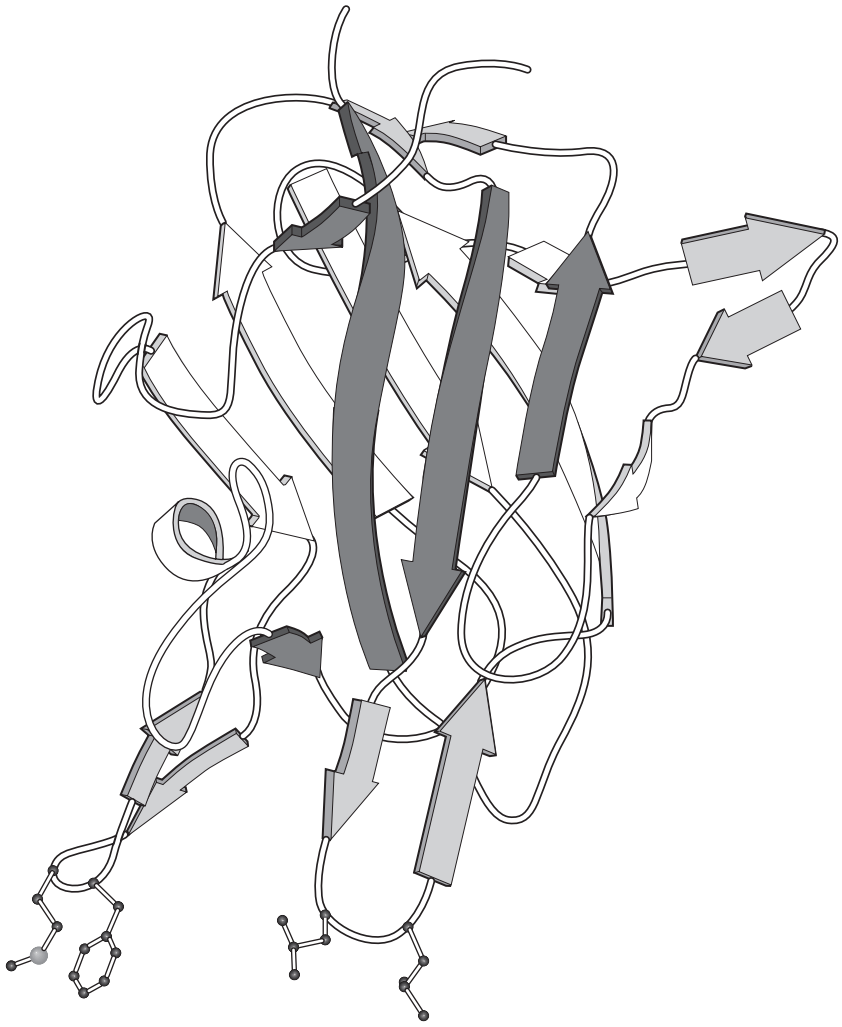


Fig. 1.1

(a) Explain how the shape of the Factor VIII protein molecule shown in Fig. 1.1 is maintained.

.....

.....

.....

.....

.....[3]

(b) Outline how the isolated gene for human Factor VIII is obtained and inserted into a host cell.

.....

.....

.....

.....

.....

.....

.....[4]

(c) State **one** advantage of using recombinant Factor VIII instead of blood derived Factor VIII.

.....

.....

.....[1]

(d) Suggest why the host cell used to produce genetically engineered Factor VIII must be a mammalian cell and not a bacterial cell.

.....

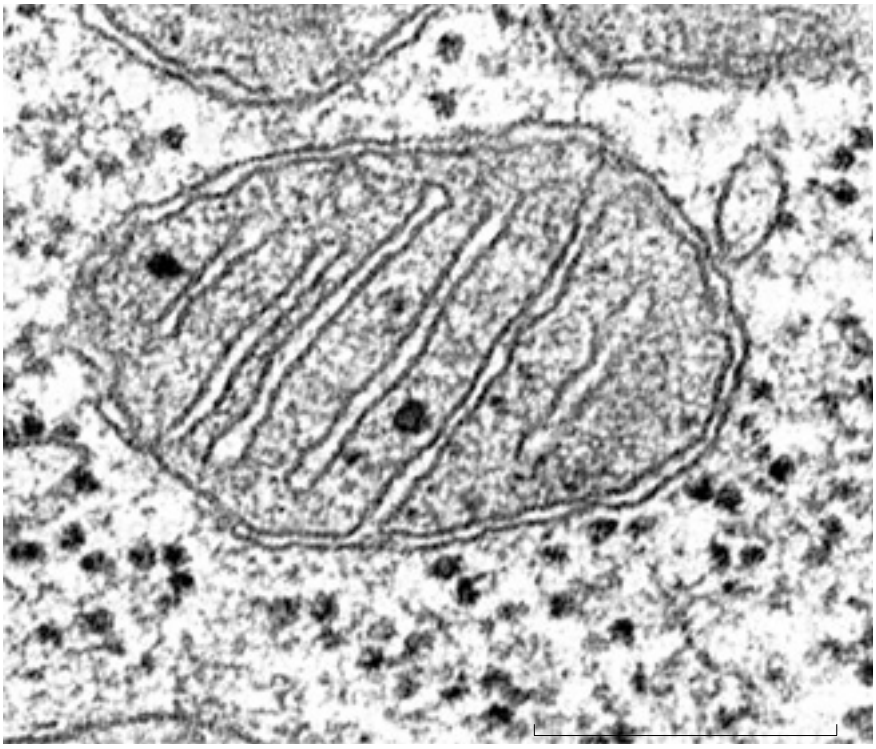
.....

.....

.....[1]

[Total: 9]

2 Fig. 2.1 is an electron micrograph showing the main structural features of a mitochondrion in section.



1 μm

Fig. 2.1

(a) Indicate clearly on the diagram where:

(i) oxidative phosphorylation occurs;

(ii) Krebs cycle occurs.

[2]

(b) Describe two ways in which the structure of the mitochondrion is adapted for oxidative phosphorylation.

1. .....

.....

.....

2. .....

.....

.....[4]

(c) Explain how the lack of oxygen will affect the respiratory processes **in the mitochondria**. References to processes in the cytoplasm are not required.

.....

.....

.....

.....

.....[3]

[Total: 9]

3 Fig. 3.1 is a diagram of a section through the proximal convoluted tubule of a kidney nephron showing details of cell structure, as seen with the electron microscope.

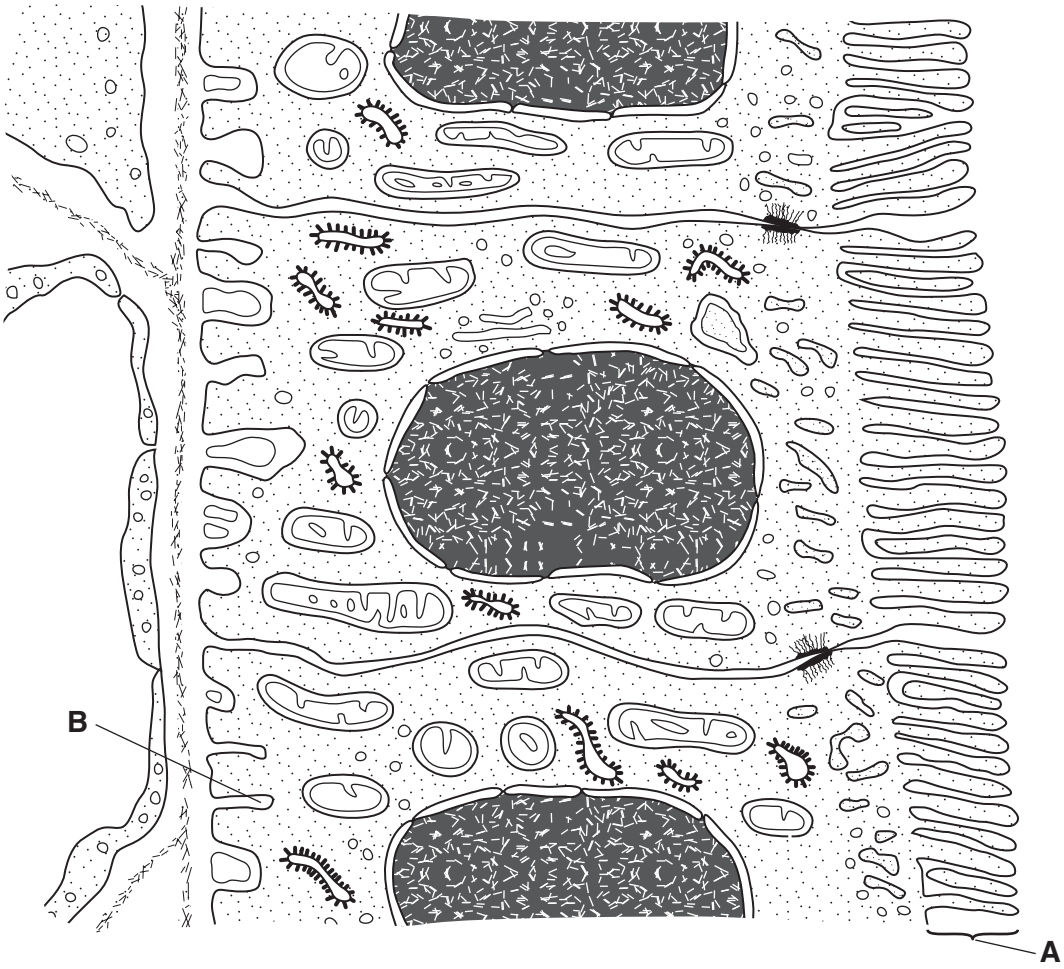


Fig. 3.1

(a) Name the structures **A** and **B**.

A .....

B .....[2]

(b) Explain three ways in which the cells of the proximal convoluted tubule are adapted for selective reabsorption.

1. .....

.....

2. .....

.....

3. .....

.....[3]

(c) Describe the mechanism of glucose reabsorption into the blood from the lumen of the proximal convoluted tubule of the kidney.

.....

.....

.....

.....

.....[3]

(d) Outline, in terms of water potential, how water is reabsorbed by the cells of the **proximal convoluted tubule**.

.....

.....

.....[2]

[Total: 10]

4 **(a)** Explain, **with one example**, how a mutation may affect the phenotype of an organism.

.....

.....

.....

.....

.....

.....[4]

A mutation of the gene for the β polypeptide chain of haemoglobin can result in sickle cell anaemia, a lethal or near lethal condition.
Only people who are homozygous for this allele have sickle cell anaemia.
All haemoglobin is affected in people who have sickle cell anaemia.
At low oxygen levels red blood cells are distorted (sickle shape) which leads to blockage of capillaries and the destruction of many red blood cells by phagocytosis leading to severe anaemia.

Fig. 4.1 shows the distribution of malaria and the sickle cell allele.

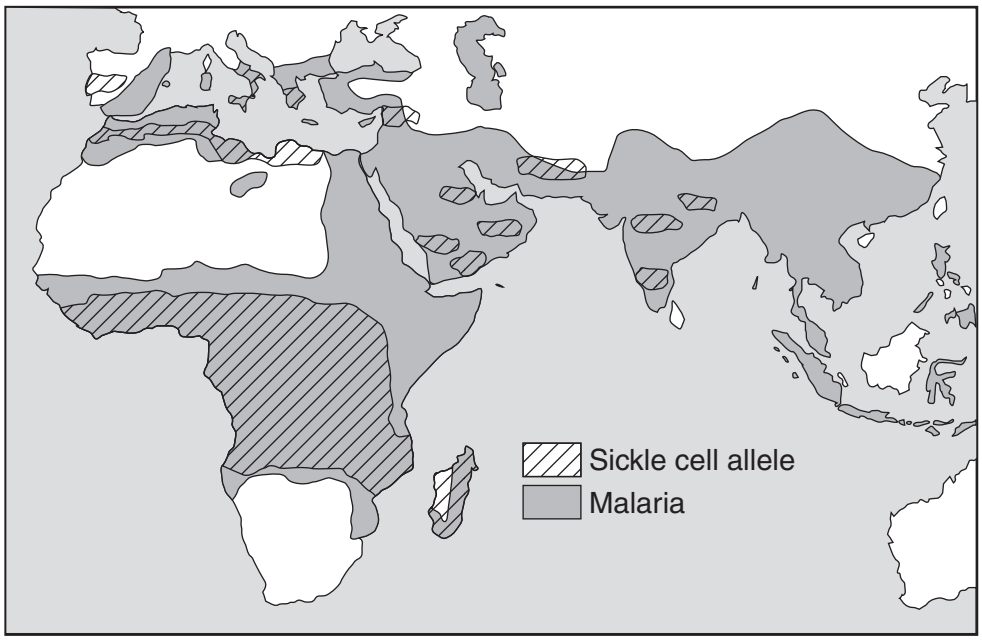


Fig. 4.1

(b) Explain why the sickle cell allele occurs at such high frequencies in some areas.

.....

.....

.....

.....

.....

.....[4]

[Total: 8]

5 Coat colour in cats is determined by a sex-linked gene with two alleles, black and orange. When black cats are mated with orange cats, the female offspring are always tortoiseshell, their coats show black and orange patches of various sizes, while the male offspring have the same coat colour as their mothers.

(a) Using the symbols $\mathbf{X^B}$ for black and $\mathbf{X^O}$ for orange, draw genetic diagrams to account for both these crosses.

black female X orange male

orange female X black male

[4]

(b) List the genotypes and their phenotypes of the offspring that may result from mating a tortoiseshell female with a black male.

.....

.....

.....

.....

.....[4]

(c) Suggest an explanation for the tortoiseshell coat in terms of the activity of the X chromosomes.

.....

.....

.....[1]

[Total: 9]

Section B

Answer only **one** question from this section, either question 6 or question 7.

Your answer to Section B must be in continuous prose, where appropriate.

Answers may be illustrated by large, clearly labelled diagrams.

Your answer must be set out in sections **(a)** and **(b)** etc., as indicated in the question.

6 **(a)** Explain how a synapse functions. [9]

(b) Describe the role of glucagon in regulating blood glucose. [6]

[Total: 15]

7 **(a)** Outline the main features of the Calvin Cycle. [9]

(b) Explain the role of NADP in photosynthesis. [6]

[Total: 15]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....