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General Certificate of Education  
June 2004  
Advanced Level Examination



**BIOLOGY (SPECIFICATION B)**  
**Unit 7 Section A Microbes and Disease**

**BYB7/A**

Friday 25 June 2004 1.30 pm to 3.45 pm

**In addition to this paper you will require:**

- Section B provided as an insert (enclosed);
- a ruler with millimetre measurements.

You may use a calculator.

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

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 extra 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.

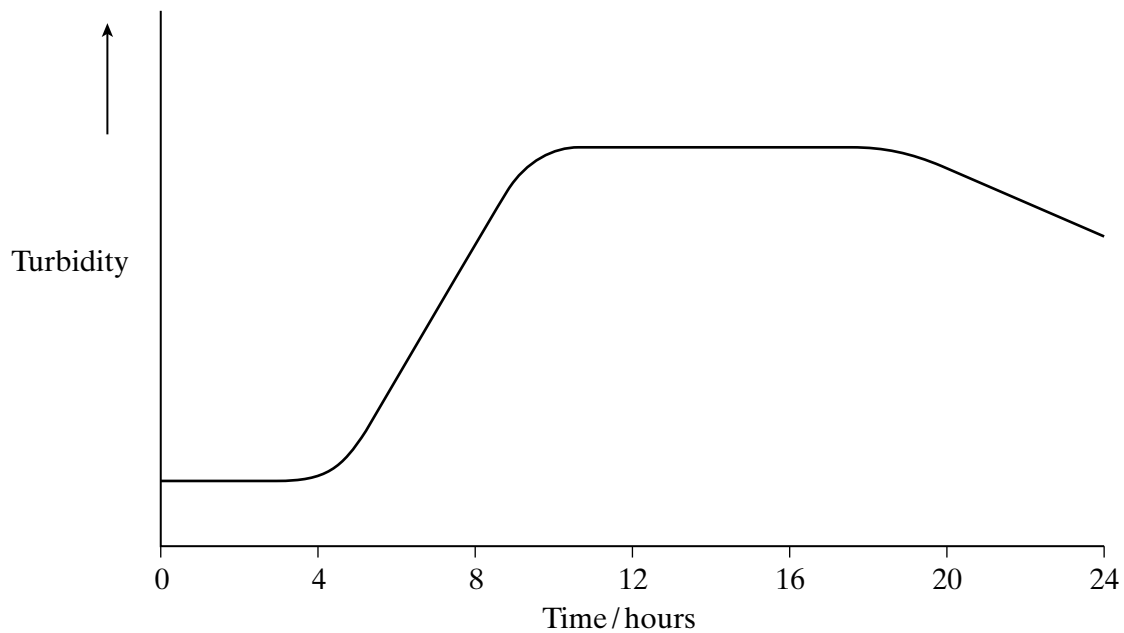
**Information**

- 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 different parts of the specification as well as Module 7 in answering synoptic questions. These questions are indicated by the letter **S**.

**SECTION A**

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

- 1 In an investigation of population growth, a liquid medium was inoculated with a bacterial culture. Samples were removed at regular intervals and their turbidity was measured. The results are shown in the graph.



- (a) Describe how the turbidity of a sample could be determined.

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(1 mark)

(b) Explain the shape of the curve

(i) over the first four hours;

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.....  
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.....

(2 marks)

(ii) after twenty hours.

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(1 mark)

(c) In optimum conditions each bacterium in this culture is able to divide once every 20 minutes. Calculate the maximum number of bacteria that could be produced after 2 hours from 50 bacteria.

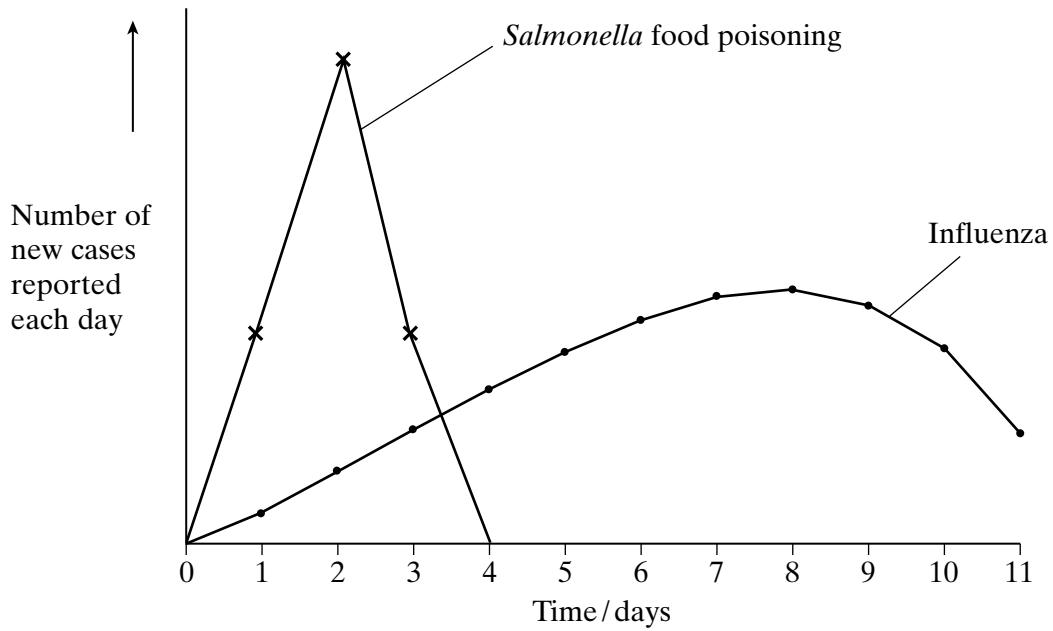
Answer .....  
(1 mark)

5

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ▶

- 2 (a) The graph shows the number of new cases of two diseases which occurred in two different human populations.



Explain the shape of the curve for

- (i) *Salmonella* food poisoning;

.....

.....

- (ii) influenza.

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(2 marks)

- (b) Individuals with food poisoning often suffer from diarrhoea. Explain how the effects of diarrhoea on the body can be treated.

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(2 marks)

- S** (c) Botulism is a serious food-borne infection caused by the bacterium *Clostridium botulinum*. The bacteria release botulinum toxin which binds to presynaptic membranes of neuromuscular junctions, blocking the release of acetylcholine. Death from botulism may occur due to paralysis of the breathing system.

Explain how the action of the botulinum toxin could cause paralysis of the breathing system.

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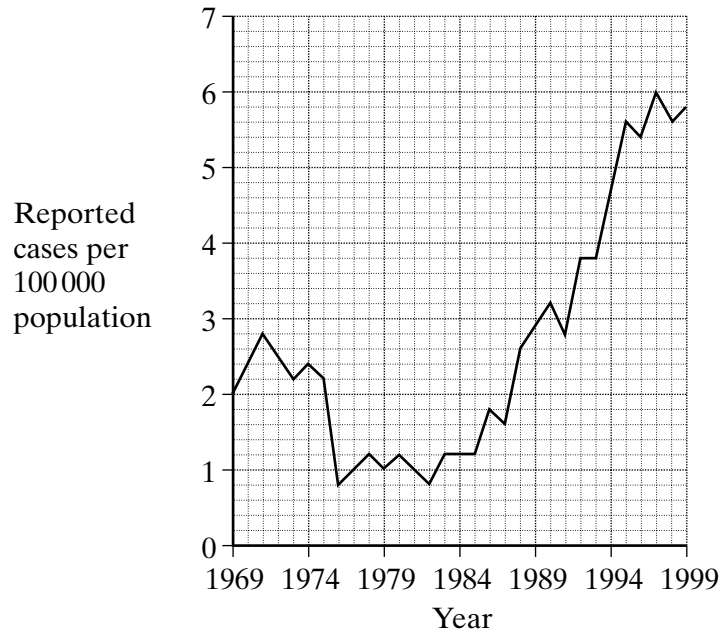
(3 marks)



**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

- 3 (a) Whooping cough is a childhood respiratory disease caused by a bacterium. The graph shows the incidence of whooping cough in Central Europe from 1969 to 1999.



- (i) Calculate the percentage change in the incidence of whooping cough from 1982 to 1999. Show your working.

Answer .....  
(2 marks)

- (ii) Suggest **one** reason for the trend in the number of cases of whooping cough since 1982.

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.....  
(1 mark)

- (b) Whooping cough bacteria prevent the normal functioning of cilia in the respiratory tract. Explain how this effect is linked to the persistent coughing associated with the disease.

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(2 marks)



**TURN OVER FOR THE NEXT QUESTION**

**Turn over**

4 Casein is a protein used to screen strains of bacteria for protease production.

(a) Describe in outline a method that could be used to identify strains of bacteria which can break down casein.

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*(3 marks)*

S (b) Describe how the bacteria break down casein.

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*(3 marks)*

6



5 Some bacteria possess one or more genes for antibiotic resistance. When these bacteria reproduce, these genes are replicated and passed on to the next generation.

(a) What name is given to the asexual method of reproduction of bacteria?

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(1 mark)

S (b) Describe how replication of the genes occurs.

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(4 marks)

(c) A new antibiotic is being developed for the treatment of human diseases. Apart from resistance, suggest **two** factors which should be taken into account before a new antibiotic is released for general use.

1 .....

2 .....

.....  
(2 marks)

7

Turn over ►

6 (a) Give **one** way in which an influenza virus and a human immunodeficiency virus (HIV)

(i) are similar;

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.....  
*(1 mark)*

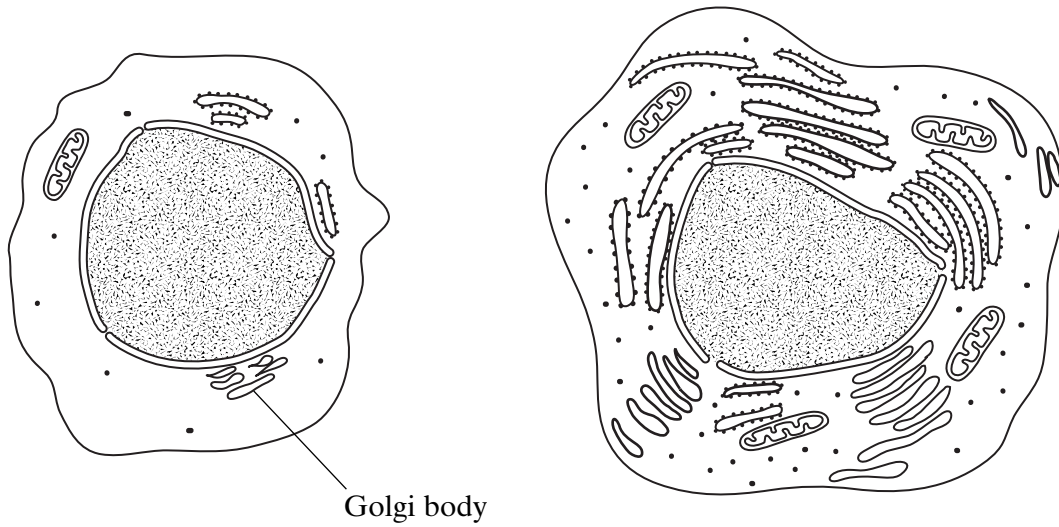
(ii) are different.

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.....  
*(1 mark)*

(b) Changes to the protein coat of the influenza virus cause antigenic variability. Explain how antigenic variability has caused some people to become infected more than once with influenza viruses.

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*(2 marks)*

(c) The drawings show the changes in a B lymphocyte after stimulation by specific antigens.



B lymphocyte before stimulation

B lymphocyte after stimulation

(i) Describe the role of macrophages in stimulating B lymphocytes.

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(1 mark)

S (ii) Explain how the changes shown in the drawings are related to the function of B lymphocytes.

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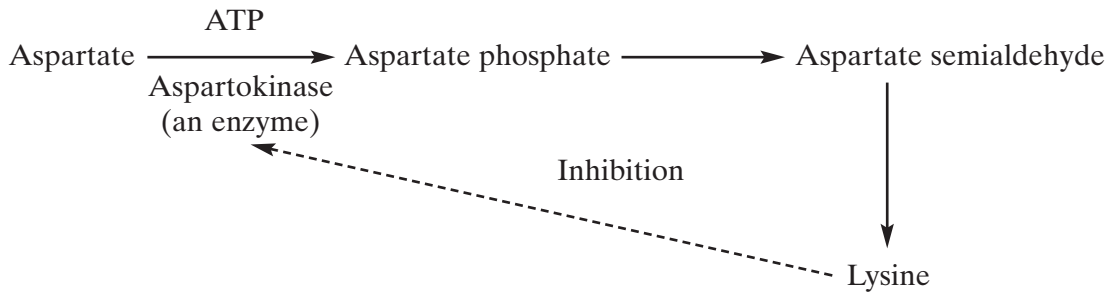
(4 marks)

7 (a) Give **two** advantages of using microorganisms for industrial processes.

- 1 .....
- .....
- 2 .....
- .....

(2 marks)

The diagram shows the metabolic pathway used by the bacterium *Brevibacterium flavum* to produce lysine.



(b) S (i) Give **two** functions of ATP in the first reaction of this metabolic pathway.

- 1 .....
- .....
- 2 .....
- .....

(2 marks)

(ii) Use the information in the diagram to explain how the amount of lysine produced is controlled in this metabolic pathway.

- .....
- .....
- .....
- .....

(2 marks)

(c) Lysine, an essential amino acid for humans, is commercially produced for use as a food supplement. The commercial production of lysine involves the use of a mutant strain of *B. flavum*. This strain has a different form of the enzyme aspartokinase. The enzyme functions as normal but it is not inhibited by lysine.

(i) Explain why manufacturers use the mutant strain of *B. flavum* for the commercial production of lysine.

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(1 mark)

S (ii) Explain how a mutation can result in a change in the structure of the enzyme aspartokinase.

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(4 marks)

**END OF SECTION A**

**SECTION B IS PROVIDED AS AN INSERT**

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