Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Education
January 2005
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION B) BYB7/A
Unit 7 Section A Microbes and Disease

Thursday 27 January 2005 9.00 am to 11.15 am

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.

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** 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 7 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			

SECTION A

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

1 (a) The table shows some features of bacteria and viruses. Complete each box in the table to show whether the feature is present or absent in a bacterium and in the human immunodeficiency virus (HIV). Use a tick (✓) to indicate that the feature may be present or a cross (✘) to indicate that it is always absent.

Feature	Bacterium	HIV
Capsid		
Cell wall		
Flagellum		
Plasmid		

(2 marks)

S (b) Describe **one** similarity and **one** difference between the structure of a mesosome of a bacterium and the structure of a mitochondrion from a eukaryotic cell.

Similarity

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Difference

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(2 marks)

4

2 (a) Some species of bacteria are more virulent than others. Describe **three** factors which make some species of bacteria more likely to cause disease.

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2 .....

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3 .....

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(3 marks)

S (b) Streptomycin is an antibiotic that binds to bacterial ribosomes, preventing mRNA attaching to the ribosomes.

(i) Explain how this effect of streptomycin prevents the growth of bacteria.

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(2 marks)

(ii) Explain why streptomycin does **not** affect the growth of human cells.

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(1 mark)

6

3 Papain is an enzyme used to break down protein in industrial processes. In many of these processes papain is immobilised.

(a) Describe **one** way in which an enzyme can be immobilised.

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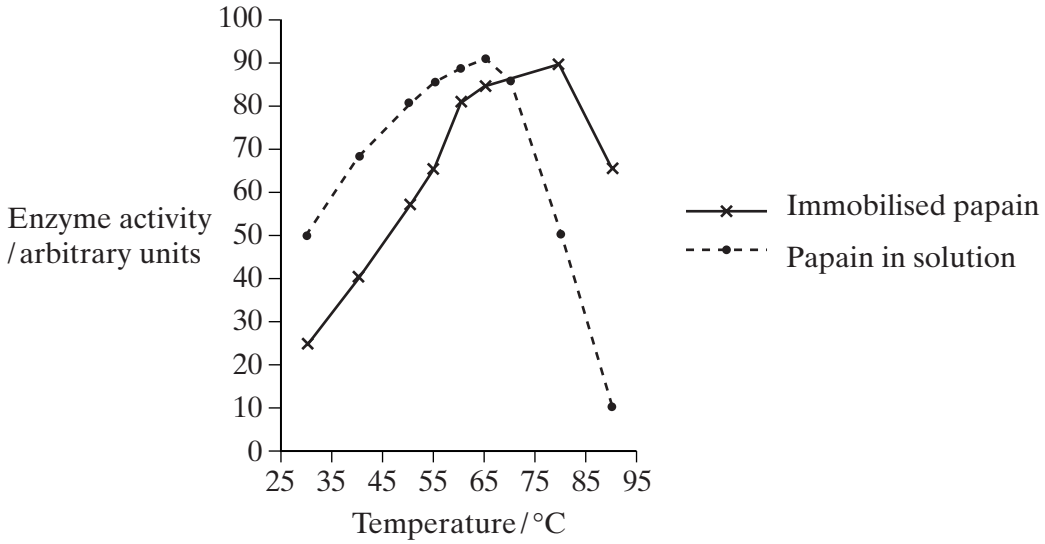
(1 mark)

(b) The graph shows the effect of temperature on the activity of papain in solution and immobilised papain.



(i) Describe the differences between the activity of papain in solution and immobilised papain.

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(2 marks)

S (ii) Explain the effect of temperature on the activity of papain in solution.

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(3 marks)

(iii) Using information from the graph, suggest **one** advantage of using papain in industrial processes rather than using proteases obtained from a mammalian digestive system.

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(1 mark)

7

TURN OVER FOR THE NEXT QUESTION

4 (a) Describe how rubella vaccine is produced.

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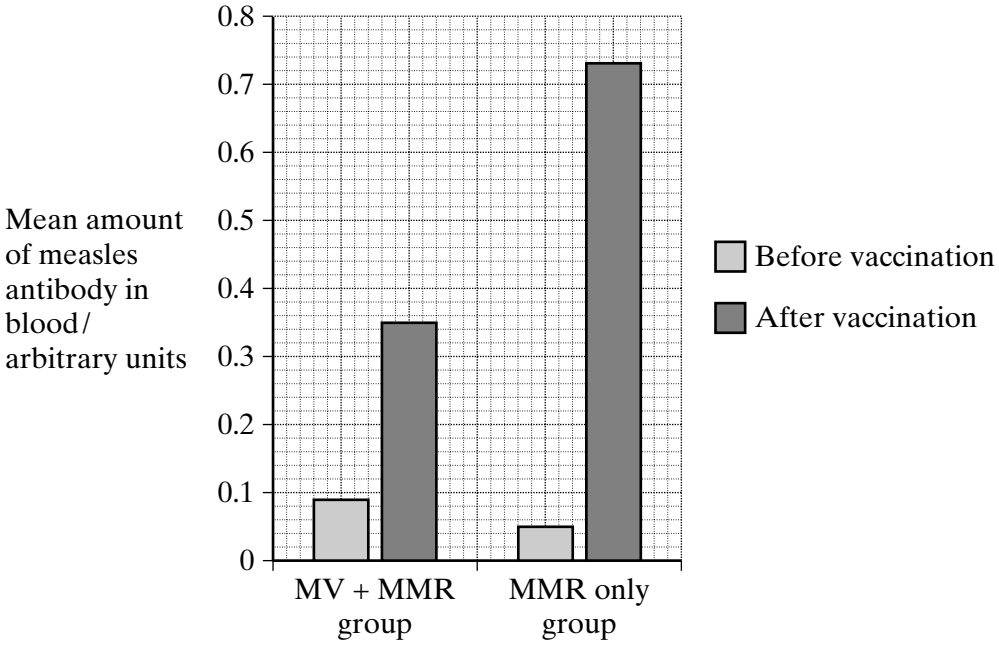
(2 marks)

(b) Measles is an infectious disease that can cause serious complications in children. In countries where measles is uncommon a combined measles, mumps and rubella vaccine (MMR) is given at 15 months. In a country where measles is common a single measles vaccine (MV) may be given at 9 months, followed by MMR at 15 months. In an investigation, the efficiency of the two vaccination programmes was compared in a country where measles is common. The amounts of measles antibody in the blood of children before vaccination and after completing vaccination were measured. The graph shows the results. All differences are statistically significant.



(i) What was the effect of vaccination in the MMR only group? Express your answer as the percentage increase in the amount of measles antibody in the MMR group after vaccination. Show your working.

Percentage increase ..... %

(2 marks)

(ii) The MV + MMR group had more measles antibodies in their blood before vaccination than the MMR only group. Suggest an explanation for this.

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(1 mark)

LEAVE MARGIN BLANK

5 Eggs are one source of *Salmonella* food poisoning.

(a) Explain how the way in which eggs are used may increase the risk of *Salmonella* food poisoning.

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(2 marks)

S (b) One effect of the toxin produced by *Salmonella* is to cause epithelial cells lining the intestine to secrete sodium ions and chloride ions into the lumen. Suggest how this results in diarrhoea.

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(2 marks)

S (c) The presence of live *Salmonella* in food can be shown by using a technique that detects mRNA from *Salmonella*. The technique is similar to the polymerase chain reaction (PCR), except that it copies RNA rather than DNA.

(i) Explain how the technique makes multiple copies of a *Salmonella* mRNA molecule.

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(3 marks)

(ii) The same technique could also detect DNA, but this is prevented by carrying out the reaction at 40 °C rather than 90 °C. Explain how this will prevent DNA being copied.

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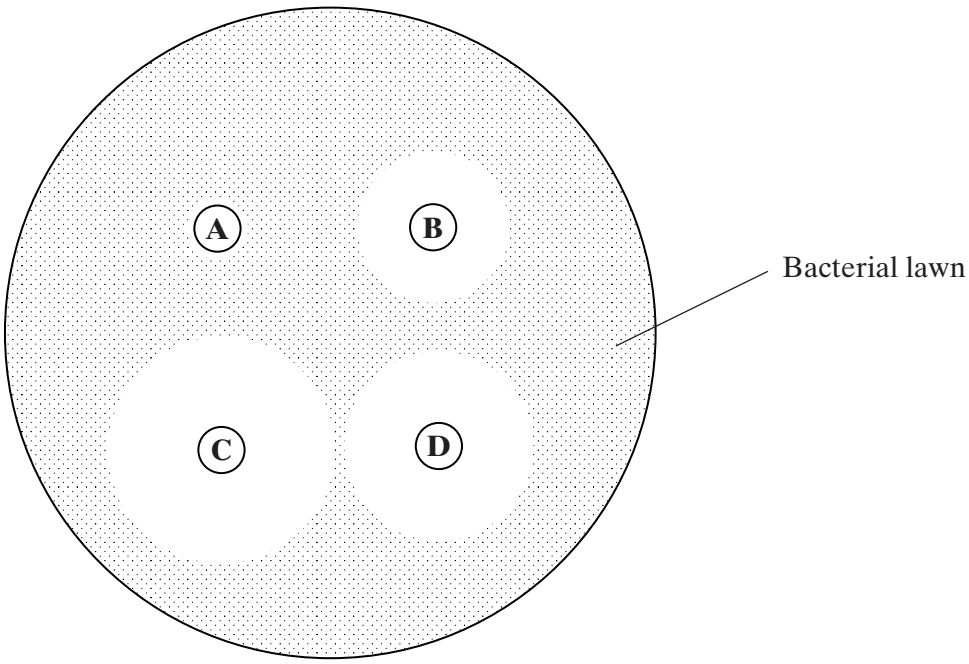
(2 marks)

9

Turn over ▶

6 An agar plate was flooded with a culture of a species of bacterium usually found in the mouth. Four sterile paper discs, **A**, **B**, **C** and **D**, each containing a different brand of mouthwash, were then placed on the agar plate. The drawing shows the appearance of the plate after it had been incubated at 37 °C for three days.



(a) Describe the aseptic techniques that would be used when flooding the agar plate with bacteria.

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(3 marks)

(b) The effectiveness of a mouthwash can be measured by calculating the total area of a paper disc and the clear zone around it. The area of a circle is given by πr^2, where r is the radius of the circle. Calculate how many times more effective mouthwash **C** is than mouthwash **B**. Show your working.

Mouthwash **C** is ..... times more effective than mouthwash **B**.
(2 marks)

S (c) Several factors affect the rate at which the antiseptic in the mouthwash from each paper disc diffuses through the agar. Describe the effect of **three** named factors on this rate.

1 .....

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2 .....

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3 .....

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(3 marks)

8

TURN OVER FOR THE NEXT QUESTION

7 (a) Describe **two** control measures that could be used to reduce the spread of influenza during a major epidemic.

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2 .....

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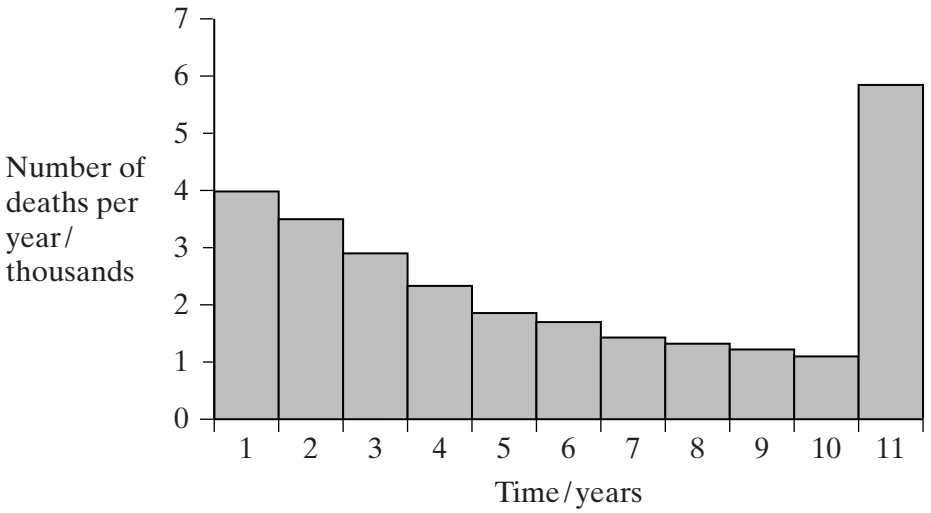
(2 marks)

(b) The graph shows the number of deaths from influenza per year in a developed country.



(i) Suggest an explanation for the change in the number of deaths from influenza during the first 10 years.

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(1 mark)

(ii) Suggest an explanation for the large increase in the number of deaths from influenza in year 11.

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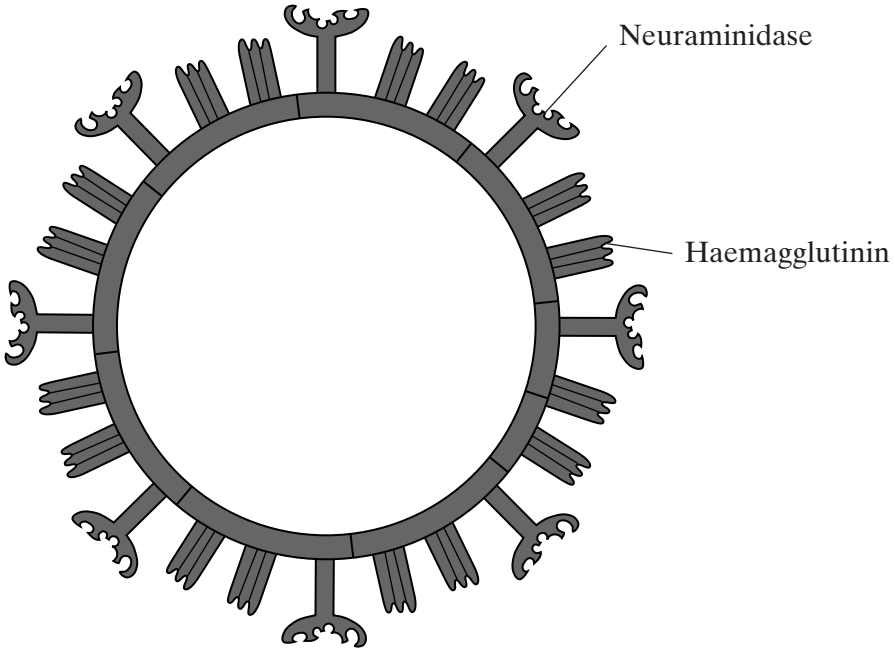
(2 marks)

(c) The diagram shows some of the structures on the outside of an influenza virus.



Haemagglutinin and neuraminidase are protein molecules. Haemagglutinin binds to receptor molecules on the surface of epithelial cells in the breathing system. Neuraminidase is an enzyme which breaks down molecules in the surface membrane of epithelial cells and allows the viruses to be released from the cells.

(i) Describe how T lymphocytes recognise and respond to the influenza virus.

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(2 marks)

(ii) Describe how B lymphocytes respond to the influenza virus.

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(2 marks)

QUESTION 7 CONTINUES ON THE NEXT PAGE

(d) New drugs have recently become available for treating influenza. One type is a neuraminidase inhibitor. Explain how this type of drug would act as a treatment for influenza.

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(2 marks)

11

END OF SECTION A

SECTION B IS PROVIDED AS AN INSERT