Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2009

Biology BIOL1

Unit 1 Biology and disease

Monday 1 June 2009 1.30 pm to 2.45 pm

For this paper you must have:
- a ruler with millimetre measurements.

You may use a calculator.

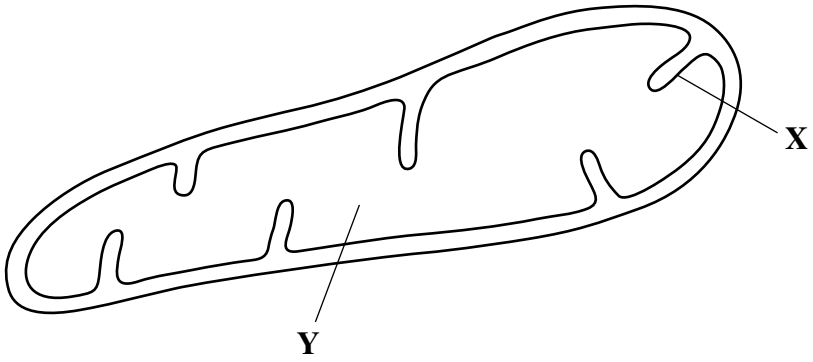
Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked.**
- You may ask for extra paper. Extra paper must be secured to this booklet.
- 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 60.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.
- Quality of Written Communication will be assessed in all answers.

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

1 The diagram shows a mitochondrion.



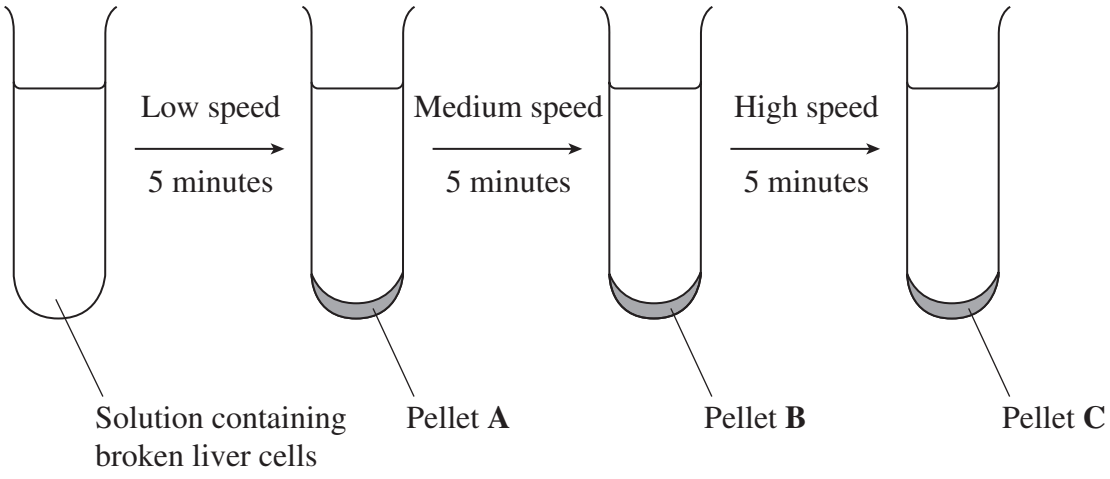
1 (a) Name the parts labelled **X** and **Y**.

1 (a) (i) **X** .....

1 (a) (ii) **Y** .....

(2 marks)

Scientists isolated mitochondria from liver cells. They broke the cells open in an ice-cold, isotonic solution. They then used a centrifuge to separate the cell organelles. The diagram shows some of the steps in the process of centrifugation.



1 (b) Suggest which pellet, **A**, **B** or **C** contained the mitochondria.

(1 mark)

1 (c) Explain why the solution used was

1 (c) (i) ice-cold

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(1 mark)

1 (c) (ii) isotonic.

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(2 marks)

Extra space .....

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1 (d) People with mitochondrial disease have mitochondria that do not function properly. Some people with mitochondrial disease can only exercise for a short time. Explain why a person with mitochondrial disease can only exercise for a short time.

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(2 marks)

Extra space .....

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8

2 (a) The sinoatrial node (SAN) is in the right atrium of the heart. Describe the role of the sinoatrial node.

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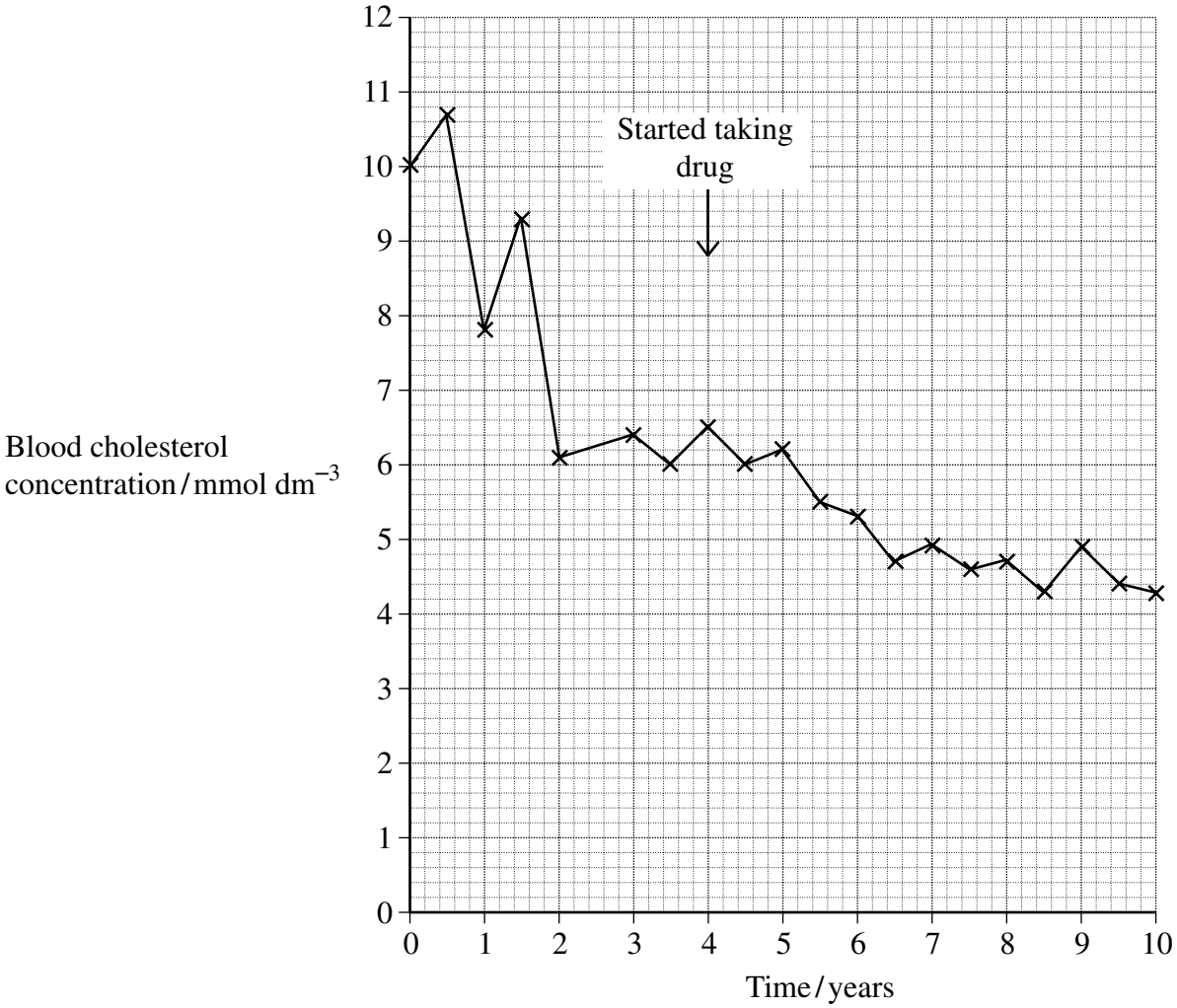
(2 marks)

Ten years ago, a woman was found to have a high concentration of cholesterol in her blood. As a result, she was put on a special diet. She has been on this diet ever since. Four years after starting the diet, she started taking a drug to lower her blood cholesterol. The graph shows the concentration of cholesterol in her blood over the ten-year period.



2 (b) Describe how the concentration of cholesterol in her blood changed over the ten-year period.

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(2 marks)

2 (c) Explain the overall change in cholesterol concentration in the blood in the first two years.

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(2 marks)

2 (d) Use the graph to evaluate the success of the special diet and of the drug in reducing the risk of coronary heart disease.

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(2 marks)

Extra space .....

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8

3 A glucose biosensor is an instrument used to measure glucose concentration. It contains an enzyme called glucose oxidase.

3 (a) A glucose biosensor detects only glucose. Use your knowledge of the way in which enzymes work to explain why.

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(3 marks)

(Extra space).....

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3 (b) It is better to use a biosensor than the Benedict's test to measure the concentration of glucose in a sample of blood. Suggest **two** reasons why.

1 .....

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2 .....

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(2 marks)

3 (c) (i) Diabetes mellitus is a disease that can lead to an increase in blood glucose concentration. Some diabetics need insulin injections. Insulin is a protein so it cannot be taken orally. Suggest why insulin cannot be taken orally.

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(1 mark)

3 (c) (ii) A drug company produced a new type of insulin. Scientists from the company carried out a trial in which they gave this new type of insulin to rats. They reported that the results of this trial on rats were positive. A newspaper stated that diabetics would benefit from this new drug. Suggest **two** reasons why this statement should be viewed with caution.

1 .....

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2 .....

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(2 marks)

8

Turn over for the next question

4 (a) Give **two** ways in which pathogens can cause disease when they enter the body of their host.

1 .....

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2 .....

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(2 marks)

4 (b) Vaccines provide protection against disease. What is a vaccine?

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(2 marks)

4 (c) The only vaccine used against pulmonary tuberculosis is the BCG vaccine. Scientists have carried out trials on a 'booster' vaccine, MVA85A. This 'booster' vaccine is designed to increase the immune response to the BCG vaccine. One trial involved measuring the increase in the number of memory T cells in three groups of adult volunteers following different vaccination programmes.

- Group **A** – injected with BCG
- Group **B** – injected with MVA85A
- Group **C** – injected with BCG and, two weeks later, injected with MVA85A

4 (c) (i) Suggest **two** factors the scientists should have considered when selecting adult volunteers for this trial.

1 .....

2 .....

(2 marks)

4 (c) (ii) The adults in group **C** produced the greatest increase in the number of memory T cells.
Suggest what this shows about the BCG and MVA85A vaccines.

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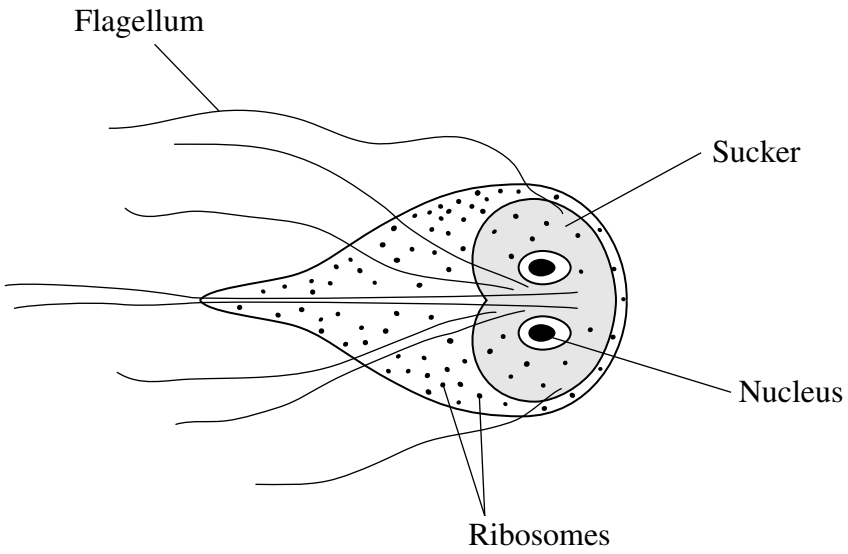
(1 mark)

7

Turn over for the next question

5 Giardiasis is an intestinal disease. It is caused by the microorganism *Giardia lamblia*. The drawing shows some of the structures present in *G. lamblia*.



5 (a) Name **one** structure shown in the drawing which confirms that *G. lamblia* is a eukaryotic organism.

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(1 mark)

5 (b) *G. lamblia* can attach itself with its sucker. Explain how this is an adaptation to living in the intestines.

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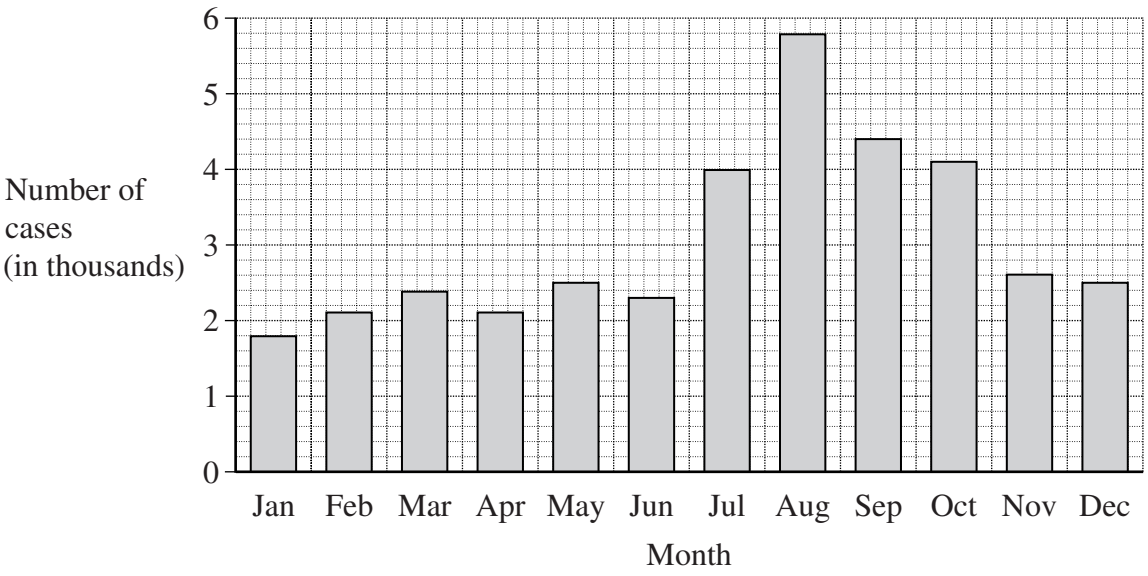
(1 mark)

5 (c) Giardiasis is one of the main causes of diarrhoea in the USA. It is usually transmitted by drinking contaminated water. The bar chart shows the number of cases of giardiasis in one state of the USA during one year.



5 (c) (i) Calculate the percentage increase in the number of cases of giardiasis from January to August. Show your working.

Answer ..... *(2 marks)*

5 (c) (ii) Suggest **one** reason for the number of cases being highest in the late summer months.

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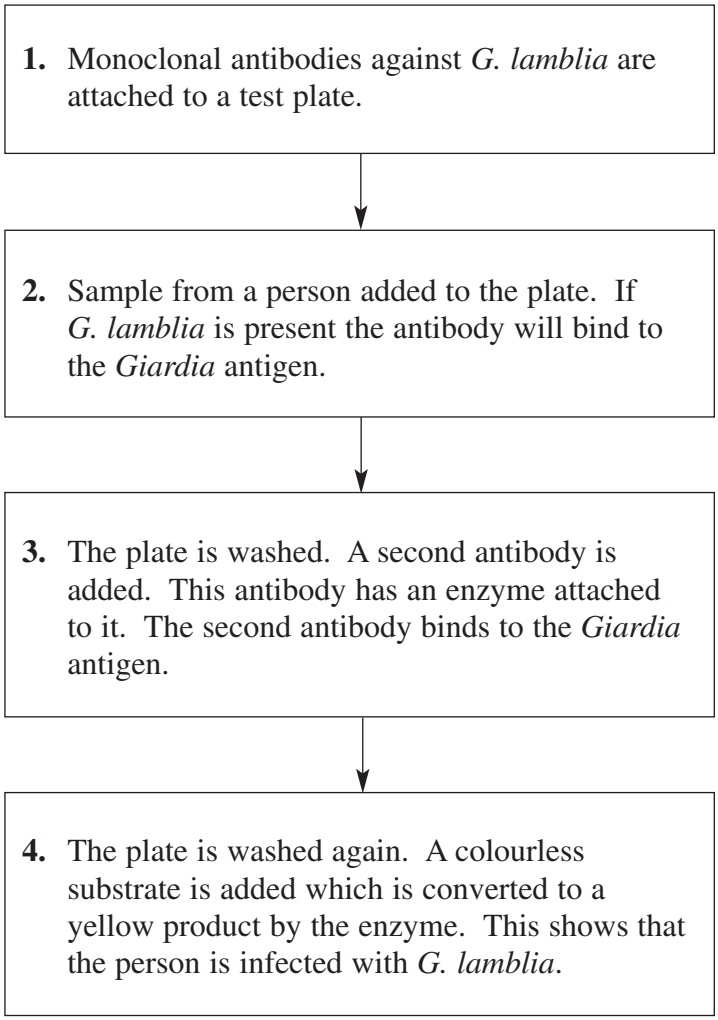
(1 mark)

Question 5 continues on the next page

5 (d) A test has been developed to find out whether a person is infected with *G. lamblia* The test is shown in the flow chart.



5 (d) (i) Explain why the antibodies used in this test must be monoclonal antibodies.

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(1 mark)

5 (d) (ii) Explain why the *Giardia* antigen binds to the antibody in step **2**.

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(1 mark)

5 (d) (iii) The plate must be washed at the start of step **4**, otherwise a positive result could be obtained when the *Giardia* antigen is not present. Explain why a positive result could be obtained if the plate is not washed at the start of step **4**.

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(2 marks)

Extra space .....

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9

Turn over for the next question

6 Read the following passage.

Several diseases are caused by inhaling asbestos fibres. Most of these diseases result from the build up of these tiny asbestos fibres in the lungs.

One of these diseases is asbestosis. The asbestos fibres are very small and enter the bronchioles and alveoli. They cause the destruction of phagocytes and the surrounding lung tissue becomes scarred and fibrous. The fibrous tissue reduces the elasticity of the lungs and causes the alveolar walls to thicken. One of the main symptoms of asbestosis is shortness of breath caused by reduced gas exchange.

People with asbestosis are at a greater risk of developing lung cancer. The time between exposure to asbestos and the occurrence of lung cancer is 20–30 years.

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

6 (a) Destruction of phagocytes (lines 4–5) causes the lungs to be more susceptible to infections. Explain why.

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(2 marks)

Extra space .....

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6 (b) (i) The reduced elasticity of the lungs (lines 6–7) causes breathing difficulty. Explain how.

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(2 marks)

Extra space .....

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6 (b) (ii) Apart from reduced elasticity, explain how changes to the lung tissue reduce the efficiency of gas exchange.

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(4 marks)

(Extra space) .....

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6 (c) (i) Doctors did not make the link between exposure to asbestos and an increased risk of developing lung cancer for many years. Use information in the passage to explain why.

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(1 mark)

6 (c) (ii) Give **one** factor, other than asbestos, which increases the risk of developing lung cancer.

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(1 mark)

10

7 (a) Describe the role of the enzymes of the digestive system in the complete breakdown of starch.

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(5 marks)

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7 (b) Describe the processes involved in the absorption of the products of starch digestion.

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(5 marks)

(Extra space) .....

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10

END OF QUESTIONS

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