Surname	Centre Number	Candidate Number
Other Names		2

GCE A level

1074/02

S15-1074-02

HUMAN BIOLOGY – HB4

P.M. MONDAY, 8 June 2015

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**10**	
3.	**14**	
4.	**13**	
5.	**13**	
6.	**13**	
7.	**10**	
Total	**80**	

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ADDITIONAL MATERIALS

In addition to this examination paper you will need a ruler and a calculator.

INSTRUCTIONS TO CANDIDATES

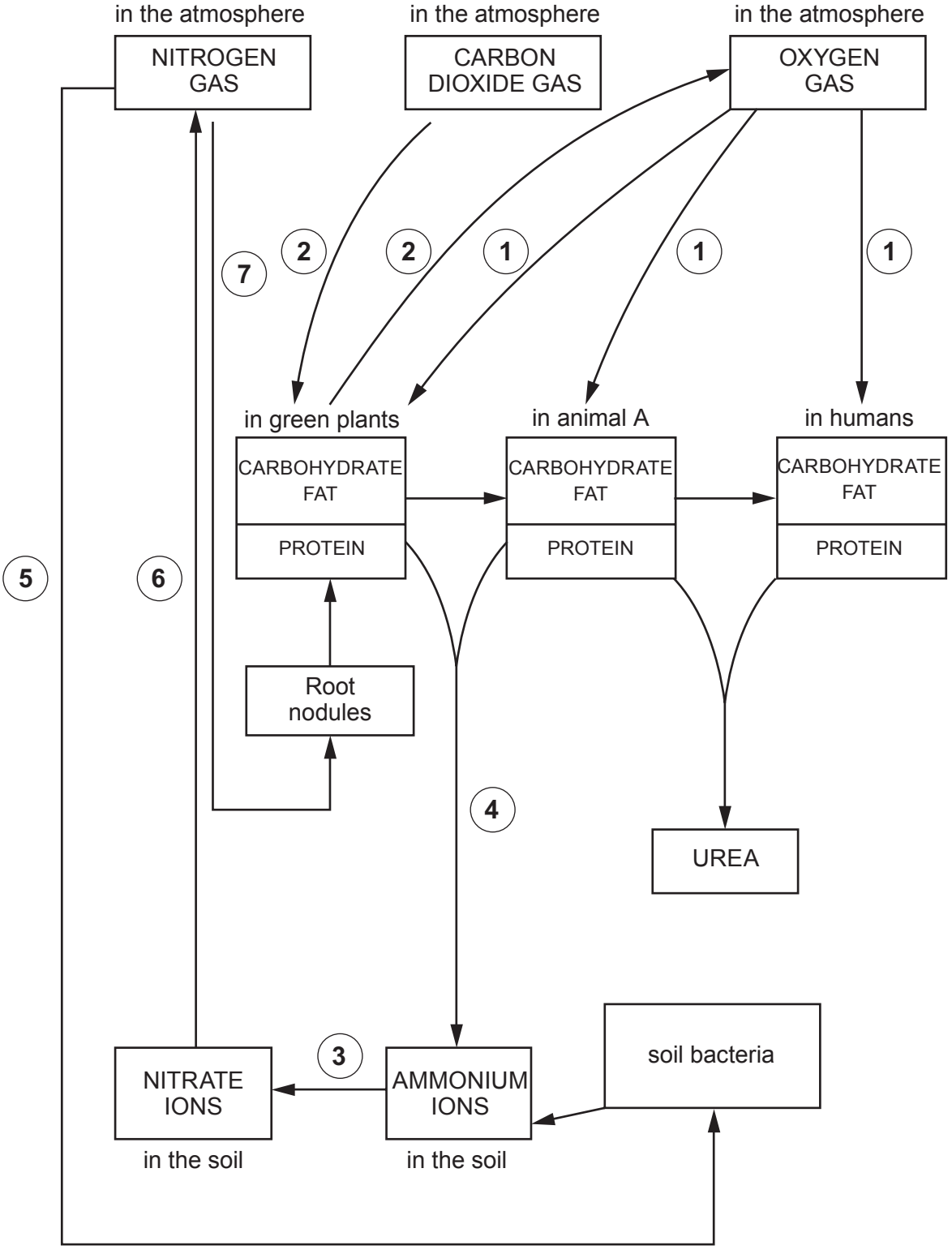
Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.

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.

Answer **all** *questions.*

1. The diagram below represents some of the more important inter-relationships between living organisms and the occurrence of nitrogen, carbon and oxygen in the environment.
Study the diagram and answer the questions that follow.



Examiner only

(a) What is the name of the processes represented by the arrows labelled **1** and **2**? [1]

1. .....

2. .....

(b) Why does ploughing and drainage of the soil encourage the process represented by arrow **3**? [1]

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(c) What general name is given to all the organisms responsible for the process represented by arrow **4**? [1]

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(d) Name the term which describes the biochemical process represented by arrow **5**. [1]

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(e) What is the general name given to the organisms carrying out the process shown by arrow **3**? [1]

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(f) What process is indicated by arrow **6**? [1]

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(g) Give the name of the genus of bacteria that could carry out the process represented by arrow **7**. [1]

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7

Turn over.

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2. *(a)* (i) In 1541, one African slave who was infected with smallpox introduced the smallpox virus to Mexico. The smallpox epidemic killed 20 million people out of a total population of 22 million.
Calculate the % decrease in the population brought about by this epidemic. [2]

Answer .....

(ii) Suggest **two** reasons why it took a very long time for this human population to recover to its original size. [2]

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(iii) State **three** ways by which humans are able to influence human population size. [3]

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(b) The graphs below show the human population growth curve and the growth curve of a bacterial culture.

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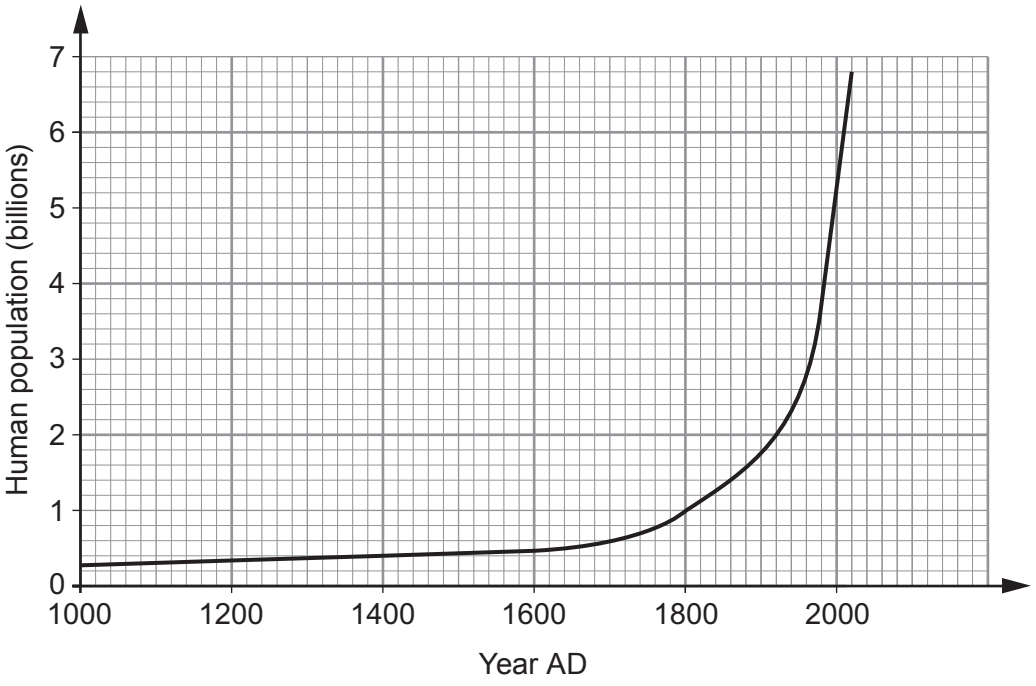
Human population curve



Bacterial population curve

Complete the table below to show **three** differences between the phases in the two population growth curves. [3]

Human population curve	Bacterial population curve

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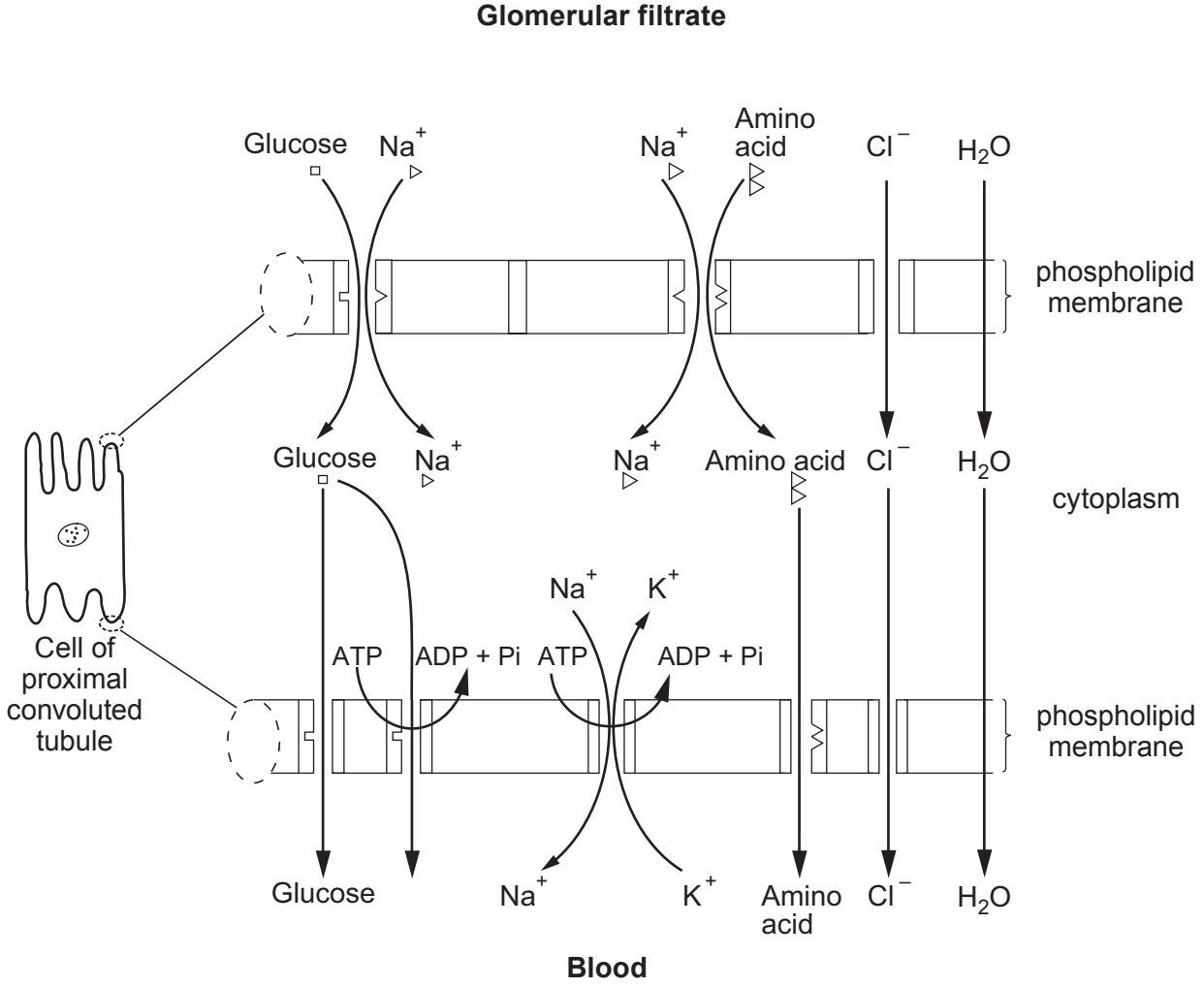
3. The diagram represents selective reabsorption by the cells of the proximal convoluted tubule in the kidney.



(a) Sodium ions are essential for the uptake of glucose and amino acids by a mechanism called co-transport. Both glucose and amino acids attach to sodium ions to move through a membrane protein. Using the information shown in the diagram, explain how the following molecules and ions are selectively reabsorbed.

(i) Chloride ions. [2]

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(ii) Water. [3]

(iii) Sodium ions. [3]

(iv) Glucose and amino acids. [3]

(b) People suffering from diseases such as cholera suffer from chronic diarrhoea which can lead to dehydration. To help prevent dehydration, water containing sodium chloride and glucose is given to the patient. Suggest why the sodium chloride and glucose improve water reabsorption by the kidneys. [3]

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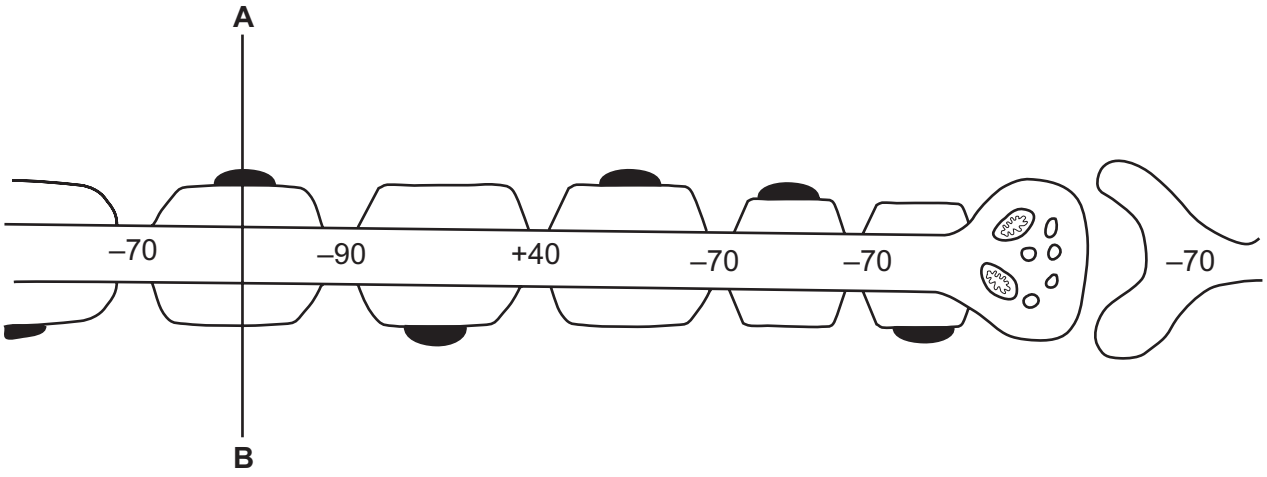
4. The diagram shows part of two nerve fibres and a synapse. The figures indicate the potential difference across the membrane between the cytoplasm of each fibre and the extracellular fluid at intervals along the fibre.



Figures represent potential difference across membrane in mV

(a) Draw a circle around **one** region of the diagram where an action potential exists. Explain your choice. [2]

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(b) Give **two** reasons shown on the diagram which would prevent the nerve impulse travelling in the opposite direction. [2]

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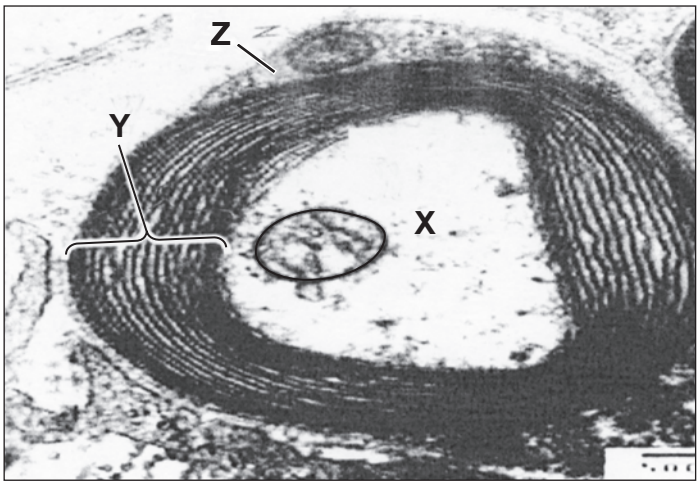
(c) The electron micrograph below shows a transverse section of the nerve fibre through **A** – **B** on the diagram on page 8.



(i) Identify cell **Z** and structures **X** and **Y**. [3]

cell **Z** .....

structure **X** .....

structure **Y** .....

(ii) Explain what would happen to the rate of transmission of the nerve impulse if structure **Y** was damaged. [2]

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Turn over.

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(d) Curare is a poisonous plant extract used by South American Indians on the tips of blowpipe arrows. It causes muscle paralysis in the victim by acting on the post synaptic membrane, preventing the transmission of the nerve impulse across a neuromuscular junction.

(i) Suggest and explain how curare may prevent the transmission of the impulse across the neuromuscular junction. [3]

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(ii) Suggest why curare has no effect on the contraction of the muscles of the heart. [1]

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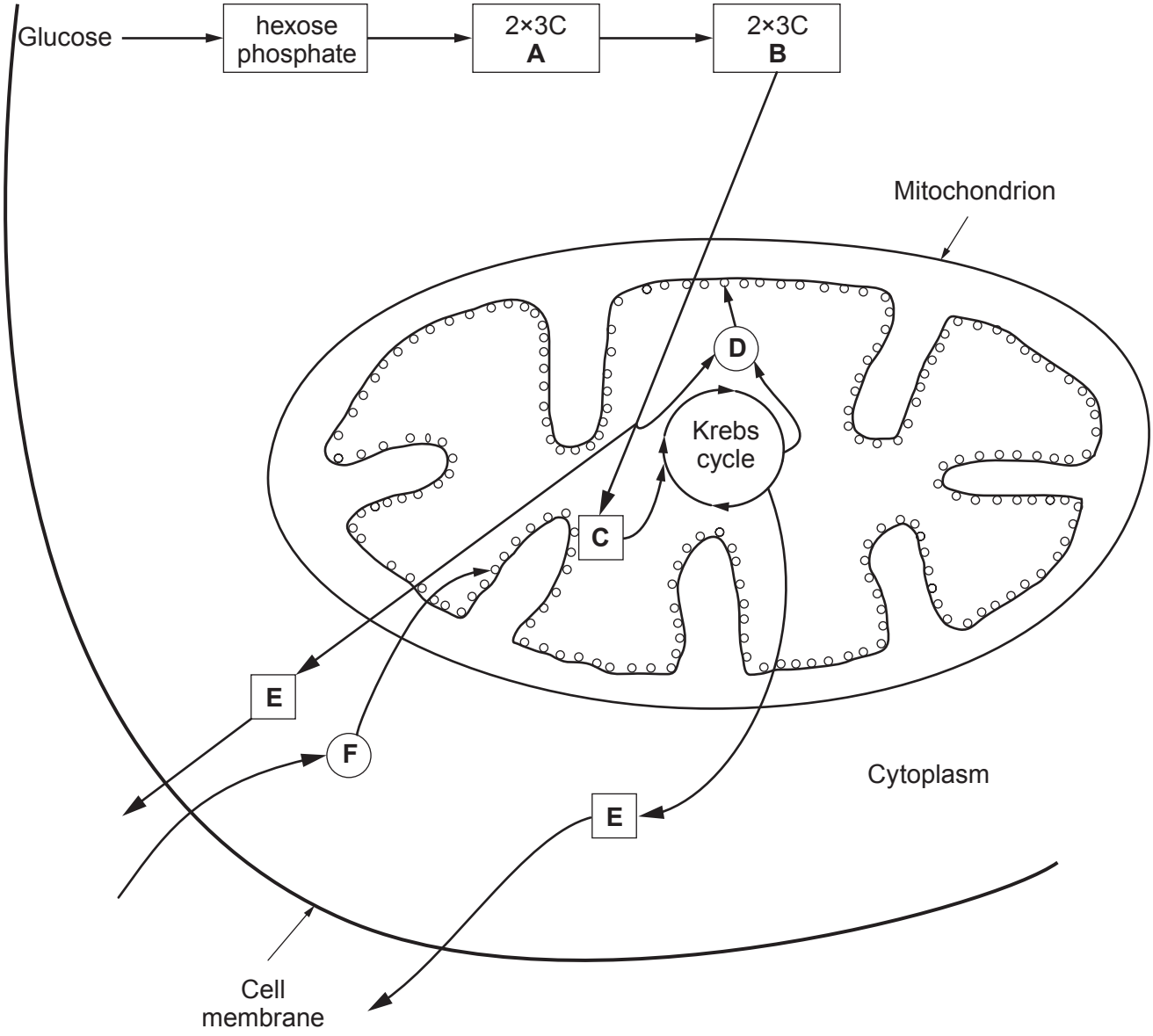
5. The diagram represents an overview of the main stages in the breakdown of a glucose molecule in a liver cell when oxygen is freely available.



(a) Identify the molecules which are represented by the boxes **A** – **F**. [6]

A .....

B .....

C .....

D .....

E .....

F .....

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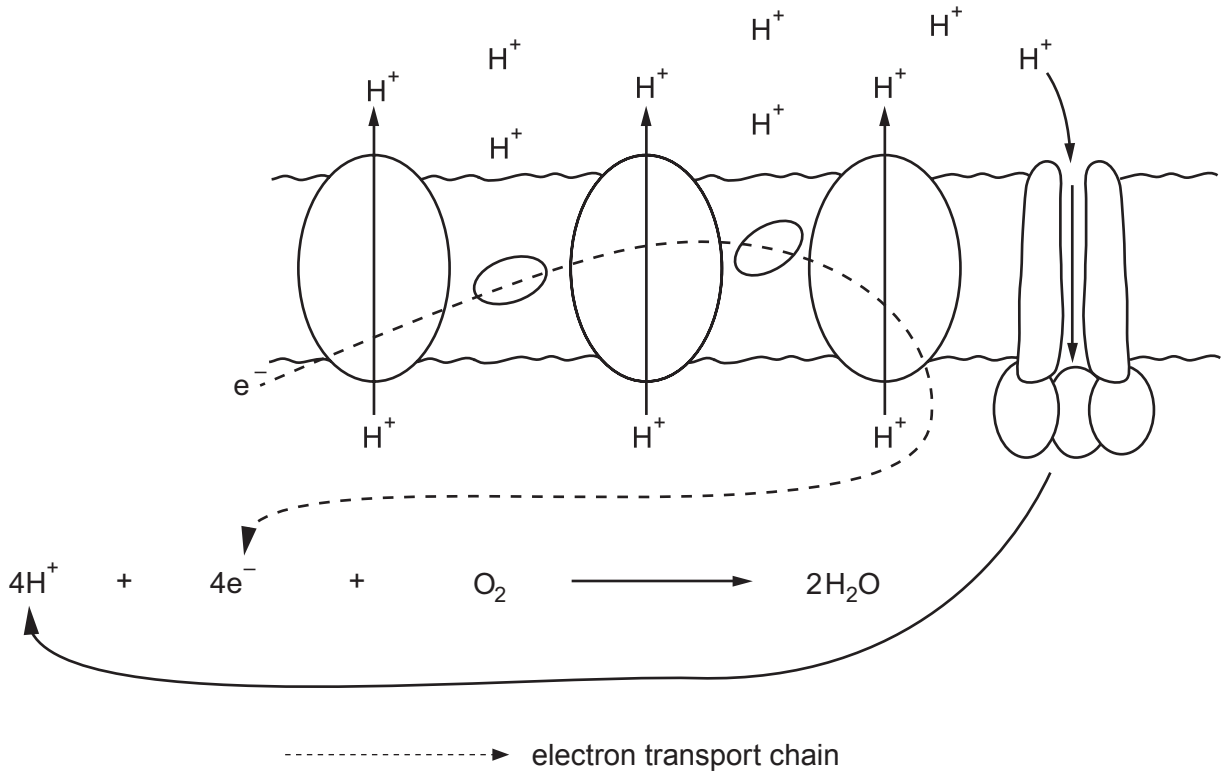
(b) The diagram below represents the electron transport chain in a liver cell.



(i) State precisely where this process takes place in the liver cell. [1]

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(ii) What is the **origin** of the electron passed along the chain? [1]

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(iii) As electrons are passed along the electron transport chain, energy is made available for the production of ATP. Using information from the diagram, explain how this energy is used to produce ATP. [5]

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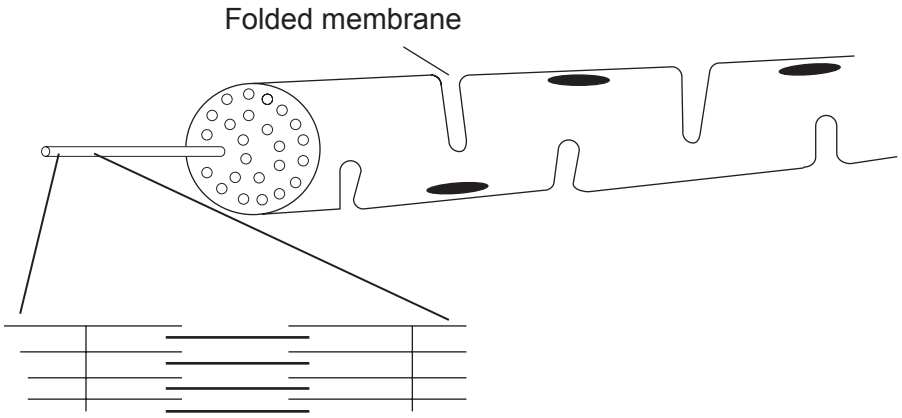
6. *(a)* The diagram represents a skeletal muscle fibre.



(i) Explain why the muscle fibre has a striated (striped) appearance when viewed using a light microscope. [1]

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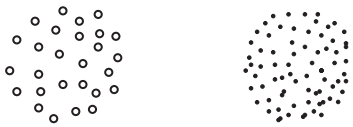
(ii) The following diagrams represent transverse sections through a sarcomere.



Name the regions through which the two sections shown above were taken. [2]

A .....

B .....

(iii) Suggest why there are folds in the membrane of the muscle fibre. [2]

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Examiner only

(b) Heart rate, lactate production and oxygen consumption are all related to the level of exercise.

(i) How does the body provide the muscle with more oxygen to meet increased oxygen consumption? [1]

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(ii) Explain the increase in lactate levels in a muscle during intense exercise. [2]

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(iii) What is the effect of the increase in lactate levels in the muscle? [1]

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(iv) Explain what will happen to the lactate made in the muscle. [2]

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(c) Suggest why during prolonged exercise, such as a marathon, the blood urea concentration increases. [2]

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7. Answer **one** of the following questions.

Either, *(a)* Kidneys can be damaged by injury or disease and this results in kidney failure.

(i) State the effects of kidney failure and describe how the condition can be treated. [7]

(ii) Describe the ethical considerations related to the treatment of kidney failure. [3]

Or, *(b)* Describe how you would estimate the numbers of pathogenic bacteria in a sample of water contaminated with sewage. [10]

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10

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