Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

General Certificate of Education
June 2008
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

HUMAN BIOLOGY (SPECIFICATION A) **BYA7**
Unit 7 The Human Life-span

Friday 13 June 2008 1.30 pm to 3.00 pm

For this paper you must have:
- a ruler with millimetre measurements.

You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked**.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Use accurate scientific terminology in all your answers.

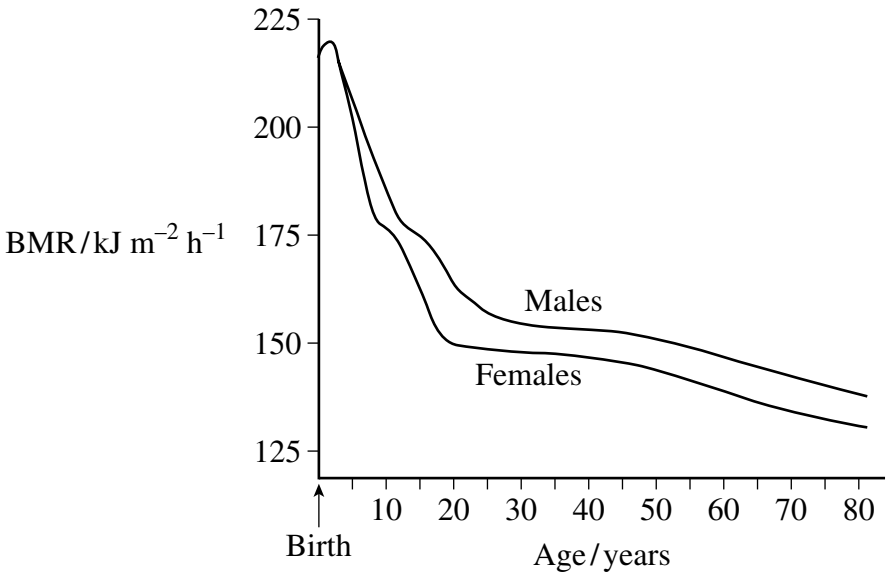
Information

- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- You are reminded that this test requires you to use your knowledge of Modules 1, 3, 4 and 5 as well as Module 7 in answering synoptic questions. These questions are indicated by the letter **S**.

For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Answer **all** questions **in the spaces provided**.

1 The graph shows the effect of age on basal metabolic rate (BMR) in males and females.



1 (a) Under what conditions should BMR be measured?

.....

.....

(1 mark)

1 (b) Suggest an explanation for each of the following.

1 (b) (i) The high BMR between the ages of 0 and 5 years

.....

.....

.....

.....

(2 marks)

1 (b) (ii) The difference in BMR between males and females above the age of 5 years

.....

.....

.....

.....

(2 marks)

1 (b) (iii) The change in BMR after the age of 45 years

.....

.....

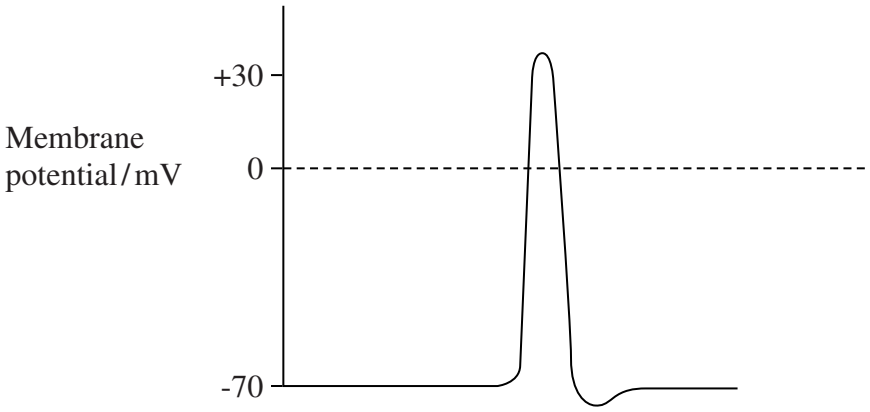
(Extra space) .....

(1 mark)

6

Turn over for the next question

2 (a) The diagram shows an action potential.



Label the diagram with the letter **X** to show where the rate of diffusion of sodium ions is fastest.

(1 mark)

S 2 (b) As a neurone transmits an impulse, its rate of oxygen consumption increases. Explain why.

.....

.....

.....

.....

.....

.....

(Extra space) .....

(3 marks)

2 (c) Myelination affects the rate of conduction of a nerve impulse. Explain how.

.....

.....

.....

.....

(2 marks)

6

3 In a medical trial, doctors gave injections of human growth hormone (hGH) to a group of elderly people. These people showed improvements in some features associated with senescence. The improvements included an increase in basal metabolic rate and an increase in the density of the bones.

3 (a) Give **one** other feature associated with senescence.

.....

.....

(1 mark)

S 3 (b) Growth hormone is a small protein. In this trial, the people were given human growth hormone. Growth hormone made naturally by cows or sheep would not have been suitable. Explain why.

.....

.....

.....

.....

(Extra space) .....

(2 marks)

S 3 (c) Human growth hormone is a single polypeptide chain, 191 amino acids in length. Its gene is 1964 base pairs long.

S 3 (c) (i) Human growth hormone is manufactured using genetically-modified eukaryotic cells. Suggest why eukaryotic cells are used rather than prokaryotic cells.

.....

.....

.....

.....

(2 marks)

S 3 (c) (ii) Does hGH have a quaternary structure? Give the reason for your answer.

.....

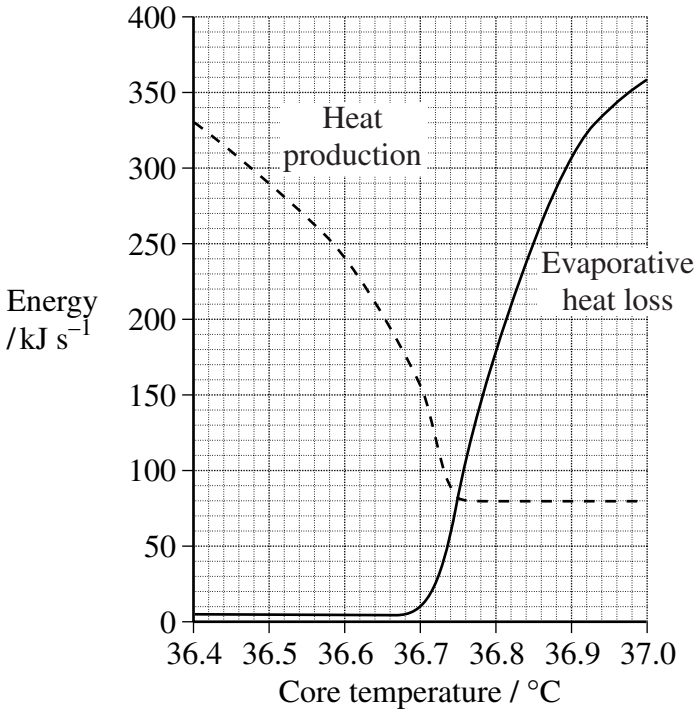
.....

(1 mark)

6

Turn over ▶

4 Scientists studied heat production and evaporative heat loss in a person who was at rest. The results are shown in the graph.



4 (a) The person's core temperature was monitored using a sensor in contact with one eardrum. The eardrum is very close to the hypothalamus. What is the advantage of recording the core temperature close to the hypothalamus?

.....

.....

(1 mark)

4 (b) (i) What is evaporative heat loss?

.....

.....

(1 mark)

4 (b) (ii) Describe and explain **one** other way in which the body increases heat loss as core temperature rises.

.....

.....

.....

.....

(2 marks)

4 (c) Use the graph to give the range of temperatures over which the rate of respiration remained constant.

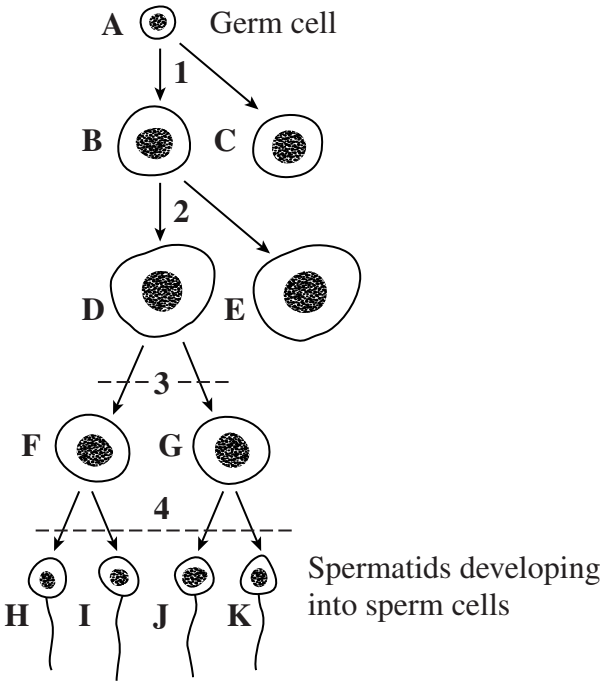
.....

(1 mark)

5

Turn over for the next question

5 The diagram shows spermatogenesis.



5 (a) Give **one** number in the diagram that represents

5 (a) (i) mitosis ..... *(1 mark)*

5 (a) (ii) meiosis I? ..... *(1 mark)*

S 5 (b) At the start of interphase, the nucleus of cell **A** contains 6.5 picograms of DNA. How much DNA would be present in the nucleus of

S 5 (b) (i) cell **F** ..... picograms *(1 mark)*

S 5 (b) (ii) cell **H**? ..... picograms *(1 mark)*

S 5 (c) Give the letters of **two** cells which would be genetically identical.

.....

(1 mark)

S 5 (d) Zygotes always receive more DNA from the egg than from the sperm. Suggest why.

.....

.....

.....

.....

(2 marks)

7

S 6 (a) Use your knowledge of Fick's law to describe and explain the adaptations of the placenta for efficient gas exchange.

.....

.....

.....

.....

.....

.....

.....

.....

(Extra space) .....

.....

(4 marks)

6 (b) The pH of the mother's blood falls from 7.43 to 7.40 as it passes through the placenta. Explain why.

.....

.....

.....

.....

.....

.....

.....

.....

.....

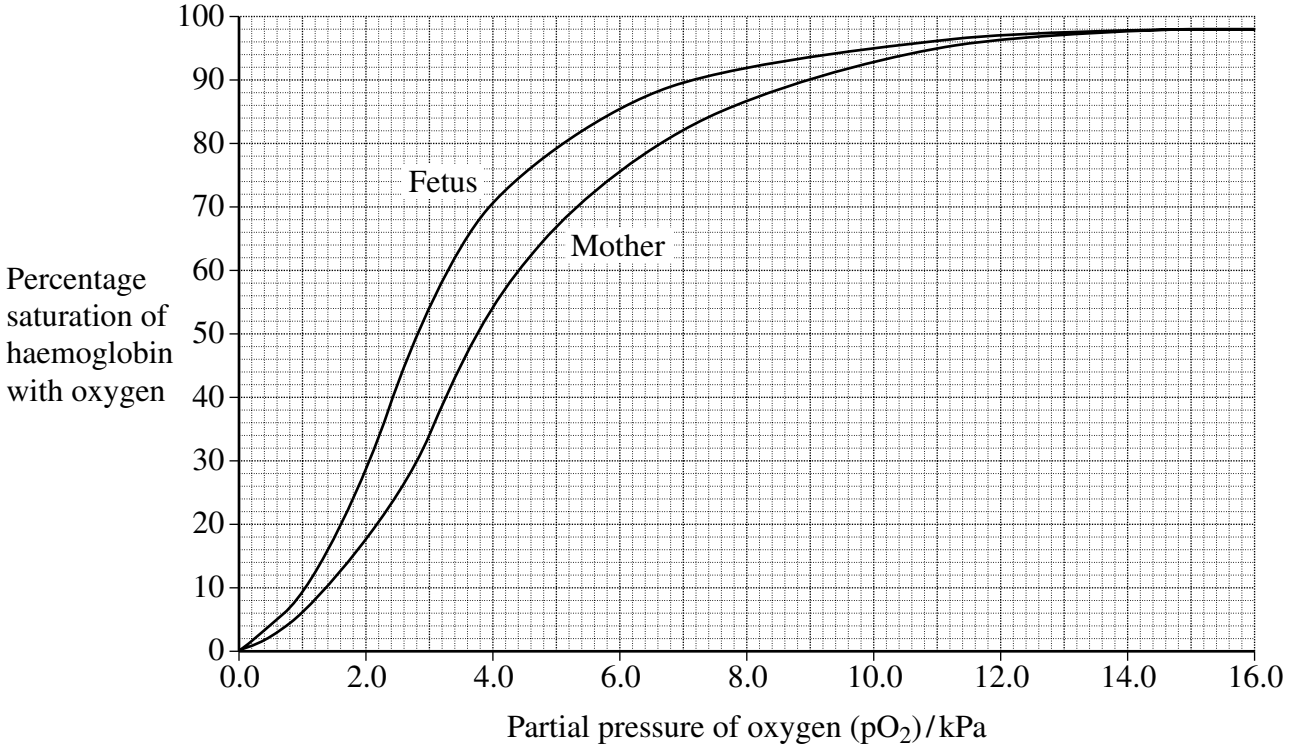
(Extra space) .....

.....

(4 marks)

Question 6 continues on the next page

The graph shows oxyhaemoglobin dissociation curves for a pregnant mother and her fetus.



6 (c) Explain the advantage to the fetus of having haemoglobin with properties as shown in the graph.

.....

.....

.....

.....

(2 marks)

6 (d) (i) The mother's blood in the artery supplying the placenta has a pO_2 of 4.0 kPa. The blood in the mother's vein leaving the placenta has pO_2 of 3.2 kPa. Use information from the graph to find the fall in percentage saturation of the mother's haemoglobin as it passes through the placenta.

.....

(1 mark)

6 (d) (ii) Each dm^3 of blood leaving the mother's lungs carries 200 cm^3 oxygen and its haemoglobin is 98 % saturated with oxygen.
Use your answer from part (d) (i) to calculate the amount of oxygen lost from 1 dm^3 of the mother's blood at the placenta.

Answer ..... cm^3 oxygen *(2 marks)*

6 (d) (iii) The mother's dissociation curve shown in the graph is for her blood entering the placenta with a pCO_2 value of 5.3 kPa. When leaving the placenta, her blood has a pCO_2 of 9.3 kPa.

Sketch on the graph the dissociation curve of the mother when a higher concentration of carbon dioxide is present in the blood.

(2 marks)

15

Turn over for the next question

S 7 (a) Muscle contraction requires ATP. What are the advantages of using aerobic rather than anaerobic respiration to provide ATP in a long-distance race?

.....

.....

.....

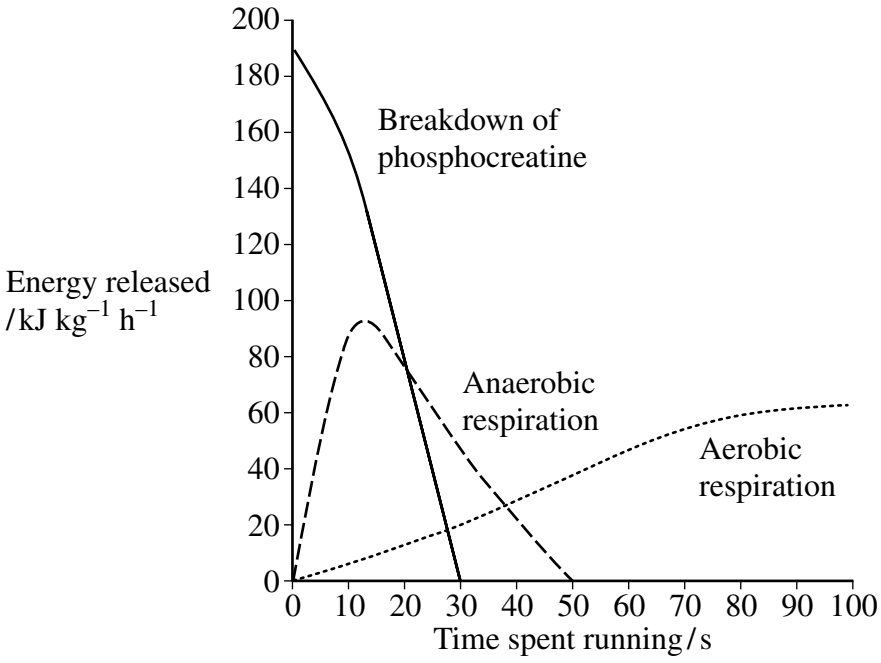
.....

.....

.....

(3 marks)

7 (b) During running, muscles use more ATP than at rest. The graph shows how the relative importance of three different sources of this additional ATP varies during running.



7 (b) (i) A 100 m race can last about 10 seconds. Which of the three processes shown in the graph is the main source of ATP in the athlete's muscles during this race?

.....

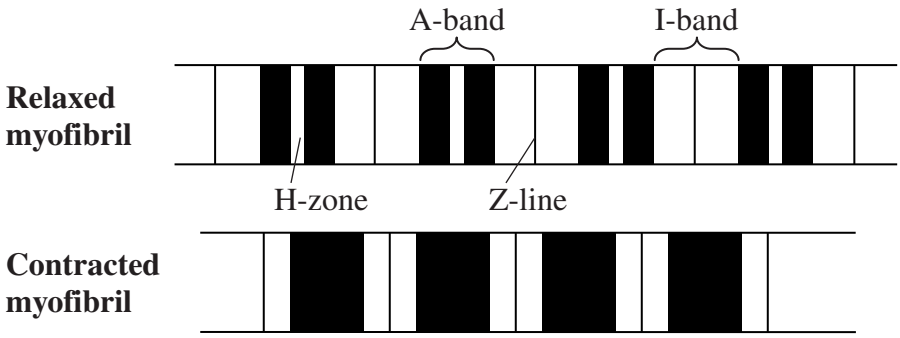
(1 mark)

7 (b) (ii) Why are additional sources of ATP needed during a 200 m race?

.....

(1 mark)

7 (c) The diagram shows the appearance of a relaxed myofibril and of the same myofibril when fully contracted.



7 (c) (i) Describe **two** ways, visible in the diagram, in which the contracted myofibril differs from the relaxed myofibril.

1 .....

.....

2 .....

.....

(2 marks)

7 (c) (ii) What causes the changes shown in the diagram as the myofibril contracts? Refer to the proteins actin and myosin in your answer.

.....

.....

.....

.....

.....

.....

(3 marks)

Question 7 continues on the next page

7 (d) A muscle fibre contracts when it is stimulated by a motor neurone. Describe how transmission occurs across the synapse between a motor neurone and a muscle fibre.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Extra space) .....

.....

(5 marks)

15

8 (a) Describe and explain the part played by enzymes in the digestion of protein in the human digestive system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Extra space) .....

.....

(5 marks)

8 (b) Describe the nervous and hormonal control of the digestion of protein in the human digestive system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

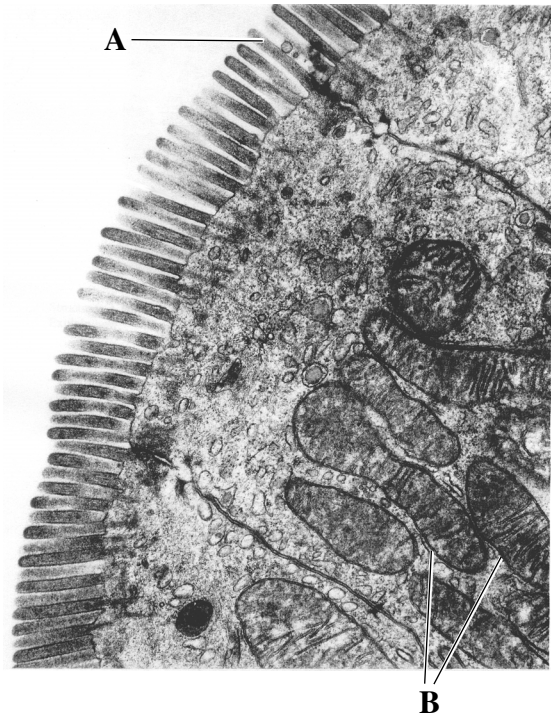
(Extra space) .....

.....

(5 marks)

Question 8 continues on the next page

S 8 (c) The photograph shows the structure of the epithelium lining the small intestine.



Structures **A** and **B** assist in the absorption of the products of protein digestion. Explain how.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Extra space) .....

.....

(5 marks)

END OF QUESTIONS