Surname

Other Names

Candidate Signature

AQA

General Certificate of Education
Advanced Subsidiary Examination
January 2010

Human Biology   HBIO1

Unit 1   The body and its diseases

Tuesday 12 January 2010   9.00 am to 10.30 am

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

Time allowed
● 1 hour 30 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. Do not write outside the box around each page or on blank pages.
● Do all rough work in this book. Cross through any work you do not want to be marked.

Information
● The marks for questions are shown in brackets.
● The maximum mark for this paper is 80.
● You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use accurate scientific terminology.

HBIO1

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

1 The diagram shows cells from the lining of the airways in the lungs.
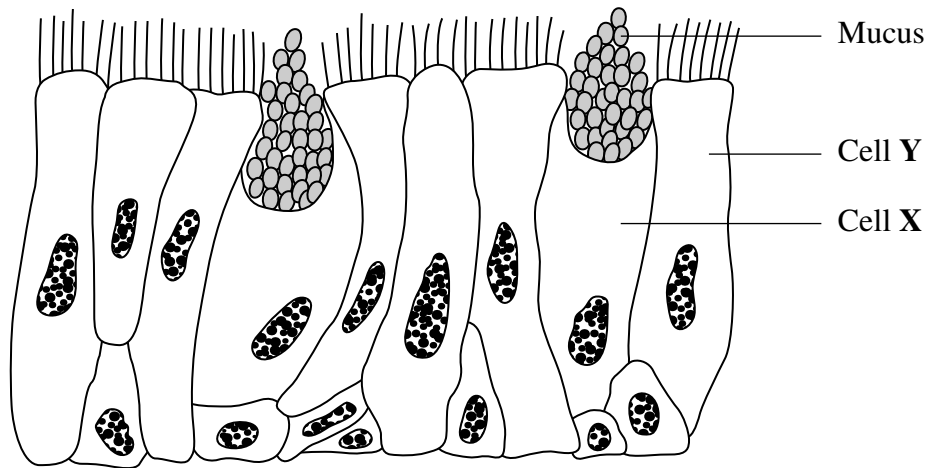
1 (a) Describe how Cell **X** and Cell **Y** help to protect the lungs from infection.

Cell **X**

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....

Cell **Y**

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(2 marks)

1 (b) Mucus is a protein with sugar molecules attached. Describe the role of each of the following in producing mucus.

Ribosomes

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Golgi body

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Vesicles

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(3 marks)

Turn over for the next question

5

Turn over ▶

*Areas outside
the box will
not be scanned
for marking*

2 (a) Atheroma may lead to the development of angina. Describe how.

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(3 marks)

(Extra space) ....

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2 (b) Angioplasty may be carried out to treat atheroma. Describe how angioplasty is carried out.

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(3 marks)

(Extra space) ....

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6

Turn over for the next question

Turn over ▶

3 (a) The statements below refer to events during one cardiac cycle. The statements are not in the correct order.

    A Impulses stimulate the atrioventricular node (AVN).

    B The walls of the atria contract.

    C The ventricle walls contract from the base upwards.

    D Impulses produced by the sinoatrial node (SAN) pass across the walls of the atria.

    E Impulses pass down the bundle of His.

3 (a) (i) The cardiac cycle starts at **D**. Use the letters to place the remaining events in the correct order.

D				

(1 mark)

3 (a) (ii) Explain the advantage of the ventricles contracting from the bottom upwards.

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(1 mark)

3 (b) A baby was born with a leaking atrioventricular valve in the left side of her heart. Describe and explain the effect this had on the volume of blood entering her aorta with each beat.

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(2 marks)

3 (c) Describe how an artificial pacemaker regulates heart activity.

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(2 marks)

6

Turn over for the next question

Turn over ▶

4 Guideline Daily Amounts (GDAs) are recommendations concerning the amount of different food substances that people should eat so that they have a balanced diet. There are different GDAs for men, women and children.

4 (a) Suggest **one** advantage and **one** disadvantage of giving information about GDAs on the labels of processed foods such as pizzas.

Advantage ....

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Disadvantage ....

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(2 marks)

4 (b) The table shows part of a label from a pizza.

Spinach & ricotta pizza			
Nutritional Information			
Typical values (cooked as per instructions)	Per 100g	Per 1/2 pizza	% based on GDA for adult
Energy	1001kJ	1977kJ	
Protein	9.3g	18.4g	40.9%
Carbohydrate of which sugars	28.7g 2.7g	56.7g 5.3g	24.7% 5.9%
Fat of which saturates mono-unsaturates polyunsaturates	9.3g 3.7g 4.0g 1.6g	19.0g 7.3g 7.9g 3.2g	27.1% 36.5% – –
Fibre	2.3g	4.5g	18.8%
Salt (sodium chloride)	1.0g	2.0g	33.3%

Half of this pizza provides 27.1% of the GDA of fat for a woman. Calculate the GDA of fat for a woman. Show your working.

Answer .... g

(2 marks)

4 (c) The figure for the sugar content of the pizza is much lower than the figure for carbohydrate content. Explain why.

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(1 mark)

5

Turn over for the next question

Turn over ▶

5 The diagram shows a bacterial cell.
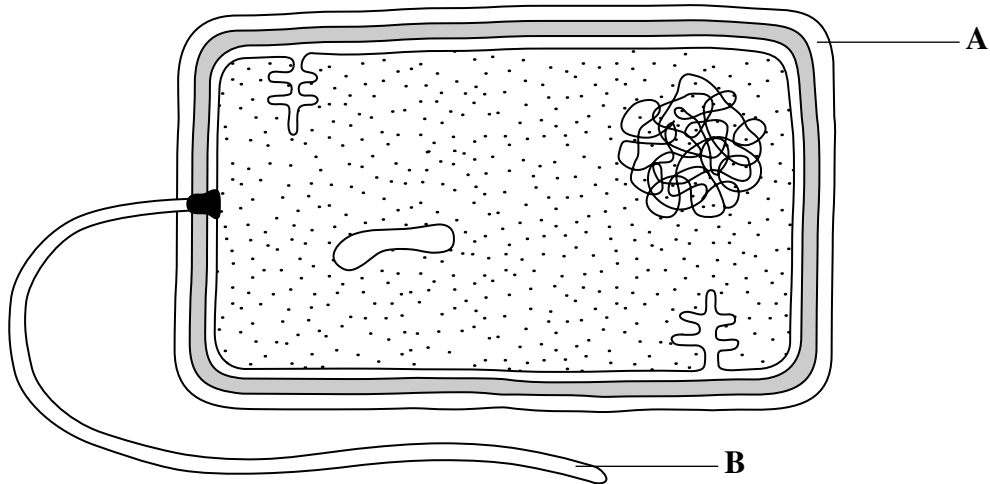
5 (a) (i) Name

Structure **A** ....

Structure **B** ....

(2 marks)

5 (a) (ii) Give **one** function of structure **A**.

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(1 mark)

5 (b) Describe how a person becomes infected with the bacterium that causes tuberculosis.

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(2 marks)

5 (c) Doctors treated a tuberculosis patient with antibiotics. The treatment involved taking a mixture of four antibiotics for six months. This treatment was necessary to make sure that the patient was cured of tuberculosis.

5 (c) (i) Explain why four antibiotics were used.

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5 (c) (ii) Explain why the treatment lasted for six months.

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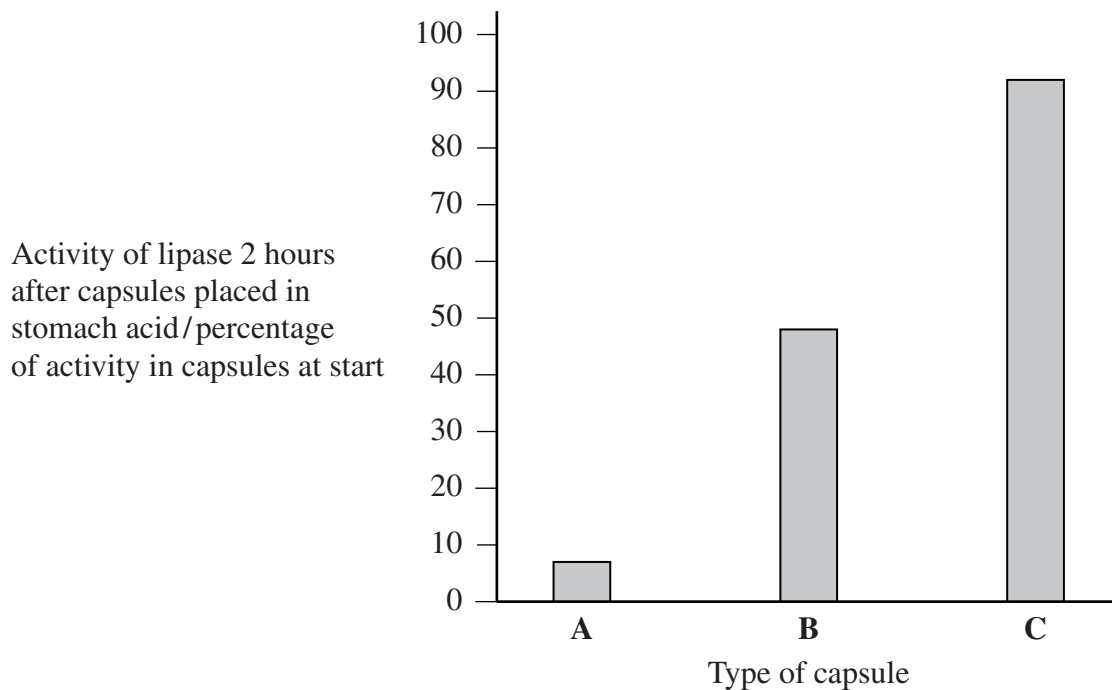*(3 marks)*

8

Turn over for the next question

Turn over ▶

6 Many people with cystic fibrosis swallow capsules containing digestive enzymes before meals. The enzymes include lipase. The acid produced in the stomach could reduce the activity of the digestive enzymes.

Scientists investigated three different capsules, **A**, **B** and **C**, produced by three drug companies. They measured the activity of the lipase in samples of each type of capsule before being swallowed. They also placed samples of each capsule into stomach acid for two hours and then measured the activity of the lipase.

Their results are shown in the graph.

Activity of lipase 2 hours after capsules placed in stomach acid/percentage of activity in capsules at start

Type of capsule

6 (a) Explain the results shown in the graph.

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(2 marks)

6 (b) The scientists concluded that the enzyme in capsule **C** would be the best enzyme to give to people with cystic fibrosis. Suggest reasons why this conclusion might not be valid.

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(2 marks)

4

Turn over for the next question

Turn over ▶

7 (a) Give **one** useful role of gut bacteria.

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(1 mark)

7 (b) Hospital patients who have taken antibiotics sometimes go on to develop bacterial infections that cause diarrhoea. Suggest why.

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(2 marks)

Scientists investigated whether yoghurt drinks containing beneficial gut bacteria reduced the probability of hospital patients developing diarrhoea.

The scientists divided a large number of patients receiving antibiotics into two groups.
- Group **A** received a yoghurt drink with gut bacteria.
- Group **B** received a yoghurt drink without gut bacteria.

The results showed that 12% of the patients in group **A** and 34% of group **B** developed diarrhoea.

7 (c) (i) Why was group **B** important in this investigation?

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(2 marks)

7 (c) (ii) It was important that the patients did not know who was receiving the yoghurt drink containing gut bacteria and who was not. Explain why.

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(1 mark)

7 (c) (iii) Describe how you could have allocated the patients to each group in this study.

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(2 marks)

7 (c) (iv) The results were reported as percentages. Explain why.

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(2 marks)

10

Turn over for the next question

Turn over ▶

8 (a) (i) Describe **two** symptoms of lactose intolerance.

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(1 mark)

8 (a) (ii) Describe how the symptoms of lactose intolerance are caused.

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(2 marks)

8 (b) A lactose tolerance test is performed as follows.

- The person must not eat, and can drink only water, for at least 8 hours.
- After 8 hours, a blood sample is taken. The concentration of glucose is measured in this blood sample.
- The person then drinks a solution containing lactose.
- The concentration of glucose in the blood is measured regularly over the next 2 hours.

8 (b) (i) The person must not eat, and can drink only water, for at least 8 hours before the first blood sample is taken. Explain why.

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(1 mark)

8 (b) (ii) The concentration of glucose in the blood is measured before the person drinks the solution containing lactose. Explain why.

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(1 mark)

8 (b) (iii) The test will show whether the person is lactose intolerant or not lactose intolerant. What results would you expect if the patient is **not** lactose intolerant? Explain your answer.

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(3 marks)

(Extra space) ....

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8

Turn over for the next question

Turn over ▶

9 (a) What is an isotonic drink?

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(2 marks)

Doctors investigated whether isotonic drinks are useful for women during labour.

Women in labour are not allowed to eat solid food in case they need a general anaesthetic. This means that their blood glucose concentration can fall quite low. The doctors wanted to find out whether isotonic drinks would help to maintain the women's blood glucose concentration.

The doctors used a large number of pregnant women in their study. One group was given an isotonic drink during labour. The control group was given water. The table below shows some of the results.

	Group given isotonic drink		Group given water	
	Before labour started	**End of labour**	**Before labour started**	**End of labour**
Mean blood glucose concentration /mmol dm^{-3}	5.29	5.59	5.38	4.88

9 (b) The mean blood glucose concentration of the two groups was different before labour started. Suggest why.

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(2 marks)

9 (c) The doctors concluded that pregnant women should have isotonic drinks during labour. Evaluate their conclusion.

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(4 marks)

(Extra space) ....

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Turn over for the next question

Turn over ▶

10 Read the following passage.

An anti-gal antibody is a type of antibody that helps to fight infections caused by bacteria. If a person has a bacterial infection, for example *Salmonella*, anti-gal antibodies bind to antigens on the surface of the *Salmonella*. Not all the anti-gal antibodies are used to fight the infection. Even after the infection, anti-gal antibodies remain in the blood. 5

Scientists have made adaptor molecules to try to use the anti-gal antibodies against viruses such as HIV. The adaptor molecules are proteins. Each adaptor molecule had a receptor site to which the HIV binds. This receptor site was similar to the receptor site on human cells to which the HIV binds. The adaptor molecule has another site to which an anti-gal antibody will bind. 10

The scientists then investigated whether adding adaptor molecules and anti-gal antibodies can prevent HIV entering cells. They added adaptor molecules and anti-gal antibodies to a culture of human cells. They then added HIV to the culture. Their results showed that 90% of the virus particles failed to infect cells. 15

The scientists are hoping to develop a different type of adaptor molecule to use against MRSA.

10 (a) (i) What is an antigen? (line 3)

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(2 marks)

10 (a) (ii) Explain why antibodies against *Salmonella* do not normally bind to HIV.

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(2 marks)

10 (a) (iii) Explain how the adaptor molecule allows anti-gal antibodies to associate with HIV.

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(2 marks)

10 (b) Describe how humans produce antibodies against a pathogen such as *Salmonella*.

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(6 marks)

(Extra space) ....

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Question 10 continues on the next page

Turn over ▶

10 (c) (i) HIV infects some human cells, such as T-cells, but not others. Suggest why.

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(2 marks)

10 (c) (ii) Antibiotics are **not** used to treat viral infections, such as HIV. Explain why.

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(2 marks)

10 (d) (i) When HIV, anti-gal and the *adaptor molecule* were added to a culture of human cells, 90% of the virus did **not** infect human cells. (lines 12-15). Explain why.

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(2 marks)

10 (d) (ii) Explain why a different type of adaptor molecule will have to be made to use against MRSA. (lines 16-17)

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(2 marks)

END OF QUESTIONS

20

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24

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