Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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6	
7	
8	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2013

Biology BIOL1

Unit 1 Biology and disease

Tuesday 21 May 2013 1.30 pm to 2.45 pm

For this paper you must have:
- a ruler with millimetre measurements
- 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. Do not write outside the box around each page or on blank pages.
- 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 marks for questions are shown in brackets.
- You are expected to use a calculator, where appropriate.
- The maximum mark for this paper is 60.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

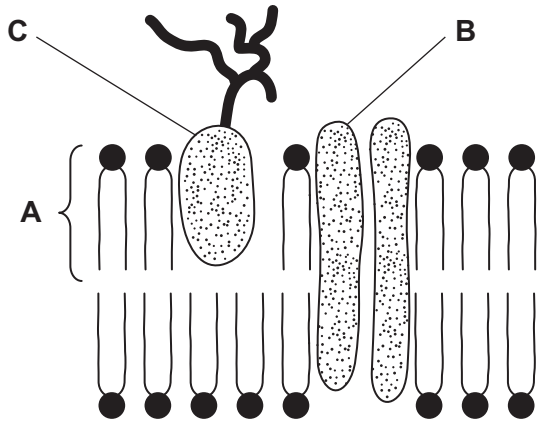
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ANSWER IN THE SPACES PROVIDED

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

1 The diagram shows the structure of the cell-surface membrane of a cell.



1 (a) Name **A** and **B**.

A .....

B .....

(2 marks)

1 (b) (i) **C** is a protein with a carbohydrate attached to it. This carbohydrate is formed by joining monosaccharides together.

Name the type of reaction that joins monosaccharides together.

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(1 mark)

1 (b) (ii) Some cells lining the bronchi of the lungs secrete large amounts of mucus. Mucus contains protein.

Name **one** organelle that you would expect to find in large numbers in a mucus-secreting cell and describe its role in the production of mucus.

Organelle .....

Description of role .....

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(2 marks)

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2 (a) An enzyme catalyses only one reaction. Explain why.

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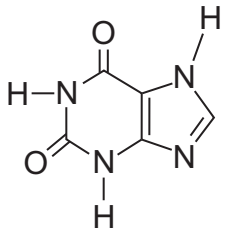
(2 marks)

2 (b) Gout is a disease caused by the build-up of uric acid crystals in joints. Uric acid is produced from xanthine in a reaction catalysed by the enzyme xanthine oxidase.

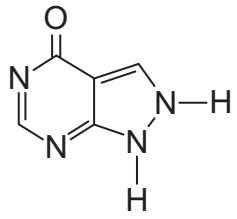
xanthine $\xrightarrow{\text{xanthine oxidase}}$ uric acid

Allopurinol is a drug used to treat gout. The diagram shows the structures of xanthine and allopurinol.

Xanthine



Allopurinol



Use this information to suggest how allopurinol can be used to treat gout.

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(3 marks)

(Extra space) .....

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3 (a) (i) Name the process by which oxygen passes from an alveolus in the lungs into the blood.

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(1 mark)

3 (a) (ii) Describe **two** adaptations of the structure of alveoli for efficient gas exchange.

1 .....

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2 .....

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(2 marks)

3 (b)



The photograph shows a fire-breather creating a ball of fire. Fire-breathers do this by blowing a fine mist of paraffin oil onto a flame. Some of this mist can be inhaled and may eventually lead to fibrosis.

People who have been fire-breathers for many years often find they cannot breathe out properly. Explain why.

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(2 marks)

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4 (a) Infection by the cholera bacterium can cause acute diarrhoea. Explain how.

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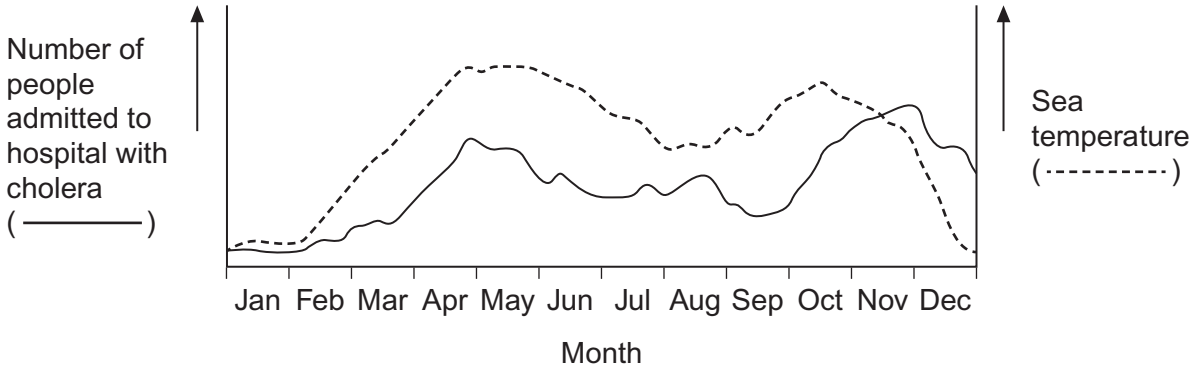
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(2 marks)

The bacteria that cause cholera can be found in seawater. Outbreaks of cholera often begin in populations living near the coast.

Scientists in Bangladesh investigated the relationship between outbreaks of cholera and the sea temperature. They used the number of people admitted to hospital with cholera as a measure of the number of cases of the disease. The graph shows their results.



4 (b) Describe the relationship between sea temperature and the number of people admitted to hospital with cholera between January and June.

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(2 marks)

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4 (c) Some scientists have suggested that a rise in sea temperatures could lead to an increase in outbreaks of cholera. Do these data support this suggestion? Give reasons for your answer.

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(2 marks)

4 (d) In areas where there are repeated outbreaks of cholera, most people who become infected by cholera bacteria do not become ill. Suggest and explain **one** reason why.

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(2 marks)

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Turn over for the next question

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5 Imatinib is a drug used to treat a type of cancer that affects white blood cells. Scientists investigated the rate of uptake of imatinib by white blood cells. They measured the rate of uptake at 4 ºC and at 37 ºC.

Their results are shown in the table.

	Mean rate of uptake of imatinib into cells / µg per million cells per hour	
Concentration of imatinib outside cells / µmol dm^{-3}	**4 ºC**	**37 ºC**
0.5	4.0	10.5
1.0	10.7	32.5
5.0	40.4	420.5
10.0	51.9	794.6
50.0	249.9	3156.1
100.0	606.9	3173.0

5 (a) The scientists measured the rate of uptake of imatinib in µg per million cells per hour. Explain the advantage of using this unit of rate in this investigation.

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(2 marks)

5 (b) Calculate the percentage increase in the mean rate of uptake of imatinib when the temperature is increased from 4 ºC to 37 ºC at a concentration of imatinib outside the cells of 1.0 µmol dm^{-3}.

Give your answer to one decimal place.

Answer .....

(2 marks)

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5 (c) Imatinib is taken up by blood cells by active transport.

5 (c) (i) Explain how the data for the two different temperatures support this statement.

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(2 marks)

5 (c) (ii) Explain how the data for concentrations of imatinib outside the blood cells at 50 and 100 µmol dm^{-3} at 37 ºC support the statement that imatinib is taken up by active transport.

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(2 marks)

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6 (a) Describe how you would test a sample of food for the presence of starch.

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(2 marks)

6 (b) The concentration of glucose in the blood rises after eating a meal containing carbohydrates.

The rise is slower if the carbohydrate is starch rather than sucrose. Explain why.

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(3 marks)

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Question 6 continues on the next page

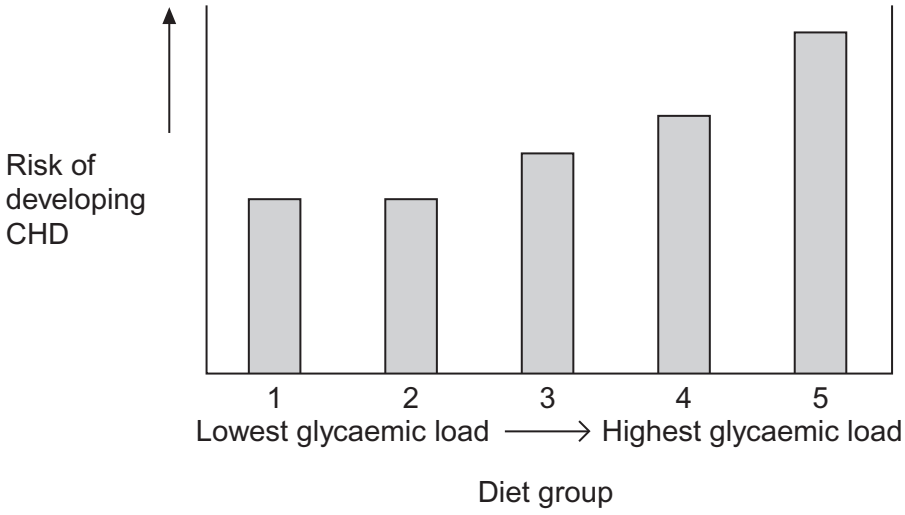
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The glycaemic load (GL) of a diet is a measure of how much digestible carbohydrate it contains. The higher the GL of a diet the more quickly it raises the blood glucose concentration after a meal. A diet with a high GL also increases the concentration of harmful lipids in the blood.

Scientists investigated the relationship between diets with different glycaemic loads and the risk of developing coronary heart disease (CHD) in women.

The scientists determined the glycaemic loads of the diets of a large number of women. They then divided the women into 5 groups. Group 1 had diets with the lowest glycaemic load and group 5 had diets with the highest glycaemic load. The scientists determined the risk of developing CHD in each group.

The graph shows their results.



6 (c) The scientists excluded women who smoked from the study. Explain why.

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(1 mark)

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6 (d) (i) What do these data show about the effect that glycaemic load of the diet has on the risk of developing CHD?

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(1 mark)

6 (d) (ii) Use the information provided to explain the effect that glycaemic load of the diet has on the risk of developing CHD.

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(2 marks)

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Turn over for the next question

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7 Read the following passage.

Microfold cells are found in the epithelium of the small intestine. Unlike other epithelial cells in the small intestine, microfold cells do not have adaptations for the absorption of food.

Microfold cells help to protect against pathogens that enter the intestine. They have receptor proteins on their cell-surface membranes that bind to antigens on the surface of pathogens. The microfold cells take up the antigens and transport them to cells of the immune system. Antibodies are then produced which give protection against the pathogen.

Scientists believe that it may be possible to develop vaccines that make use of microfold cells. These vaccines could be swallowed in tablet form.

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

7 (a) Microfold cells do not have adaptations for the absorption of food (lines 2 - 3). Give **two** adaptations that other epithelial cells have for the absorption of food.

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2 .....

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(2 marks)

7 (b) (i) Microfold cells have receptor proteins on their cell-surface membranes that bind to antigens (line 5). What is an antigen?

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(1 mark)

7 (b) (ii) Microfold cells take up the antigens and transport them to cells of the immune system (lines 6 - 7). Antigens are not able to pass through the cell-surface membranes of other epithelial cells. Suggest **two** reasons why.

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(2 marks)

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7 (c) Scientists believe that it may be possible to develop vaccines that make use of microfold cells (lines 9 -10). Explain how this sort of vaccine would lead to a person developing immunity to a pathogen.

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8 (a) Describe how a heartbeat is initiated and coordinated.

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(Extra space) .....

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8 (b) Explain how the heart muscle and the heart valves maintain a one-way flow of blood from the left atrium to the aorta.

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END OF QUESTIONS

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