Surname		Other Names	
Centre Number			Candidate Number					
Candidate Signature								

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General Certificate of Education
January 2004
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

HUMAN BIOLOGY (SPECIFICATION A) BYA3
Unit 3 Pathogens and Disease

Thursday 8 January 2004 Morning Session

No additional materials are required.
You may use a calculator.

Time allowed: 1 hour 30 minutes

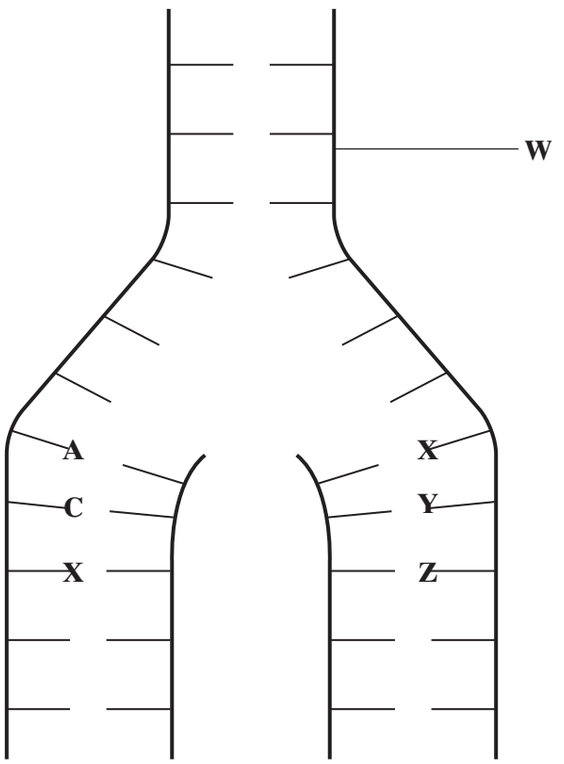
Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

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.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
9			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 The diagram shows the process of DNA replication. The horizontal lines represent the positions of bases.



(a) (i) What is represented by the part of the DNA molecule labelled **W**?

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(1 mark)

(ii) In the diagram, **A** represents adenine and **C** represents cytosine.
Name the base found at

position **X**; .....

position **Y**; .....

position **Z**. .....

(3 marks)

(b) Describe **one** way in which the process shown in the diagram differs from transcription.

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(1 mark)

2 (a) Give **one** process which occurs in the nucleus of a cell during interphase which is necessary before cell division can take place.

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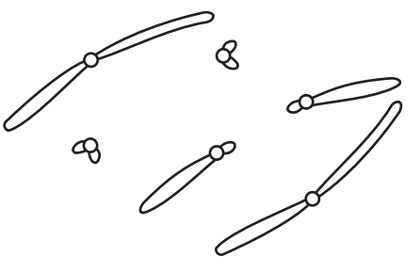
(1 mark)

(b) The diagram shows the chromosomes from a cell with a diploid chromosome number of six.



Draw a diagram to show the chromosomes from one of the resulting cells if

(i) the cell divides by **mitosis**;

(2 marks)

(ii) the cell divides by **meiosis**.

(2 marks)

(c) Explain **one** advantage of cells lining the human gut dividing very frequently.

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(1 mark)

6

3 (a) Cystic fibrosis is caused by the presence of an abnormal protein. Explain how a mutant allele can lead to the production of an abnormal protein.

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(3 marks)

(b) In pancreatitis, the enzyme trypsin, which is normally secreted in an inactive form, becomes active inside the cells of the pancreas. Explain **one** way in which the enzyme concentration in samples from the body may confirm that a person is suffering from pancreatitis.

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(2 marks)

(c) People with pancreatitis sometimes develop diabetes. One sign of this is the presence of glucose in the urine. Glucose can be detected in urine by using plastic strips containing two immobilised enzymes which form a coloured compound if glucose is present. Describe the function of each of the following enzymes on the strips.

(i) Glucose oxidase .....

.....

(ii) Peroxidase .....

.....

(2 marks)

7

4 (a) Some tumours are benign and some are malignant.

(i) Give **one** way in which a benign tumour differs from a malignant tumour.

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(1 mark)

(ii) Describe **two** ways in which both types of tumour may cause harm to the body.

1 .....

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2 .....

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(2 marks)

(b) (i) Explain the link between sunbathing and skin cancer.

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(2 marks)

(ii) Suggest why fair-skinned people are at a greater risk of skin cancer than dark-skinned people when sunbathing.

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(1 mark)

(iii) Suggest why people with a family history of cancer are at a greater risk of cancer than those with no family history of cancer.

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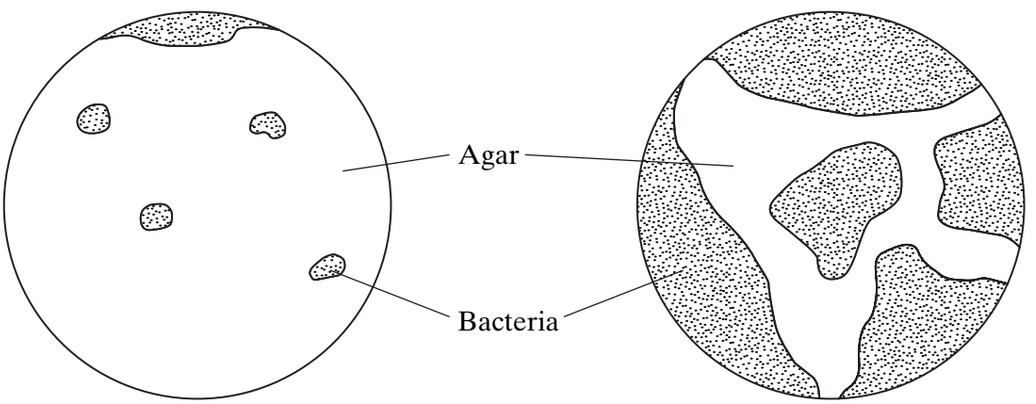
(1 mark)

7

5 (a) In an investigation, two sterile agar plates were inoculated with bacteria from the same culture. Then, using a syringe, 2 cm^3 of an antibiotic solution were added to plate **1** and 2 cm^3 of sterile water were added to plate **2**. The diagram shows the plates after 24 hours.

Plate **1** (antibiotic solution added) Plate **2** (sterile water added)



(i) At the start of the investigation, the agar was sterilised. Explain why.

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(1 mark)

(ii) The water was added to plate **2** as a control. Explain why this control was necessary.

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(1 mark)

(b) Give **two** ways in which antibiotics kill bacteria or prevent them from multiplying.

1 .....

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2 .....

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(2 marks)

(c) Explain why some bacteria were able to grow on plate **1**.

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(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

6 Damage to blood vessels sets off a series of events which results in blood clotting.

(a) Thromboplastins are released when a blood vessel is damaged. Describe the role of thromboplastins in blood clotting.

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(1 mark)

(b) The final stage in clotting involves fibrin.

(i) How is fibrin formed during blood clotting?

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(2 marks)

(ii) Describe the role of fibrin in blood clotting.

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(1 mark)

(c) Warfarin inhibits blood clotting and is used to prevent thrombosis. The table shows some data from hospital admission records.

	Total number of patients admitted to hospital	**Number of patients admitted with thrombosis**
Number taking warfarin	210	36
Number not taking warfarin	1334	409

(i) Suggest why warfarin might be given to patients at risk of myocardial infarction.

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(1 mark)

(ii) Of the patients who were already taking warfarin when admitted to hospital, what percentage were admitted with thrombosis?

Answer ..... %
(1 mark)

(iii) Of the patients who were not already taking warfarin when admitted to hospital, what percentage were admitted with thrombosis?

Answer ..... %
(1 mark)

(iv) On the evidence from the data in the table is it possible to say whether warfarin is an effective treatment for thrombosis? Explain your answer.

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(2 marks)

9

TURN OVER FOR THE NEXT QUESTION

7 Lung cancer, chronic bronchitis and coronary heart disease (CHD) are associated with smoking. **Tables 1** and **2** give the total numbers of deaths from these diseases in the UK in 1974.

Table 1 Men

Age/years	Number of deaths (in thousands)		
	lung cancer	chronic bronchitis	coronary heart disease
35 - 64	11.5	4.2	31.7
65 - 74	12.6	8.5	33.3
75+	5.8	8.1	29.1
Total (35 - 75+)	29.9	20.8	94.1

Table 2 Women

Age/years	Number of deaths (in thousands)		
	lung cancer	chronic bronchitis	coronary heart disease
35 - 64	3.2	1.3	8.4
65 - 74	2.6	1.9	18.2
75+	1.8	3.5	42.3
Total (35 - 75+)	7.6	6.7	68.9

(a) (i) Using an example from the tables, explain why it is useful to give data for men and women separately.

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(2 marks)

(ii) Data like these are often given as percentages of people dying from each cause. Explain the advantage of giving these data as percentages.

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(2 marks)

(b) Give **two** factors, other than smoking, which increase the risk of coronary heart disease.

Factor 1 .....

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Factor 2 .....

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(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

8 Read the following passage.

The life cycle of the malarial parasite consists of a number of stages. Some of these stages occur in humans and some occur in mosquitoes. At each stage, the parasite has different antigens on the surface of its cells. Attempts have been made to extract some of these antigens and use them to make vaccines to combat the disease. A trial has recently been carried out with one of these vaccines. An injection of the vaccine was given to a group of people chosen at random at the start of the trial. Another injection was given 30 days later.

Blood samples were taken at regular intervals throughout the trial. After the first injection, the concentration of antibody in the blood rose slowly then fell quickly. After the second injection, the concentration rose quickly. It reached a maximum concentration of approximately twice the concentration it reached after the first injection.

Use information from the passage and your own knowledge to answer the following questions.

(a) What is meant by *antigens* (line 3)?

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(2 marks)

(b) (i) Use information from the passage to sketch a graph to show the effects of the two injections on the concentration of antibody in the blood.

(3 marks)

(ii) Suggest **one** reason why it was necessary to give two injections of the vaccine (line 6).

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(1 mark)

(iii) Although this vaccine is made from antigens from malarial parasites, it does not cause malaria. Explain why this vaccine does not cause malaria.

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(2 marks)

(c) The blood from those taking part in the trial was also examined under the microscope at the beginning of the trial. Explain how this would enable those who had malaria to be identified.

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(1 mark)

(d) Describe and explain how the malarial parasite is adapted to its way of life.

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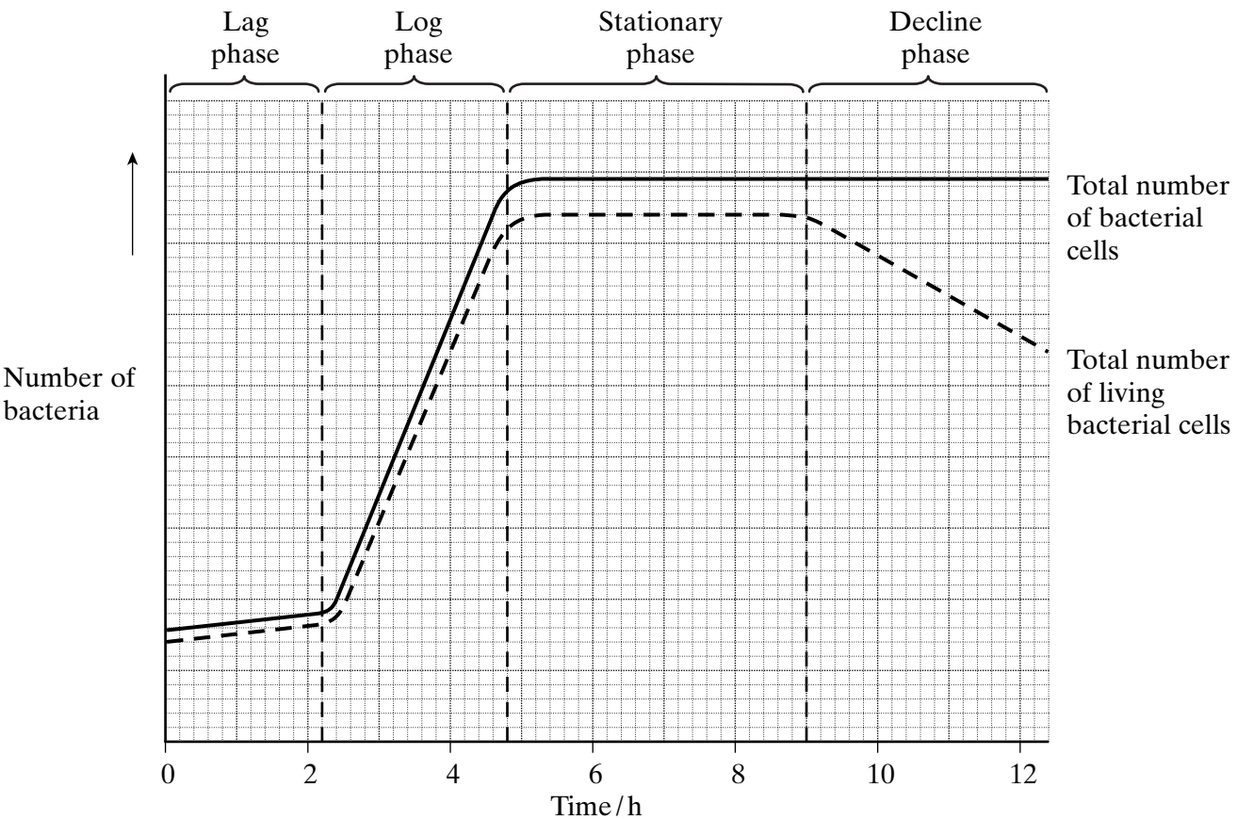
(6 marks)

15

9 (a) The graph shows the growth of a bacterial population.



(i) Explain why there is only a small change in the number of bacterial cells during the lag phase.

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(2 marks)

(ii) Describe and explain the difference between the shape of the two curves beyond 9 hours.

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(3 marks)

(b) (i) In a bacterial culture there are 10 000 000 cells. They double in number every 20 minutes. Calculate the number of cells that would be present 2 hours later. Show your working.

Answer .....

(2 marks)

(ii) In practice, this number is never achieved. Suggest why.

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(2 marks)

(c) Describe how bacteria which contain the gene for human insulin could be produced.

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(6 marks)

15

END OF QUESTIONS