

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Education
January 2008
Advanced Subsidiary Examination



HUMAN BIOLOGY (SPECIFICATION A)
Unit 3 Pathogens and Disease

BYA3

Wednesday 9 January 2008 9.00 am to 10.30 am

For this paper you must have:

- a ruler with millimetre measurements.
- 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.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- You will be marked on your ability to use good English, to organise information clearly and to use accurate scientific terminology where appropriate.

For Examiner's Use			
Question	Mark	Question	Mark
1		9	
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 (a) (i) Where in an animal cell does transcription occur?

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(1 mark)

- (ii) The table contains statements about DNA replication and transcription. Put a tick in the box if the statement is true, or a cross if the statement is not true.

Statement	DNA replication	Transcription
Involves mRNA synthesis		
Requires free nucleotides		
Involves complementary base pairing		

(2 marks)

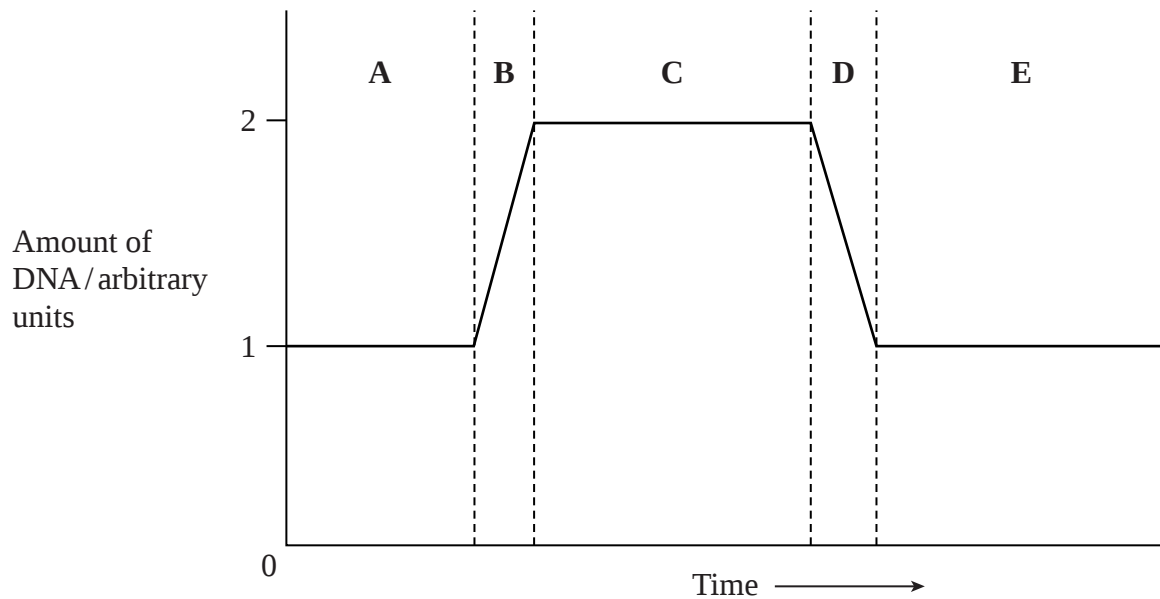
- (b) A DNA molecule contains 2500 guanine bases and 3500 thymine bases. How many deoxyribose molecules does it contain? Explain your answer.

Number of deoxyribose molecules

Explanation

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(2 marks)

2 The graph shows changes in the amount of DNA in a cell during one cell cycle.



(a) Name the phase of the cell cycle that occurs during time period **B**.

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(1 mark)

(b) Many drugs that are used to treat cancer work at different time periods during the cell cycle.

(i) Cisplatin binds to DNA, and stops free DNA nucleotides joining together. In which time period, **A** to **E**, would you expect cisplatin to have the greatest effect? Explain your answer.

Time period

Explanation

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(2 marks)

(ii) A different drug stops spindle fibres shortening. This drug has its greatest effect during time period **D**. Explain why.

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(2 marks)

- 3 (a) Name the bacterium that causes tuberculosis (TB).

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(1 mark)

- (b) (i) Give **two** symptoms that would be shown by a person with TB.

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(1 mark)

- (ii) Some people have an increased risk of developing the symptoms of TB. Explain why.

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(2 marks)

- (c) A woman went on a long-distance flight. Two months later she was found to have TB. As a result, all the other passengers on the flight were tested to see if they had TB antibodies.

- (i) The passengers were tested for the presence of TB antibodies. Suggest why they were tested for TB antibodies and not TB bacteria.

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(2 marks)

- (ii) People sitting near the infected woman were more likely to develop TB than those sitting in a different part of the aircraft. Explain why.

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(3 marks)

9

Turn over for the next question

- 4 (a) (i) The action of a bacteriostatic antibiotic is different from that of a bactericidal antibiotic. Describe how.

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(2 marks)

- (ii) Give **two** ways in which antibiotics prevent bacterial growth.

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(2 marks)

- (b) An agar plate was inoculated with a disc of growing *Penicillium* fungus. The plate was inoculated with four different types of bacteria, **A**, **B**, **C** and **D**, as shown in **Figure 1**.

Figure 2 shows the appearance of the agar plate after it had been incubated for two days.

Figure 1

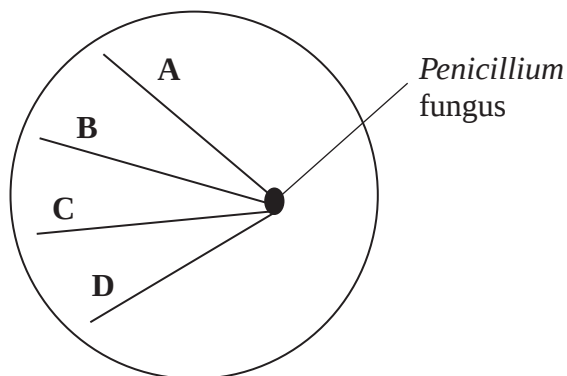
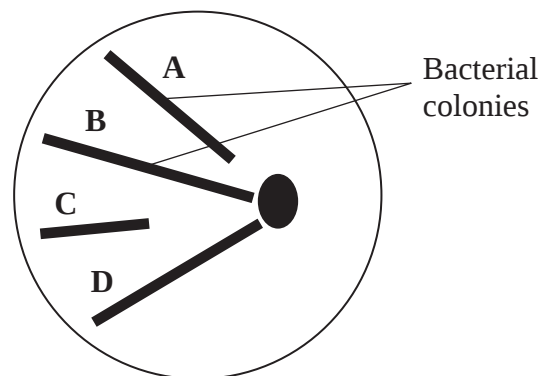


Figure 2



Explain the appearance, after incubation, of

- (i) the *Penicillium* fungus

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(1 mark)

(ii) the bacterial colonies.

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(3 marks)

8

Turn over for the next question

- 5 (a) People with pancreatitis have much lower concentrations of pancreatic enzymes in their faeces than healthy people. Explain why.

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(2 marks)

- (b) Glucose oxidase and peroxidase are enzymes used in a glucose biosensor. Describe the role of

glucose oxidase

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peroxidase.

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(2 marks)

- 6 (a) (i) Explain what causes blood to clot when tissue is damaged.

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(2 marks)

- (ii) Myocardial infarction can happen because of a blood clot. Explain how.

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(3 marks)

- (b) Desmoteplase is an enzyme obtained from the saliva of vampire bats. It breaks down fibrin. Suggest how this might be used to treat people who have had coronary thromboses.

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(1 mark)

Turn over for the next question

7 A particular species of fish contains an antifreeze protein. When the antifreeze protein is added to ice cream, it improves the texture.

(a) The gene for this antifreeze protein was inserted into microbial cells. Explain the role of each of the following in this process.

(i) DNA ligase

 (1 mark)

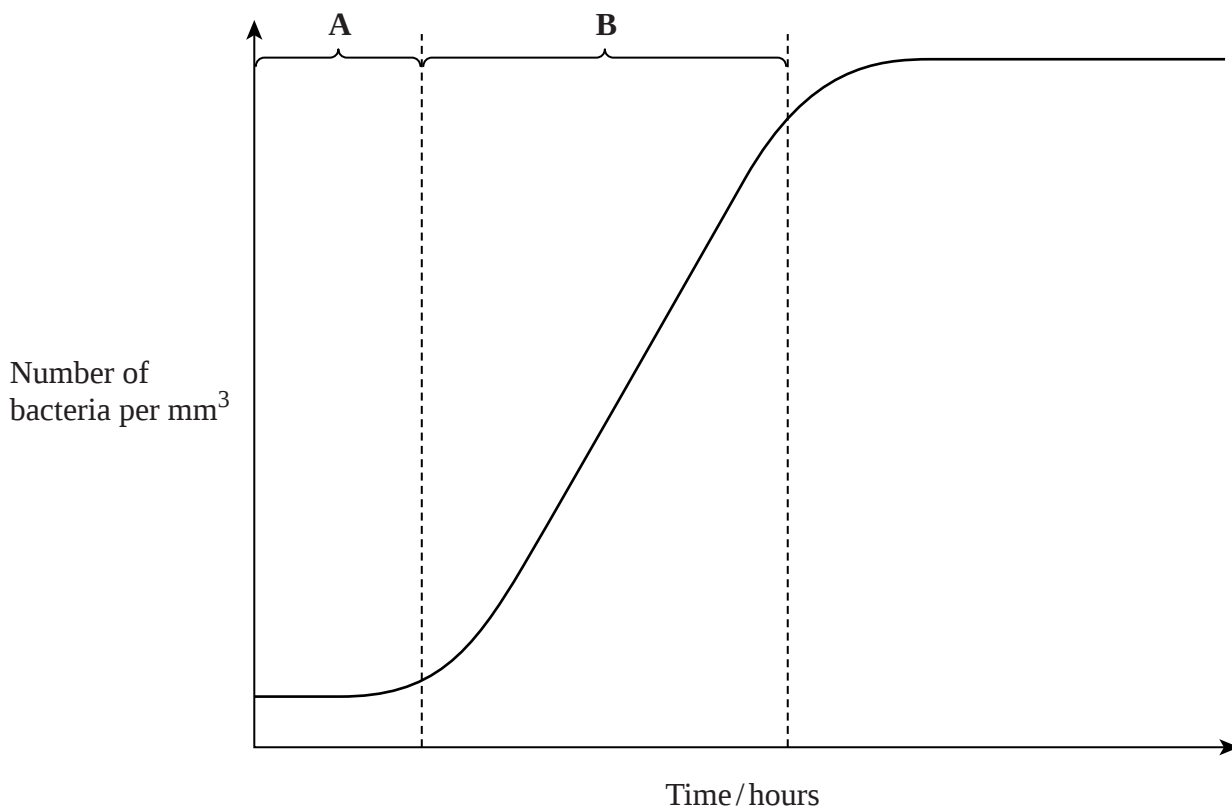
(ii) Plasmids

 (2 marks)

(iii) A marker gene

 (1 mark)

(b) The graph shows a growth curve for a population of bacteria.



Explain why

- (i) the number of bacteria stays approximately the same in stage **A**

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(2 marks)

- (ii) the number of bacteria increases rapidly in stage **B**.

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(2 marks)

Turn over for the next question

- 8 Alzheimer's disease affects the brain and causes serious mental deterioration. In this disease, a small protein called beta-amyloid is produced in large amounts. A new DNA vaccine has been developed. Scientists hope that the vaccine will protect people against Alzheimer's disease by destroying the beta-amyloid protein.

Scientists know the amino acid sequence in beta-amyloid. They used this information to produce DNA that codes for beta-amyloid. This DNA is injected into muscle cells, which use the DNA to produce beta-amyloid. This stimulates the production of antibodies against beta-amyloid. 5

- (a) Scientists know the amino acid sequence in beta-amyloid. Explain how they can use this information to produce DNA that codes for beta-amyloid (lines 5 and 6).

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(3 marks)

- (b) Describe how the muscle cells produce beta-amyloid protein from the piece of DNA in the vaccine.

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(c) (i) What is an antibody?

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(2 marks)

(ii) Beta-amyloid produced by muscle cells causes antibodies to be made.
Describe how.

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(4 marks)

Turn over for the next question

9 Malaria is caused by the parasite, *Plasmodium*.

Quinine and artemether are drugs used to treat malaria. Doctors carried out an investigation to find out which drug was more effective. They investigated the effect of the drugs on children who had malaria. The children were divided into two groups. The groups were matched for variables such as sex and age. One group was given quinine and the other group was given artemether.

- (a) (i) It was important that the two groups of children were as similar as possible. Explain why.

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(2 marks)

- (ii) It was important that the doctors did not know which children were in each group. Explain why.

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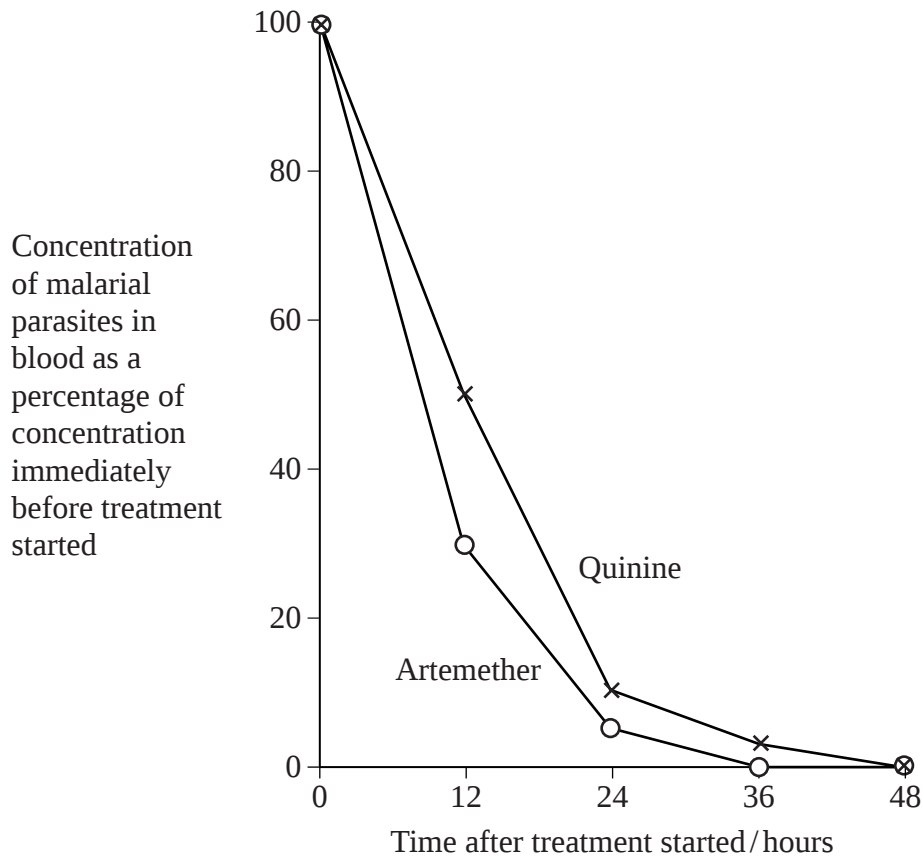
(1 mark)

The table shows some of the results from this investigation.

Drug given	Quinine	Artemether
Number of children in group	288	288
Percentage of children who died in hospital	21.5	20.5
Percentage of children who had nervous system problems after discharge from hospital	25.2	21.0

- (b) How many more children died in hospital with the quinine treatment than with the artemether treatment? Show your working.

- (c) The graph shows the effect of artemether and quinine on the level of malarial parasite infection in the blood.



- (i) The concentration of malarial parasites in the blood was given as a percentage of the concentration immediately before the treatment started. Explain why.

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(2 marks)

- (ii) Although some doctors concluded that artemether is not better than quinine at treating malaria, they still preferred to use artemether. Use the data in the graph and the table to suggest **two** reasons why they preferred to use artemether.

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(2 marks)

- (d) Describe and explain how the malarial parasite, *Plasmodium*, is adapted to its parasitic way of life.

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(6 marks)

15

END OF QUESTIONS

ACKNOWLEDGEMENT OF COPYRIGHT HOLDERS AND PUBLISHERS

Question 9 Information from an article in New England Journal of Medicine volume 335:69-75 July 11, 1996 number 2