Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	1	0	4	/	0	3	Signature	

Paper Reference(s)

6104/03

Edexcel GCE

Biology

Biology (Human)

Advanced

Unit 4C Core and Option

Human Health and Fitness

Tuesday 24 January 2006 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
Paper 31 Total	
6	
7	
8	
9	
Paper 32 Total	
Total	

Materials required for examination

Ruler

Items included with question papers

Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
The paper reference is shown above. Check that you have the correct question paper.
Answer ALL questions in the spaces provided in this booklet.
Show all the steps in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for the individual questions and parts of questions are shown in round brackets: e.g. (**2**).
The total mark for this question paper is 70.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking into account your use of grammar, punctuation and spelling.

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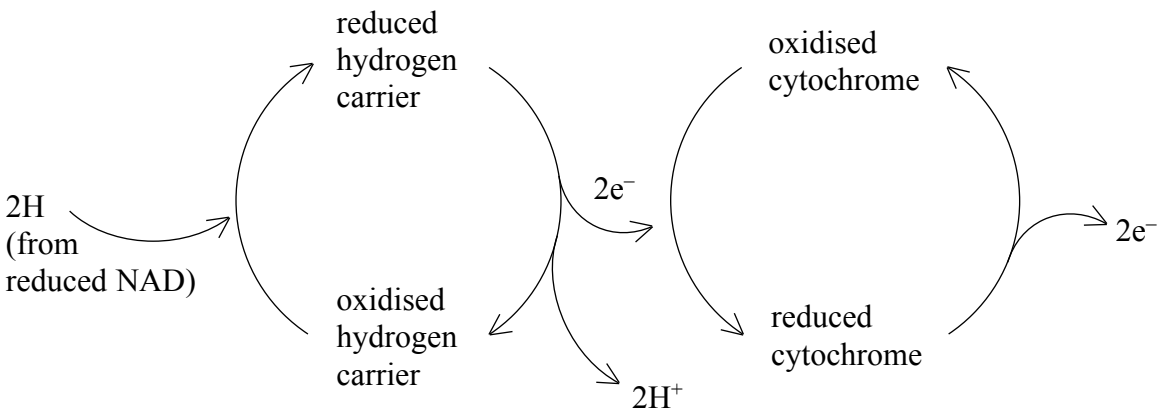
Answer ALL questions in the spaces provided.

1. The diagram below summarises some of the stages of a metabolic pathway responsible for generating ATP in mitochondria.



(a) (i) Name the metabolic pathway shown in this diagram.

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(1)

(ii) Name the type of enzyme involved in this pathway and explain its role.

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(b) Explain what happens to the electrons released at the end of this pathway.

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(2)

(Total 5 marks)

Q1

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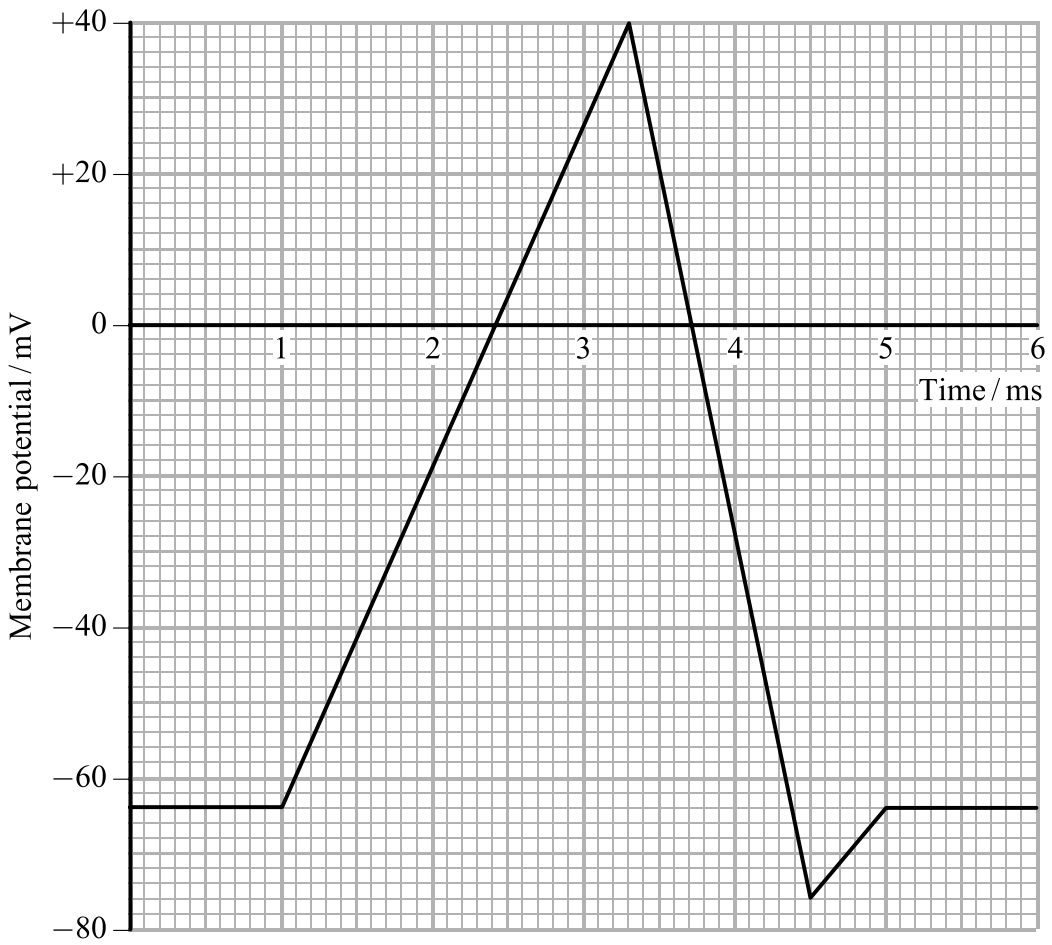
2. (a) The graph below shows the changes in membrane potential of a myelinated nerve fibre when a nerve impulse travels along it. The maximum depolarisation in the nerve fibre is +40 mV.



(i) On the graph, draw an arrow to show the time when the sodium ion channels open.

(1)

(ii) Explain the meaning of the term **myelinated**.

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(2)

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(iii) State what effect myelination has on the speed of conduction.

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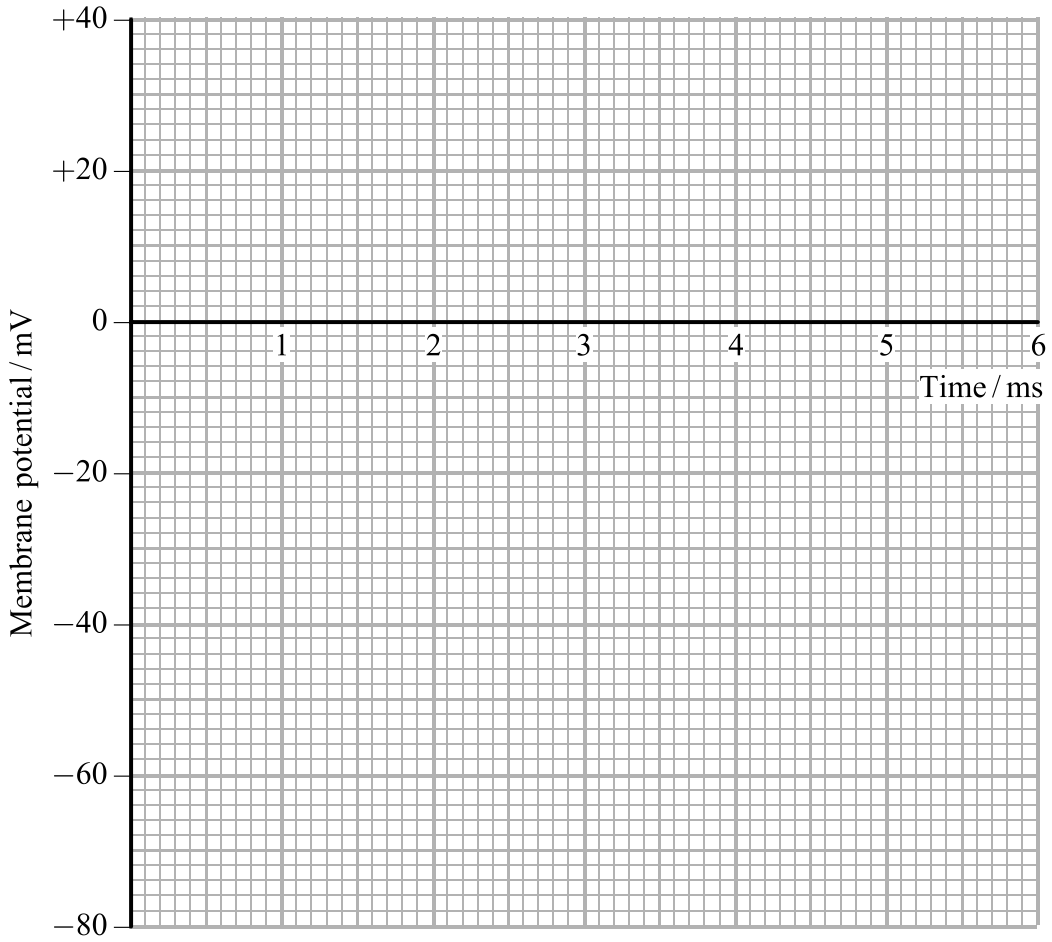
(1)

(b) On the graph below show the changes in membrane potential of a nerve fibre, with a resting potential of –60mV and a maximum depolarisation of +35mV, during the passage of an impulse.



(2) **Q2**

(Total 6 marks)

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3. (a) Explain what is meant by the term **hormone**.

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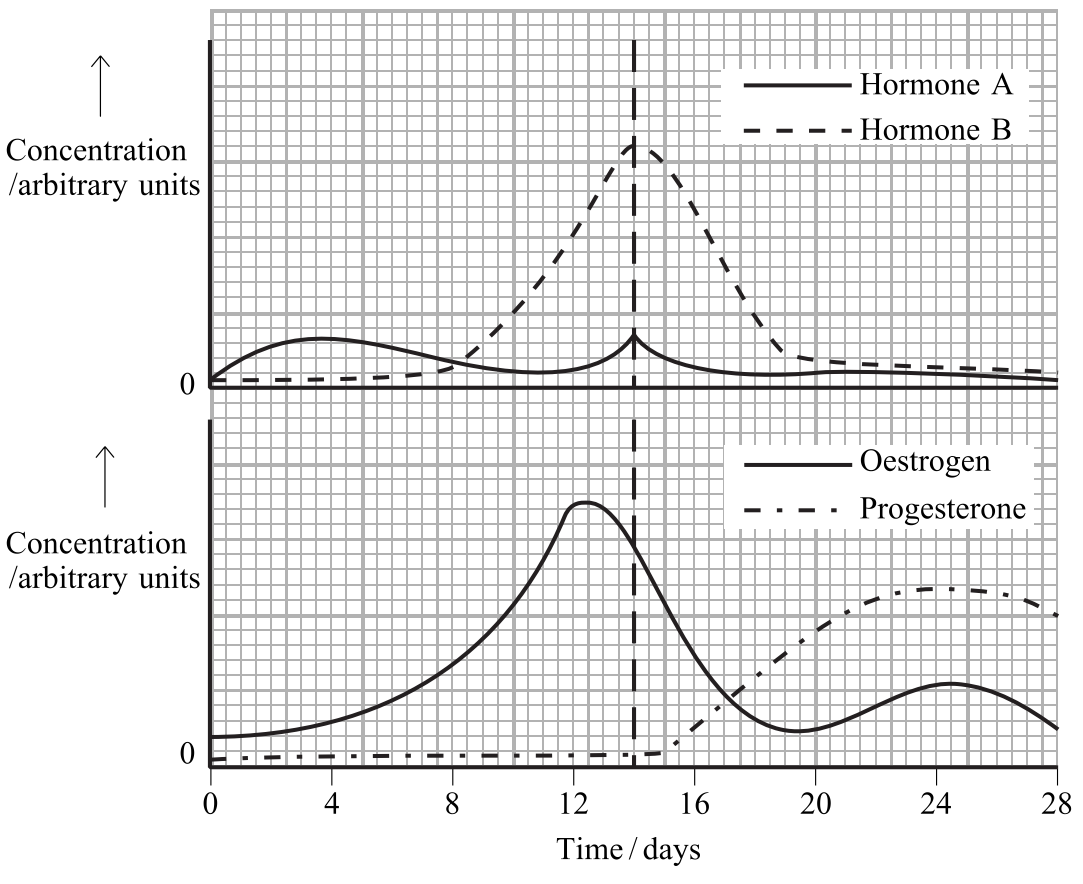
(b) Several hormones are involved in the control and coordination of the human menstrual cycle. The graph below shows the changes in the concentrations of these hormones during one cycle.



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(i) Name hormones A and B.

Hormone A .....

Hormone B .....

(2)

(ii) Using the information shown in the graph, describe and explain the relationship between the concentrations of Hormone A and oestrogen from day 0 to day 14.

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(4)

Q3

(Total 9 marks)

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4. (a) Explain how the loop of Henlé enables mammals to produce concentrated urine.

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(3)

(b) The concentration of solutes in the urine and in the blood plasma can be expressed as a ratio. The table below shows the solute concentration ratios for a range of mammals from different habitats.

Mammal	Urine : blood plasma solute concentration ratio
Beaver	2 : 1
Cat	10 : 1
Hopping mouse	25 : 1
Human	4 : 1

Using the information in the table, suggest which mammal is best suited for life in a very dry habitat. Give an explanation for your answer.

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(c) Mammals excrete most of their waste nitrogen in the form of urea in their urine. Explain how urea is produced in the liver and how it is removed from the blood by ultrafiltration.

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(Total 10 marks)

Q4

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5. (a) Describe the structure of the spinal cord.

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(b) Nerve impulses travel across a synapse from a sensory neurone to a relay neurone in the spinal cord.

Describe how a nerve impulse is transmitted across a synapse.

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(6)

Q5

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Option C: Human health and fitness.

6. The table below refers to three molecules, their precise location in the body and their importance during exercise. Complete the table by writing the appropriate word or words in the spaces.

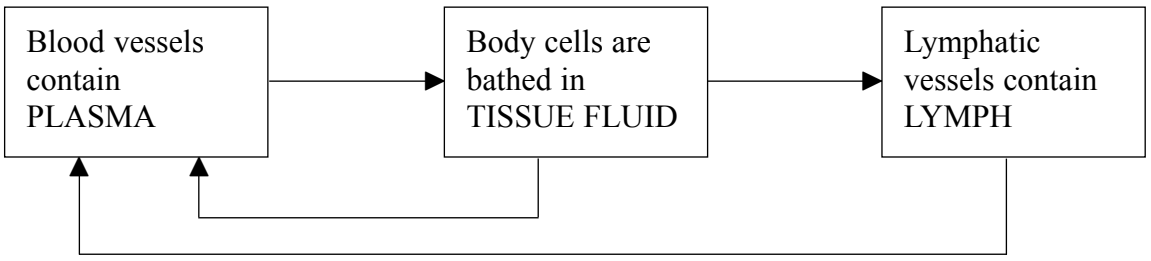
Molecule	Precise location in the body	Importance during exercise
Myoglobin	Muscle cells	
		Source of phosphate to generate ATP rapidly
Glycogen		Provides extra respiratory substrate

Q6

(Total 4 marks)

Leave blank

7. The flow diagram below illustrates the links between blood plasma, tissue fluid and lymph.



(a) Explain how the structure of lymphatic vessels maintains the flow of lymph through the lymphatic system.

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(b) Explain how pathogens are destroyed as the lymph passes through the lymph nodes.

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Q7

(Total 6 marks)

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8. (a) A group of students designed a 10 week aerobic training programme to study the effect of training on the cardiovascular system.

They selected ten students of the same gender, age and level of fitness. Before the training programme began each student's resting pulse rate was recorded.

(i) Outline a suitable aerobic training programme, in terms of the type and duration of exercise undertaken, for this group of students.

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(ii) Suggest why the resting pulse rate was recorded at the start of the training programme.

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(iii) Describe the change that you would expect to see in the resting pulse rate at the end of the training programme. Explain how this change is brought about.

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(b) All skeletal muscles are composed of a mixture of fast and slow twitch fibres. The table below summarises some of the differences between these types of fibre.

Fast twitch fibres	**Slow twitch fibres**
Fewer mitochondria	More mitochondria
Pale/white in colour	Red/brown in colour
Fewer capillaries	More capillaries
More glycolytic enzymes	Fewer glycolytic enzymes

Using the information in the table, suggest why slow twitch fibres are used more than fast twitch fibres during aerobic exercise.

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(3) **Q8**

(Total 9 marks)

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9. (a) Explain the meaning of the term **respiratory minute volume**.

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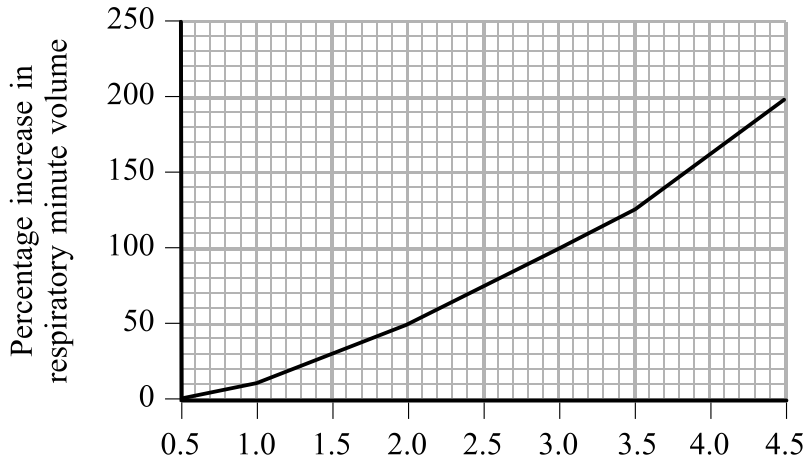
(b) The normal percentage of carbon dioxide in inspired (breathed in) air is 0.03%. The graph below shows the effect of increasing the percentage of carbon dioxide on the respiratory minute volume (V_E) at rest.

The effect is expressed as a percentage above the resting minute volume when carbon dioxide is at normal levels.



(i) The respiratory minute volume of an adult male is approximately 8 $dm^3 min^{-1}$ when breathing air containing 0.03% carbon dioxide.

Use the graph to calculate the respiratory minute volume of this man when the percentage carbon dioxide in inspired air is 1.5%.

Show your working

Answer.....

(3)

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(ii) Explain how this increase in minute volume is brought about.

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QUESTION 9 CONTINUES ON PAGE 20

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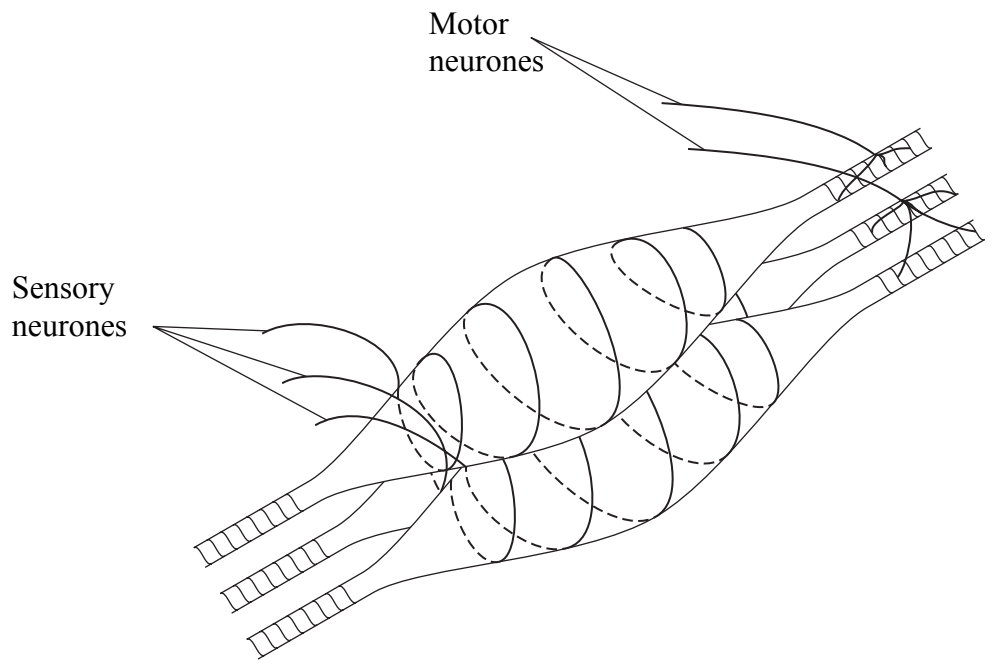
(c) The diagram below shows the structure of a stretch receptor. These are found in smooth muscle around the bronchi and bronchioles of the lungs and in the muscles of the chest wall and diaphragm.



Explain the role of stretch receptors in the control of breathing.

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(3) **Q9**

(Total 11 marks)

TOTAL FOR PAPER: 70 MARKS

END