

Surname	Centre Number	Candidate Number
Other Names		2



GCE A level

1074/02

HUMAN BIOLOGY – HB4

P.M. FRIDAY, 11 January 2013

1¾ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	12	
2	15	
3	15	
4	11	
5	11	
6	6	
7	10	
Total	80	

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

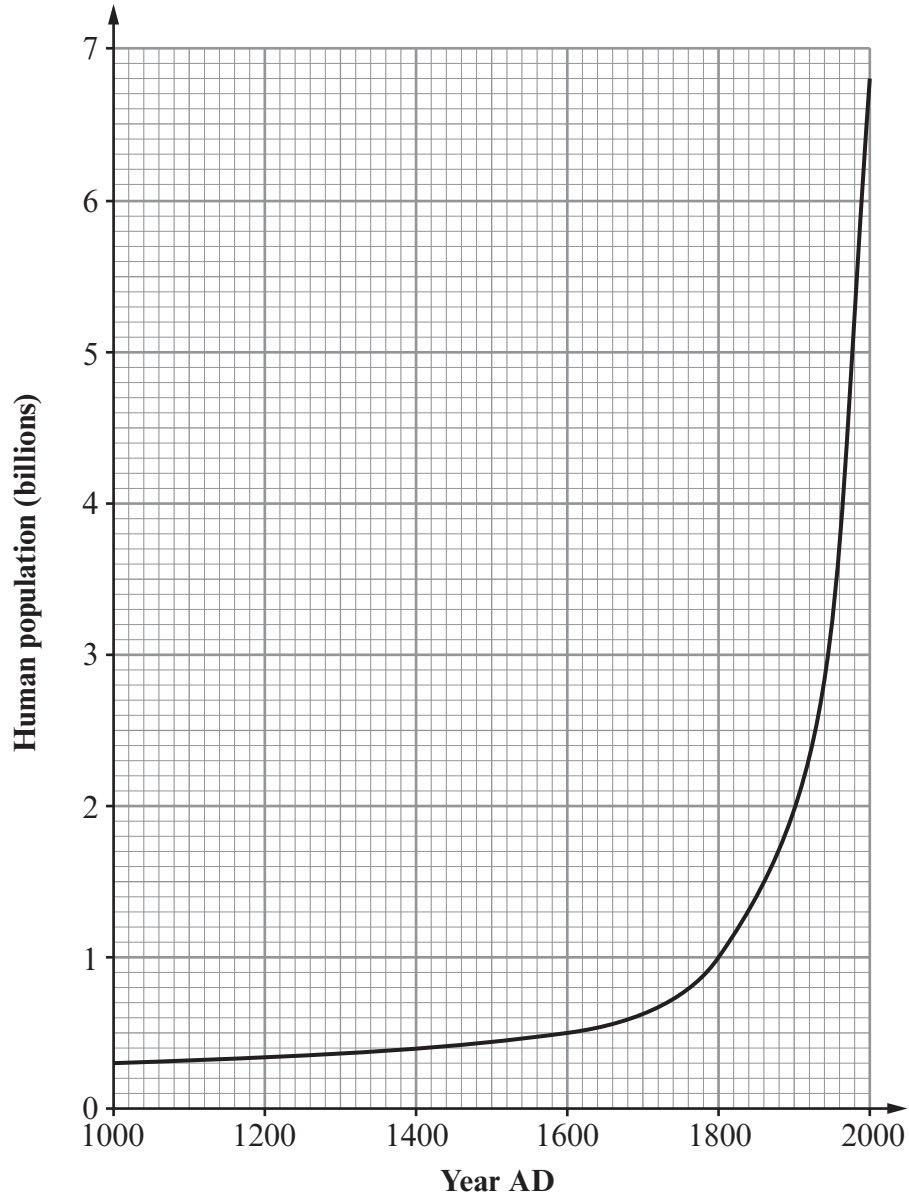
INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

1. (a) During the last 150 years the human population of the world has been increasing at an alarming rate. The graph below shows the human population growth curve.



- (i) Use the figures in the graph above to calculate the % increase in the human population between the years 1600 and 1800 and between 1800 and 2000. [2]

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(ii) Name the phases of population growth which are shown between the years 1000 to 1800 and 1800 to 2000. [1]

1000 – 1800

1800 – 2000

(b) (i) State **two** factors which have led to such an enormous increase in the size of the human population. [2]

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(ii) State **two** factors which could slow down the rate of increase in the human population. [2]

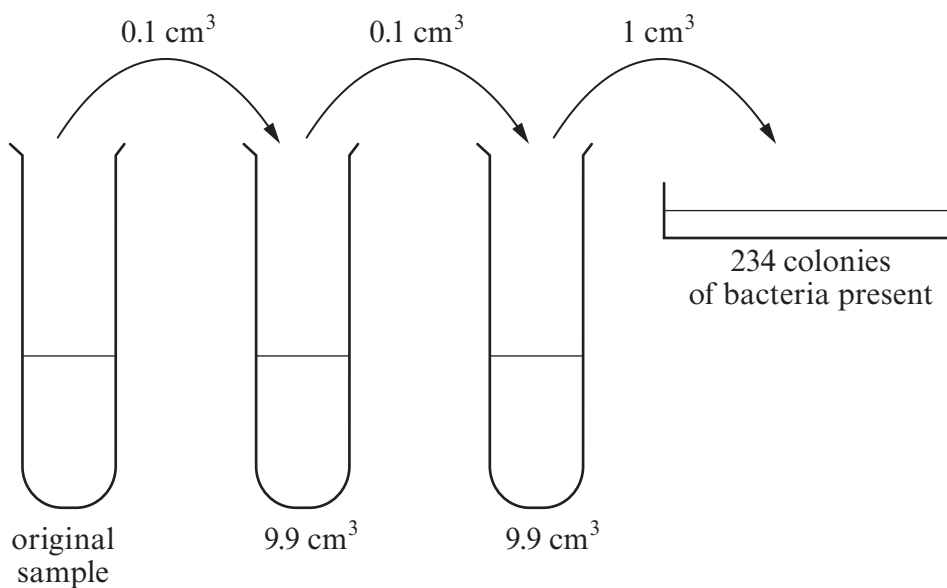
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(c) (i) Compare the shape of the human population curve shown opposite with a typical bacterial population growth curve. [3]

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- (ii) One method of estimating the numbers of bacteria present in a sample is by serial dilution.

The diagram below represents the stages of serial dilution used to assess the numbers of bacteria in an original sample.



Calculate the number of bacteria per cm^3 in the original sample.

[2]

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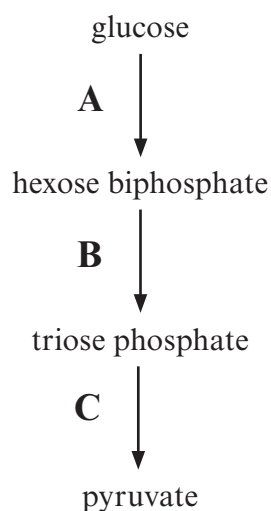
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2. (a) The diagram below is an outline of glycolysis.



- (i) State where glycolysis takes place in a cell. [1]
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- (ii) Use the letters **A**, **B** or **C** from the diagram above, to indicate when the following processes take place. [4]
- dehydrogenation
- substrate level phosphorylation
- phosphorylation using ATP
- splitting of hexose
- (iii) State the net gain of ATP when one molecule of glucose is broken down to pyruvate in glycolysis. [1]
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- (iv) Describe what would happen to the pyruvate molecules formed under **anaerobic** conditions in human muscle. [3]
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(b) The chemical formula for the fat tripalmitin is $C_{51}H_{98}O_6$ and for the sugar glucose $C_6H_{12}O_6$.

(i) Use your own knowledge and the information above to explain what happens to tripalmitin under aerobic conditions and why it has a higher energy value per molecule than glucose. [3]

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(ii) In what form is the carbon from the tripalmitin and glucose excreted from the body? [1]

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(iii) Although fats such as tripalmitin have a higher energy value than glucose, they are not the main source of energy in muscles. Suggest why this is the case. [2]

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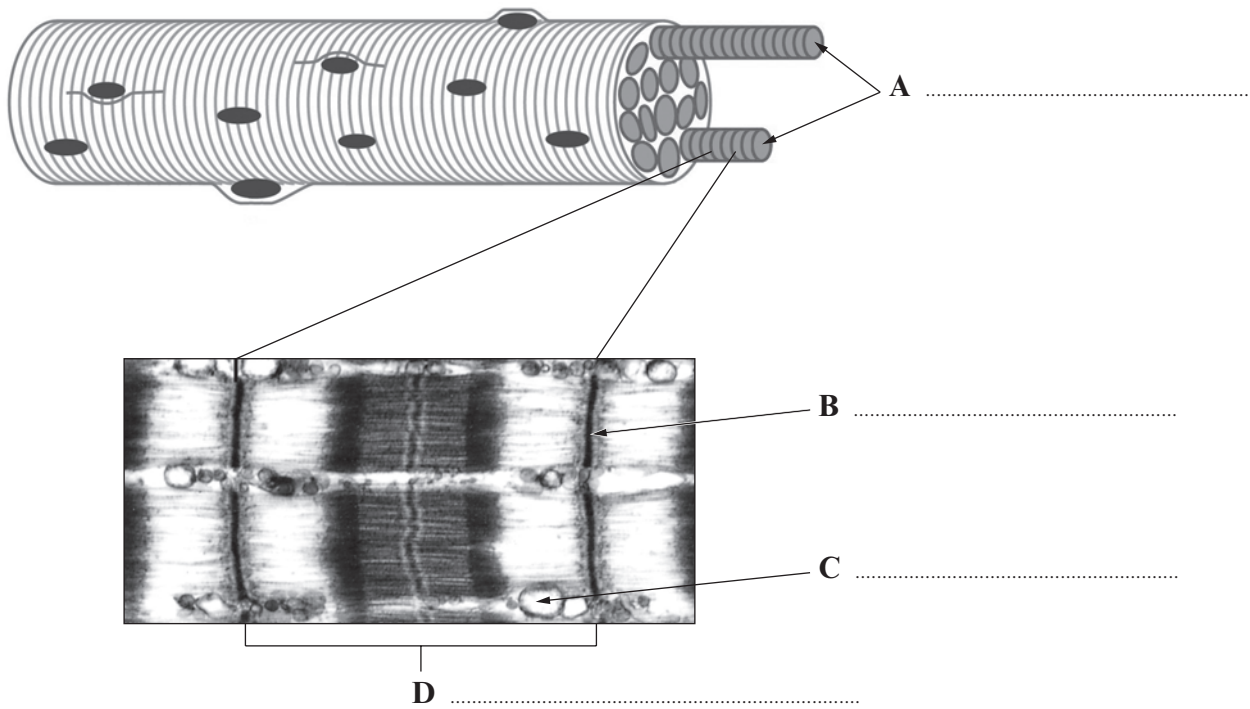
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3. The drawing and electron micrograph below show part of a muscle fibre.



(a) (i) Label structures **A-D** on the diagram and photomicrograph above. [4]

(ii) Muscle fibres can be treated with digestive enzymes before being observed using an electron microscope.
State which band would disappear if the fibre had been treated with an enzyme which digests: [1]

The protein actin

The protein myosin

(iii) Name the polysaccharide found in muscle fibres. [1]

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(b) Complete the table below using a tick (✓) in each row to show what happens to the width of each band / zone as a muscle **contracts**. [3]

Band	Increase in width	Decrease in width	Width stays the same
I band			
A band			
H zone			

(c) Complete the table below to show **four** differences between slow twitch and fast twitch muscle fibres. [4]

Slow twitch fibres	Fast twitch fibres

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(d) State **two** roles of ATP in muscle contraction. [2]

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4. (a) Name **two** nitrogen containing molecules found in living organisms. [2]

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(b) What is the role of the following bacteria in the nitrogen cycle? [2]

Nitrobacter

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Nitrosomonas

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(c) What is the importance of ploughing and drainage of agricultural land? [2]

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(d) Explain why farmers need to apply fertiliser to farmland to maintain nitrate levels in the soil after harvesting. [2]

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(e) Explain how certain crops increase the amount of nitrate in the soil. [3]

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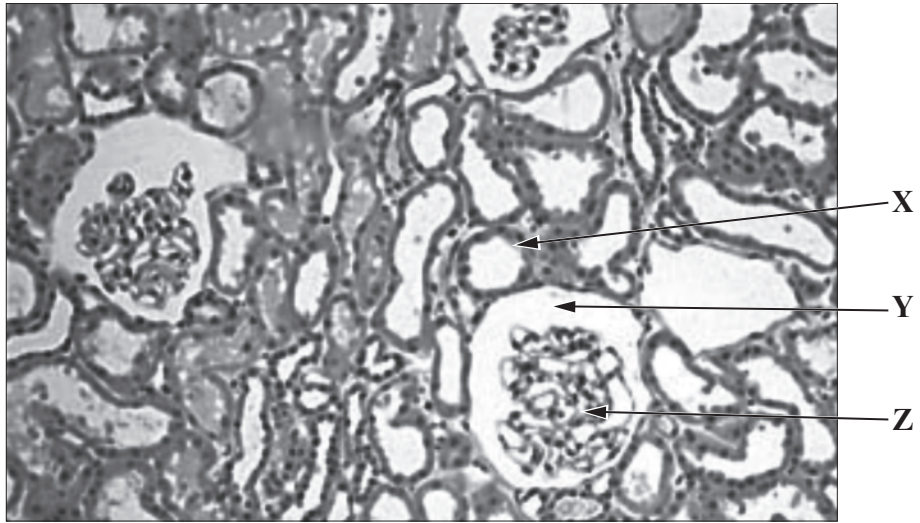
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5. The following photomicrograph shows part of a kidney.



- (a) (i) From which part of the kidney is the photomicrograph above taken? [1]

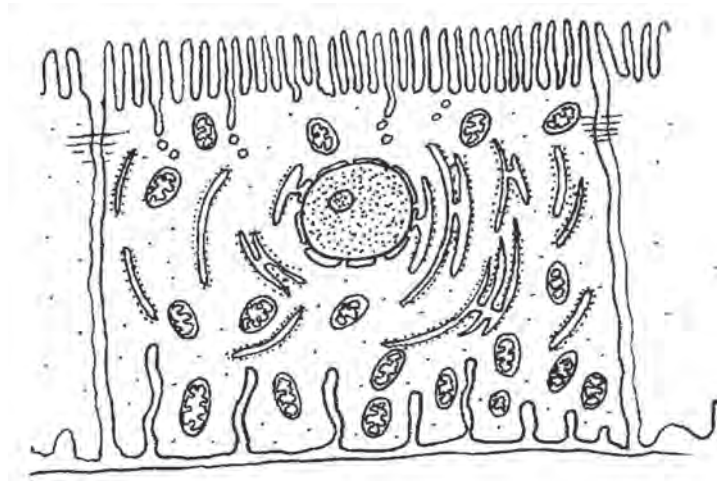
- (ii) Name the structures X-Z shown in the photomicrograph above. [3]

X

Y

Z

(iii) The following is a diagram of a cell from structure X opposite.



State **three** structural features visible in this cell which help in selective reabsorption. [3]

- 1
- 2
- 3

(b) Describe how ultrafiltration takes place in the kidney. [4]

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6. (a) It is important that humans try to maintain or reduce the carbon dioxide levels in the atmosphere.

(i) Name **two** processes which increase carbon dioxide levels. [1]

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(ii) State which organelle in a plant cell is responsible for photosynthesis. [1]

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(iii) State precisely how the process of photosynthesis reduces the carbon dioxide levels. [2]

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(b) Suggest why the following processes are required for cellular respiration to continue.

(i) Light independent stage of photosynthesis; [1]

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(ii) Light dependent stage of photosynthesis. [1]

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