

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
 June 2005
 Advanced Level Examination



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

BYA7

Tuesday 21 June 2005 Morning Session

In addition to this paper you will require:

- a ruler with millimetre measurements.

You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
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Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

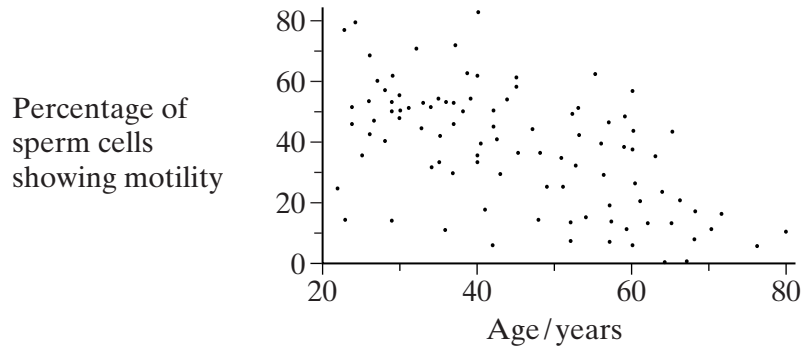
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 75.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.
- 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**.

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

1 The graph shows the motility of sperm cells released by men of different ages.



(a) Describe the trend shown in the graph.

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(1 mark)

(b) Explain how **two** features of a sperm cell result in it being able to move.

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(2 marks)

S (c) Give **two** ways in which meiosis produces genetic variation in sperm cells.

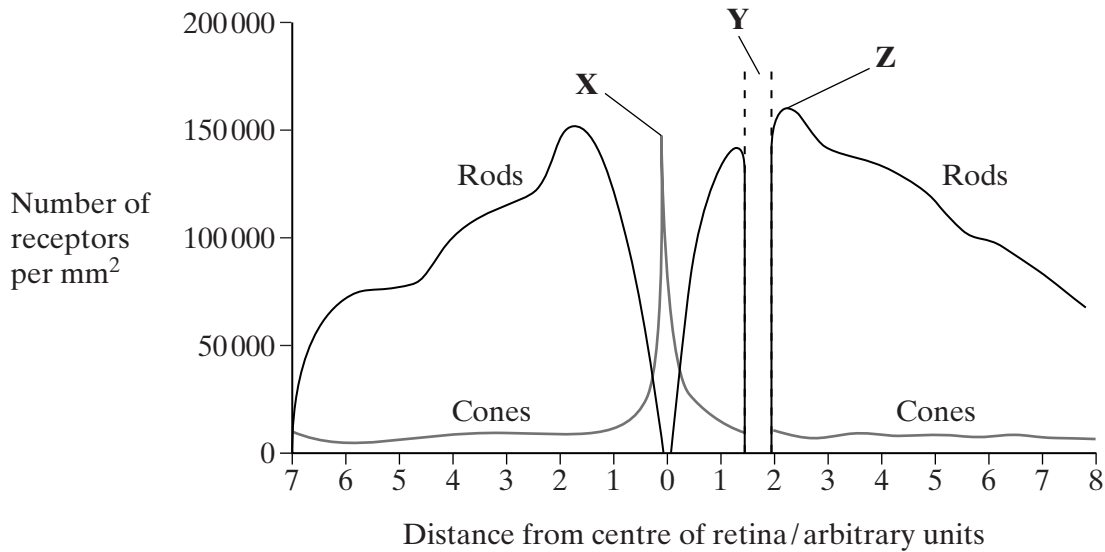
1

2

(2 marks)

5

2 The graph shows the distribution of rod cells and cone cells across the retina of a human eye.



(a) Use the diagram to explain why

(i) no image is perceived when light is focused on the retina at **Y**;

.....

 (1 mark)

(ii) an image formed at **X** is perceived in more detail than an image formed at **Z**.

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 (2 marks)

(b) Describe how cone cells allow us to see different colours.

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 (2 marks)

Turn over ▶

5

- 3 (a) The table shows the membrane potential of an axon at rest and during the different phases of an action potential. Complete the table by writing in each box whether the sodium ion (Na^+) channels and potassium ion (K^+) channels are open or closed.

	Resting	Starting to depolarise	Repolarising
Membrane potential/mV	-70	-50	-20
Na^+ channels in axon membrane			
K^+ channels in axon membrane			

(2 marks)

- (b) Describe how the resting potential is established in an axon by the movement of ions across the membrane.

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(2 marks)

- S (c) Sodium and potassium ions can only cross the axon membrane through proteins. Explain why.

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(2 marks)

6

4 (a) Name the site of secretion of growth hormone.

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(1 mark)

(b) Thyroid stimulating hormone (TSH) causes the thyroid gland to release thyroxine. People who do not produce enough thyroxine can be treated with injections of TSH. TSH is a glycoprotein made from two polypeptide chains and a carbohydrate molecule.

(i) Explain why the TSH would not be effective if taken by mouth.

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(2 marks)

S (ii) TSH can be made by genetically modified animal cells but not by genetically modified bacterial cells. Explain why genetically modified bacterial cells cannot be used to make TSH.

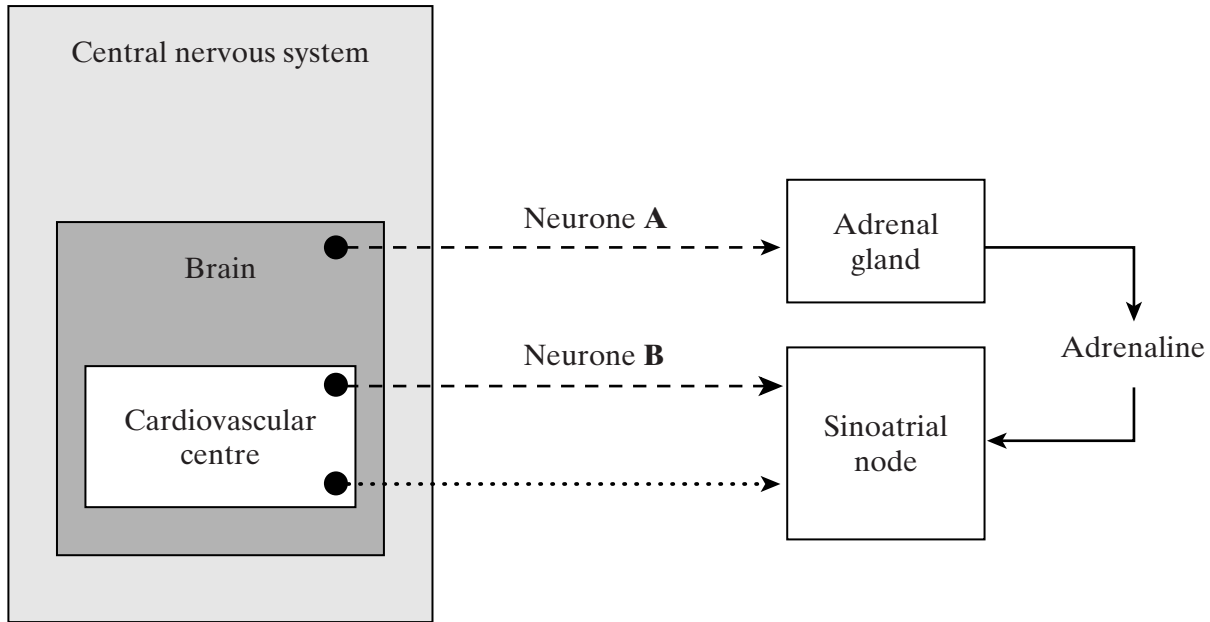
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5

TURN OVER FOR THE NEXT QUESTION

Turn over 

5 The diagram shows the control of the heart rate by the autonomic nervous system.



Key:

- - - - -> Sympathetic neurone
- ······-> Parasympathetic neurone

(a) In which part of the brain is the cardiovascular centre located?

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(1 mark)

(b) What would be the effect on heart rate of stimulating

neurone **A**;

neurone **B**?
(1 mark)

S (c) Describe how an impulse reaches the base of the ventricles of the heart from the sinoatrial node.

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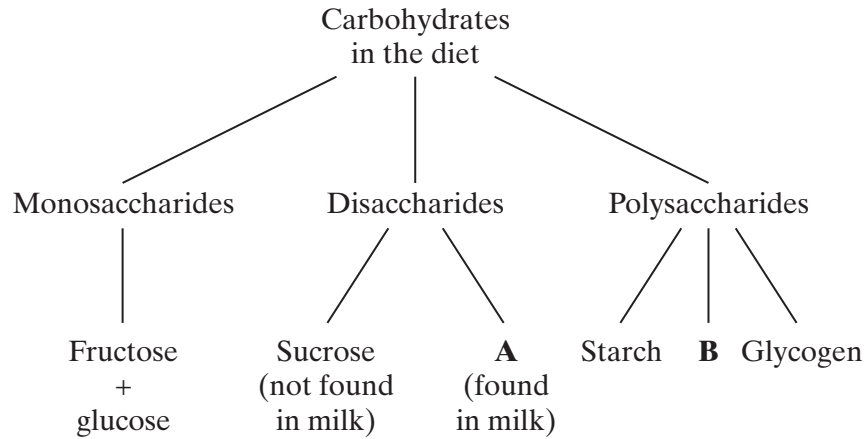
(3 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over 

6 The diagram shows the range of carbohydrates in the human diet.



(a) (i) Name carbohydrate **A**.

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(1 mark)

(ii) Name carbohydrate **B**.

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(1 mark)

(b) The table gives dietary guidelines for the intake of carbohydrates.

Carbohydrate type	Recommended percentage of total energy intake
Sucrose	10
Starch, glycogen, fructose, glucose and sugars from milk	37
Polysaccharides other than starch and glycogen	not applicable

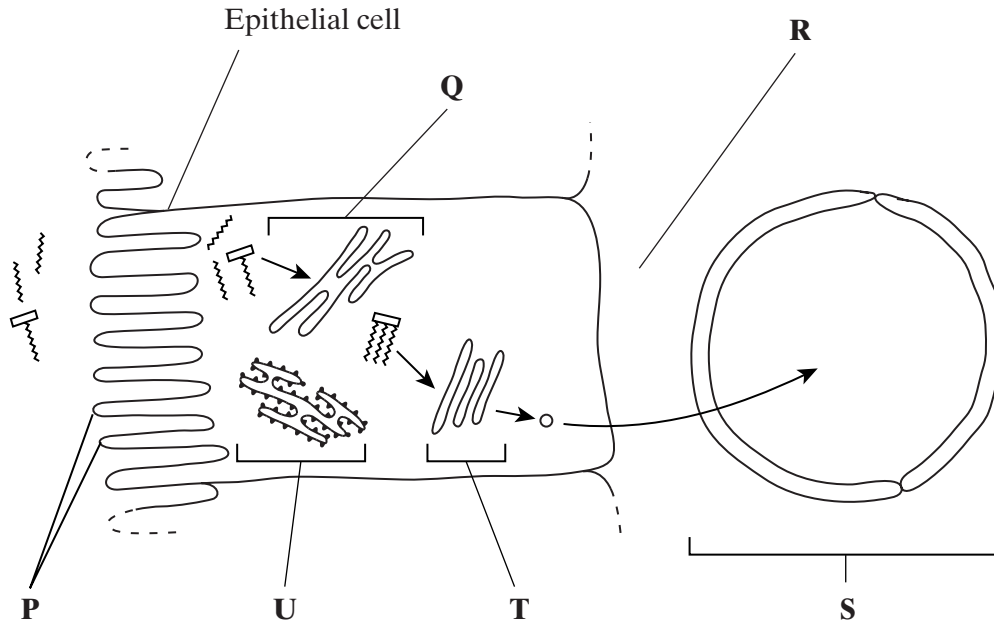
Suggest why there is no dietary guideline for energy intake from polysaccharides other than starch and glycogen.

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(2 marks)

4

- (d) The diagram shows the events that occur in the absorption of monoglycerides and fatty acids. These molecules enter the epithelial cells of the small intestine by diffusion. Once inside they are reassembled into triglycerides in organelle **Q**. The triglyceride molecules are formed into chylomicrons in organelle **T**. Chylomicrons are made from many triglyceride molecules surrounded with protein molecules. The chylomicrons leave the cell and enter vessel **S**.



- S** (i) Explain the importance of the structures labelled **P**.

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 (1 mark)

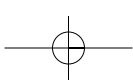
- (ii) Name

R;
S.
 (2 marks)

- S** (iii) Describe the role played by organelle **U** in the formation of chylomicrons.

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 (2 marks)



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S (iv) Suggest how the chylomicrons leave the epithelial cell. Give a reason for your answer.

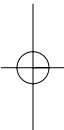
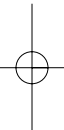
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(2 marks)

15

TURN OVER FOR THE NEXT QUESTION

Turn over 



8 The table shows the volume of oxygen transported to and from the fetus during the final week of pregnancy.

Blood vessel	Volume of oxygen transported / cm ³ minute ⁻¹
Umbilical artery	30.9
Umbilical vein	48.1

(a) Using data from the table, calculate the rate of oxygen uptake per gram for a fetus with a mass of 3.3 kg. Show your working.

Answer cm³ g⁻¹ minute⁻¹
(2 marks)

(b) (i) In the final week of pregnancy the placenta no longer grows. Suggest why the tissues of the placenta itself still have a high rate of oxygen uptake.

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(3 marks)

(ii) Physiological changes in the mother during pregnancy increase her oxygen consumption. Describe the physiological changes in her body that cause increased oxygen consumption.

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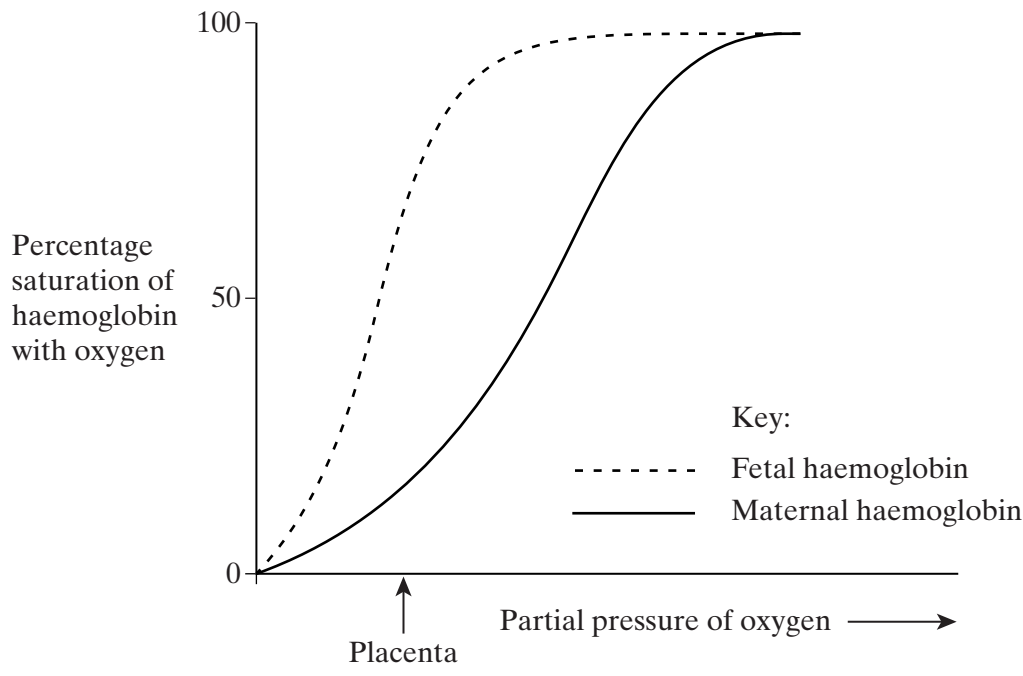
(4 marks)

(c) The structure of the placenta is adapted to promote a high rate of diffusion. Complete the table to show these adaptations.

Factor	Value of factor (high or low)	Example of how this is achieved in the placenta
Surface area	high	
	high	countercurrent blood flow
Thickness of exchange surface		breakdown of maternal capillaries

(3 marks)

(d) The graph shows the dissociation curve for fetal and maternal oxyhaemoglobin.



There is an advantage to the fetus in having haemoglobin with a dissociation curve in the position shown. Explain this advantage.

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(3 marks)

Turn over ▶

- 9 The flow chart outlines an investigation to determine from where the calcium ions involved in muscle contraction are released.

Calcium ion transport proteins were isolated from human tissue.



These proteins were injected into a rabbit.



The rabbit formed antibodies to the proteins. These antibodies were collected and labelled with gold particles.



Muscle tissue was treated with the labelled antibodies and examined with an electron microscope. High concentrations of gold particles were observed attached to the sarcoplasmic reticulum.

- S (a) Describe how antibodies were produced in the rabbit after it had been injected with the transport proteins.

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(5 marks)

S (b) Labelled antibodies and an electron microscope can be used to produce images locating proteins on the surface of organelles, but cannot be used to observe cross bridge cycling in muscle cells. Explain why.

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(5 marks)

(c) Describe the role of calcium ions and ATP in muscle contraction.

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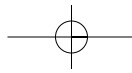
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(5 marks)

END OF QUESTIONS



THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

