

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

HUMAN BIOLOGY

2858/01

Case Studies

Monday

6 JUNE 2005

Morning

45 minutes

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Ruler (cm/mm)

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

TIME 45 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 blue or black ink, in the spaces provided on the question paper.
- Read each question carefully 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 may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	23	
2	22	
TOTAL	45	

This question paper consists of 11 printed pages, 1 blank page and 2 inserts.

Answer all the questions.

This question is based on the article 'HEART VALVE REPLACEMENT SURGERY' (Case Study 1) .

1 Heart valve replacement accounts for 20% of heart surgery operations.

(a) Name two other operations that require heart surgery.

1

2[2]

(b) Fig. 1.2 is a drawing of a longitudinal section through a human heart.

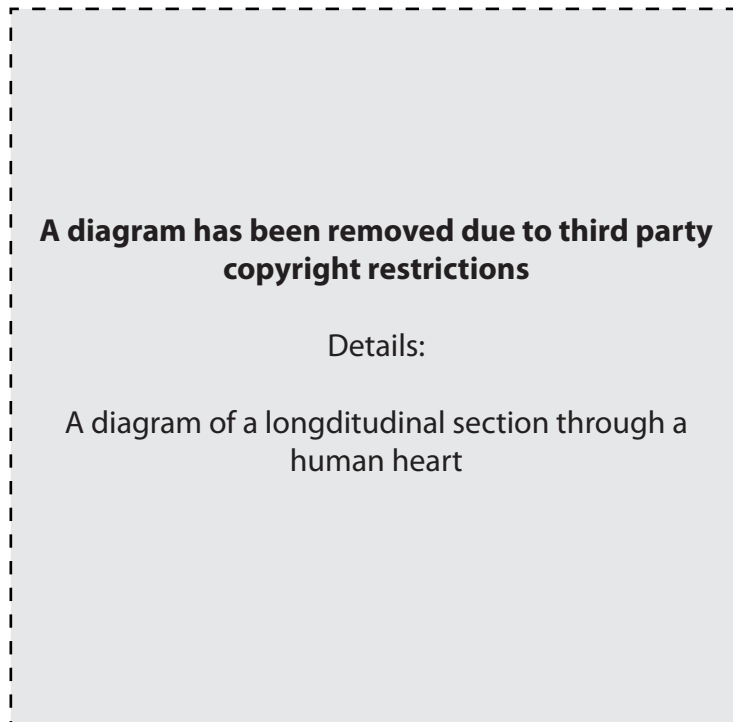


Fig. 1.2

Explain how the heart valves maintain the direction of blood flow through the heart.

.....

.....

.....

.....

.....[2]

(c) Where the **bicuspid** valve is severely damaged, some blood leaks backwards. This condition is known as regurgitation.

(i) **Draw an arrow on Figure 1.2** to indicate the direction blood would take if regurgitation is occurring. [1]

(ii) State how regurgitation might be detected by a doctor.

.....

.....

.....[2]

Fig. 1.3 shows the changes in pressure which occur in the left hand side of the heart during a **normal** cardiac cycle.

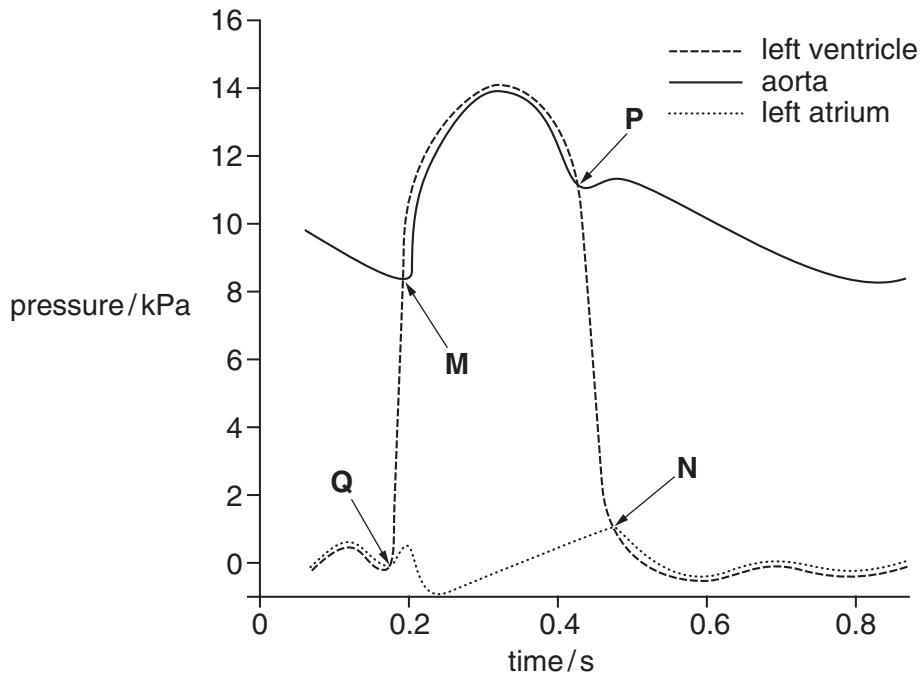


Fig. 1.3

(iii) Suggest what effect regurgitation would have on the **pressure** in the ventricle.

.....[1]

(d) Use the appropriate **letter** from Fig. 1.3 to indicate when the following events occur:

(i) the aortic valve closes;

.....[1]

(ii) the bicuspid valve closes.

.....[1]

The heart-lung machine used during heart surgery has a device containing a blood gas barrier across which carbon dioxide and oxygen diffuse. This takes the place of the gas exchange surface normally provided by the lungs.

(e) Explain how the following features contribute to the **efficiency** of the gas exchange surface in the lungs.

(i) The lungs consist of millions of alveoli.

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

(ii) The capillary wall is only one cell thick.

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

(iii) The gas exchange surface is well ventilated.

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

The heart-lung machine has other features **in addition to a gas exchange surface** which allow it to replace heart and lung function during heart surgery.

(f) (i) Suggest **two** other features of the heart-lung machine, not involved in gas exchange, that perform useful functions during heart surgery.

1
2[2]

(ii) Suggest a reason why blood needs to be filtered before it is returned to the patient from the heart-lung machine.

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

(g) In the case study, you were told that the heart may be stopped by using drugs which affect ion channels in the cell surface membranes of cardiac muscle cells. Describe how structures that are part of the cell surface membrane could act as ion channels.

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

(h) Explain why untreated pig valve tissue and bovine pericardium may provoke '*rejection by the patient's immune system*'.

.....
.....
.....
.....
.....
.....
.....[4]

[Total: 23]

BLANK PAGE

This question is based on the article 'PKU AND THE ROLE OF THE DIETICIAN' (Case Study 2).

- 2 Enzymes, such as phenylalanine hydroxylase (PAH), are proteins made up of a sequence of amino acids. The following table shows some of the **codons** for a range of different amino acids.

Table 2.1

codon	amino acid
CUU	leucine
ACU	threonine
GUG	valine
GAG	glutamine
AGU	serine
CGG	arginine
GGG	glycine

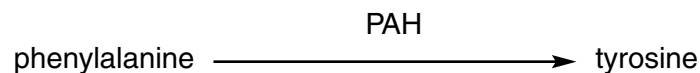
Using the information in Table 2.1:

- (a) Give the sequence of amino acids coded for by the following **DNA** sequence.

TGA-CCC-CTC

.....[2]

- (b) In the inherited disease phenylketonuria (PKU), a mutation has occurred in the gene coding for the enzyme PAH. The enzyme normally converts the amino acid phenylalanine into a different amino acid, tyrosine.



The protein substitute used in feeding infants and children with PKU contains all the essential amino acids but not phenylalanine. In addition, it may also contain essential vitamins and minerals needed for the growth and development of the infant and child.

- (c) State the name of **one** vitamin and **one** mineral and outline their role in growth and development.

vitamin
role
.....
.....
mineral
role
.....
.....[4]

- (d) Breast feeding is still encouraged for babies with PKU.
State **one** reason **other than for nutrition** why breast feeding is encouraged.
.....
.....[1]

Growth is monitored using the height and weight of the child as a guideline. Growth curves are divided into centiles. The 50th centile means that 50% of children will show a growth pattern which follows this line. Separate growth charts are used for boys and girls. A copy of the growth chart for girls is given in Fig. 2.1, which has been provided as an insert.

- (e) (i) State why separate growth charts are needed to monitor the growth of boys and girls.
.....
.....[1]

- (ii) The growth of a girl with PKU has been following the 50th centile. When she was measured at 5 years 6 months, her height and weight had dropped to the 25th centile.

Using Fig. 2.1, provided on the insert, state the actual height and weight for the girl at 5 years 6 months.

height =cm
weight =kg [2]

Fig. 2.2 is a graph showing how brain mass increases with age.

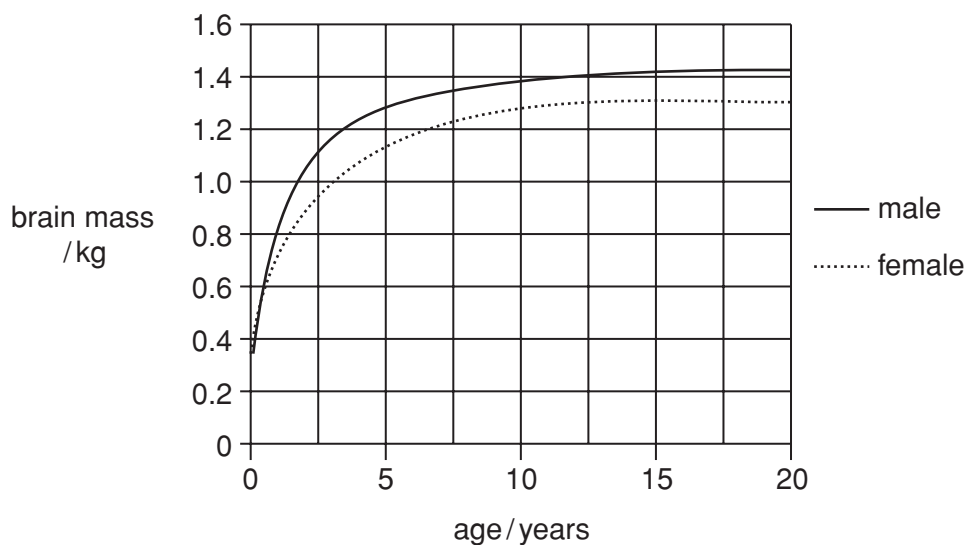


Fig. 2.2

(f) The upper acceptable limit for blood phenylalanine rises at age 11. Using the data from Fig. 2.2, explain why a higher level of phenylalanine can be tolerated from the age of 11.

.....

.....

.....

.....

.....

.....

.....[3]

(g) Kath gives a figure for the number of PKU patients who are currently being seen by the Dietetics Department. Does the figure given by Kath describe the **prevalence** or the **incidence** of PKU? Explain your answer.

.....

.....

.....[2]

[Total: 22]

END OF QUESTION PAPER

Copyright Acknowledgments:

Growth Curve Insert © CHILD GROWTH FOUNDATION 1996/1
Q2 Fig. 2.3 – Data from Documenta Geigy Scientific Tables, 7th Edition.