Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

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General Certificate of Education
January 2003
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION B) BYB8/A
Unit 8 Section A Behaviour and Populations

Tuesday 28 January 2003 9.00 am to 11.15 am

In addition to this paper you will require:
- Section B (attached);
- a ruler with millimetre measurements.

You may use a calculator.

Time allowed: The total time for Section A and Section B of this paper is 2 hours 15 minutes.

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** the questions in **Section A** in the spaces provided. All working must be shown.
- **Section A** and **Section B** will be marked by different examiners. You must ensure that any supplementary sheets are fastened to the appropriate question paper answer book.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for **Section A** is 50.
- Mark allocations are shown in brackets.
- You are reminded of the need for clear presentation in your answers. All answers should be in good English and should use accurate scientific terminology.
- You are advised to spend 1 hour on **Section A**.
- You are reminded that **Section A** requires you to use your knowledge of Modules 1-5 as well as Module 8 in answering synoptic questions. These questions are indicated by the letter **S**.

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

LEAVE MARGIN BLANK

SECTION A

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

1 (a) The theory of classical conditioning is based on Pavlov's work on the control of salivation in dogs.

In Pavlov's experiment, what was

(i) the unconditioned (normal) stimulus; .....

(ii) the conditioned (experimental) stimulus; .....

(iii) the response to the conditioned stimulus? .....

(3 marks)

S (b) The main part of a dog's diet is normally meat. Suggest why increased salivation would not be expected to help in the digestion of this component of the diet.

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(2 marks)

(c) Describe **two** ways in which operant conditioning differs from classical conditioning.

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2 .....

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(2 marks)

7

2 (a) Explain how oestrogen in an oral contraceptive prevents conception.

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(3 marks)

(b) In an experiment, human females were exposed to sweat produced by human males. The nervous activity of the hypothalamus was found to increase when the females were exposed to the sweat.

The human hypothalamus produces a hormone which stimulates FSH production.

Suggest how exposure to the male sweat could result in increased oestrogen production.

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(3 marks)

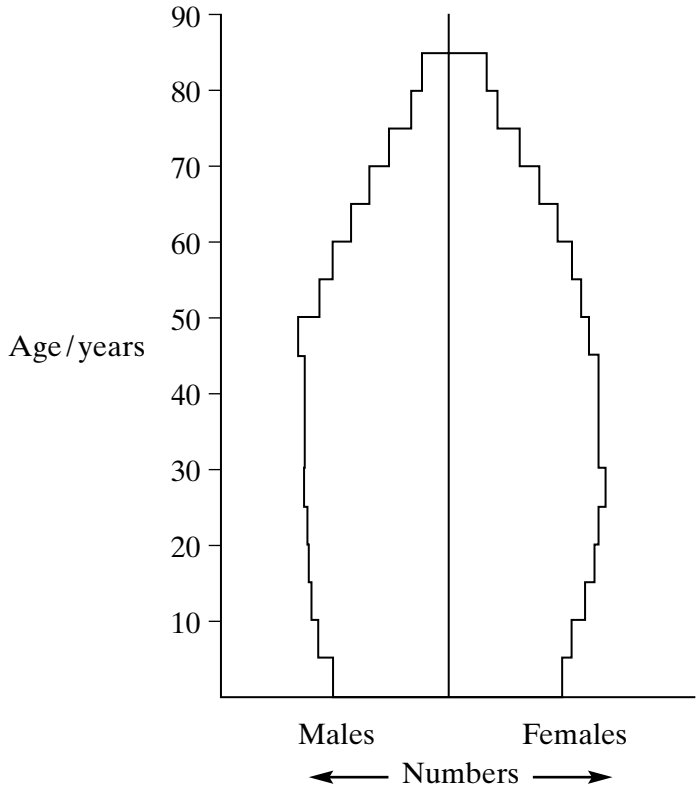
6

TURN OVER FOR THE NEXT QUESTION

3 The table shows some information about the populations of Japan and Nigeria.

Country	Population in 1999 / millions	Estimated population in 2015 / millions	Fertility rate / children per woman	Life expectancy at birth / years	Under-5 mortality / deaths per 1000
Japan	126.5	126.1	1.4	80	4
Nigeria	108.9	153.3	5.1	50	187

(a) The diagram shows a population pyramid for Japan in 1999.



On the diagram, sketch the population pyramid as you would expect it to appear in 2015.
(2 marks)

(b) (i) Use information in the table to explain why the population of Nigeria is expected to increase to over 150 million by 2015.

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(2 marks)

(ii) Suggest and explain **two** factors that could result in the actual increase in the population of Nigeria being less than estimated.

1 .....

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2 .....

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(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

4 (a) Lung capacity in an 85-year-old person is about half the lung capacity of a 25-year-old.

(i) Suggest **one** way in which lung capacity may be reduced with age.

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(1 mark)

S (ii) Explain the effect of reduced lung capacity on the ability to exercise.

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(3 marks)

S (b) The elasticity of the aorta decreases with age. Explain how this will affect blood pressure in the arteries.

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(2 marks)

6

5 Certain genes in the body, called tumour suppressor genes, normally prevent the uncontrolled growth and division of cells. Recent research has shown that tumours may develop when methyl groups (CH_3) attach to a tumour suppressor gene at certain positions. A strand of DNA which is complementary to a section of this tumour suppressor gene can be used to detect whether methyl groups have become attached. The strand only binds to the gene if no methyl groups are attached.

(a) Explain how the DNA strand would attach to a normal tumour suppressor gene.

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(3 marks)

(b) A technique based on this research is being developed as a possible way of screening the adult population for the presence of cancer of the kidney. Special 'dipsticks' with DNA strands attached would be used to test for the presence of fragments of cancerous cells in urine.

Explain **two** factors that should be taken into account before introducing such a screening programme.

1 .....

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2 .....

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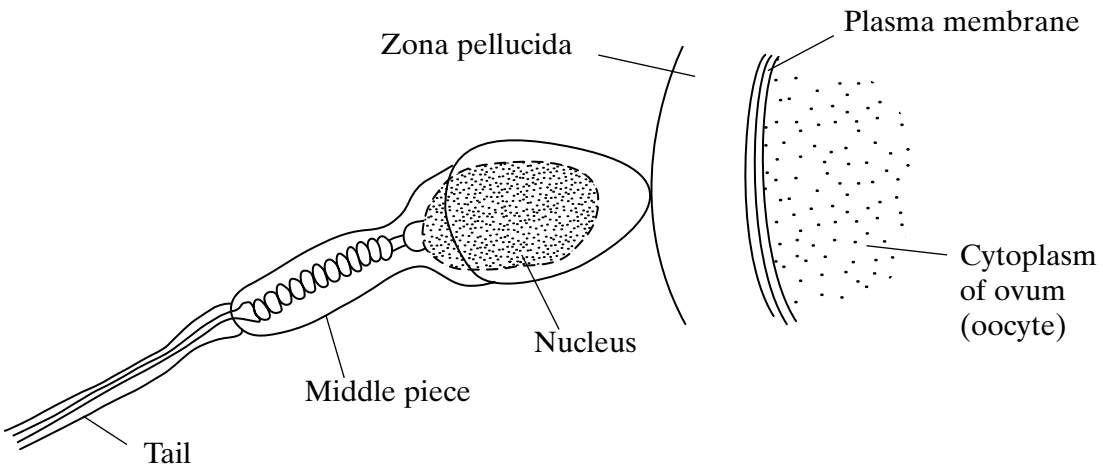
(2 marks)

5

6 The diagram shows a sperm about to fertilise an ovum (oocyte).



(a) The tip of the sperm contains enzymes which assist in fertilisation.

(i) Name the part that contains the enzymes.

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(1 mark)

(ii) Describe the function of these enzymes.

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(2 marks)

(b) Sperms may be stored for a few weeks in the tubes coming from the testes. Here, the sperms remain immobile. They only become mobile in the semen when mixed with seminal fluid.

Semen contains a mean of 70×10^6 sperms per cm^3. On average, 70 % of the sperms are of normal shape and able to be capacitated.

(i) Describe what happens during capacitation of a sperm.

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(2 marks)

(ii) A single ejaculation of semen has a volume of $3\,cm^3$. Calculate the average number of sperms in this ejaculation that will be capacitated. Show your working.

Answer .....

(2 marks)

S (c) The seminal fluid contains the monosaccharide, fructose. Suggest how this fructose enables the sperms to move after ejaculation.

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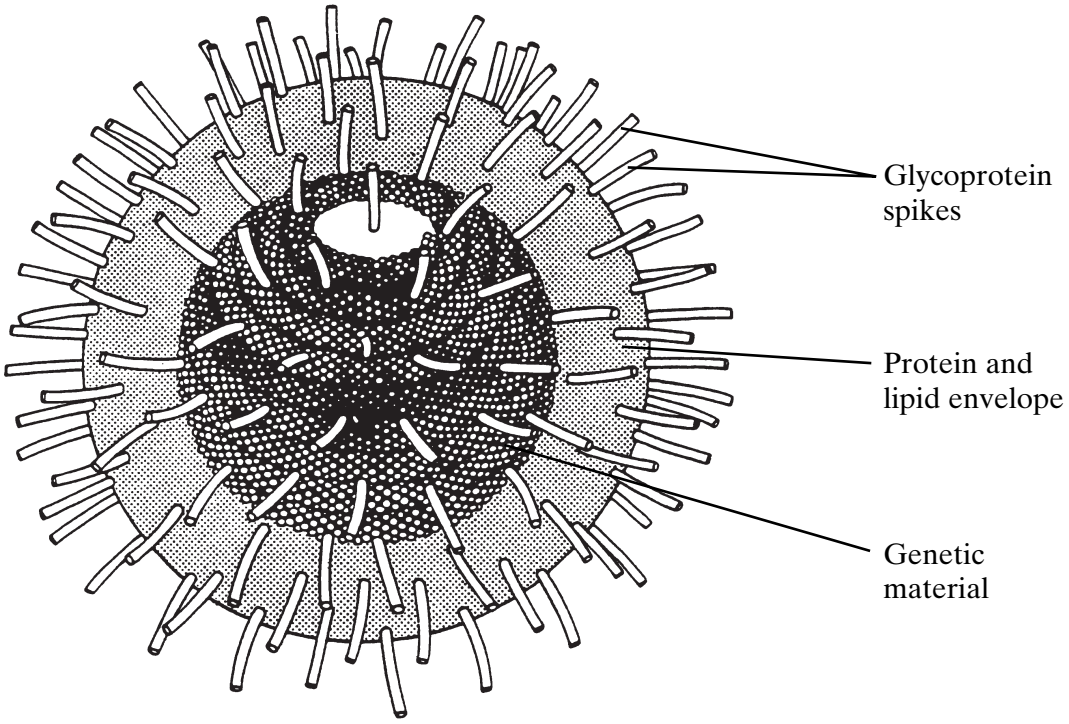
(3 marks)

10

Turn over ▶

7 The diagram shows the virus which causes influenza.



The spikes on the surface of the virus are glycoproteins (proteins with attached sugars). These glycoproteins are the main antigens. The spikes attach to the surface membranes of the cells lining the trachea, bronchi and bronchioles. The virus is then taken into these cells. The virus replicates inside the cells, causing the cells to die and release large numbers of viruses.

S (a) Give **two** ways in which the structure of a bacterium differs from the structure of this virus.

1 .....

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2 .....

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(2 marks)

(b) Explain how the influenza virus is transmitted from person to person.

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(2 marks)

S (c) Sometimes a new strain of the influenza virus arises, in which the structure of the glycoproteins in the spikes is significantly changed. This new strain may cause an influenza epidemic.

Explain how the new strain may arise and why it may cause an epidemic.

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(6 marks)

10

END OF SECTION A