

Surname	Centre Number	Candidate Number
Other Names		2



**GCE A level**

1074/02

**HUMAN BIOLOGY – HB4**

A.M. FRIDAY, 15 June 2012

1¾ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	6	
2	6	
3	8	
4	10	
5	7	
6	9	
7	11	
8	13	
9	10	
<b>Total</b>	<b>80</b>	

**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.

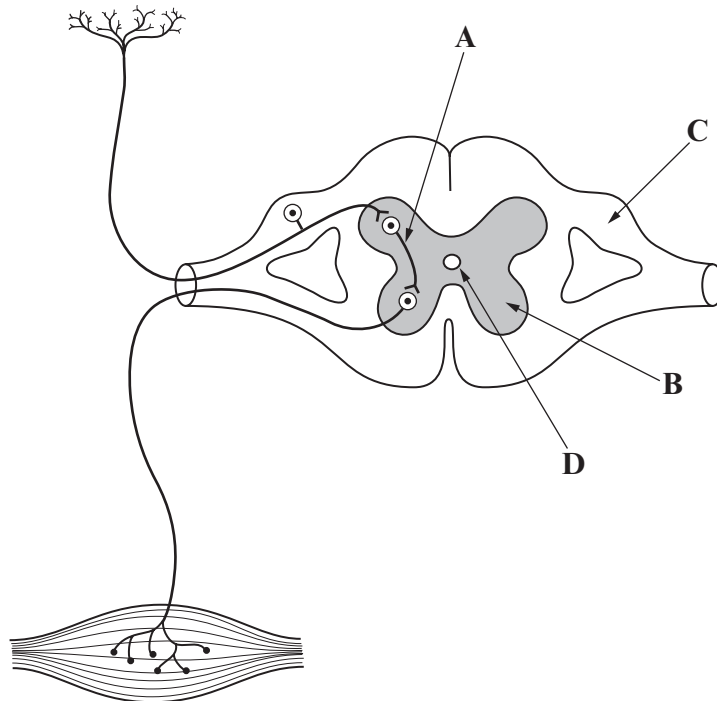
**INFORMATION FOR CANDIDATES**

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. The diagram below shows a typical reflex arc found in the mammalian nervous system.



- (a) Complete the table, naming the structures A-D.

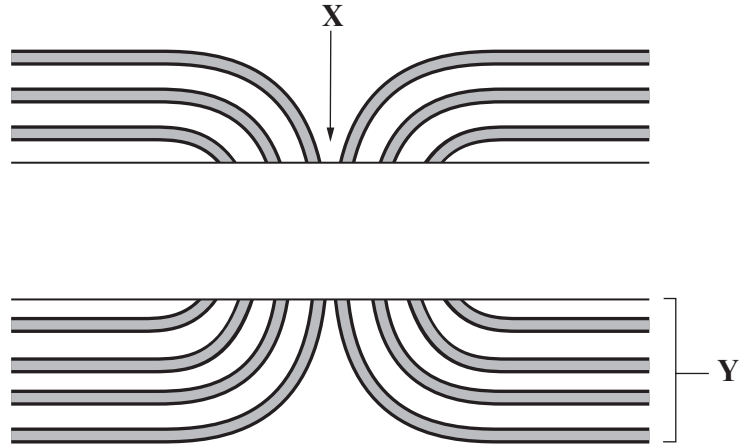
[3]

Letter	Name
A	
B	
C	
D	

- (b) Draw arrows on the sensory **and** motor neurones to show the direction of the impulse.

[1]

(c) The diagram below shows a section through a motor neurone.



(i) Name feature X.

[1]

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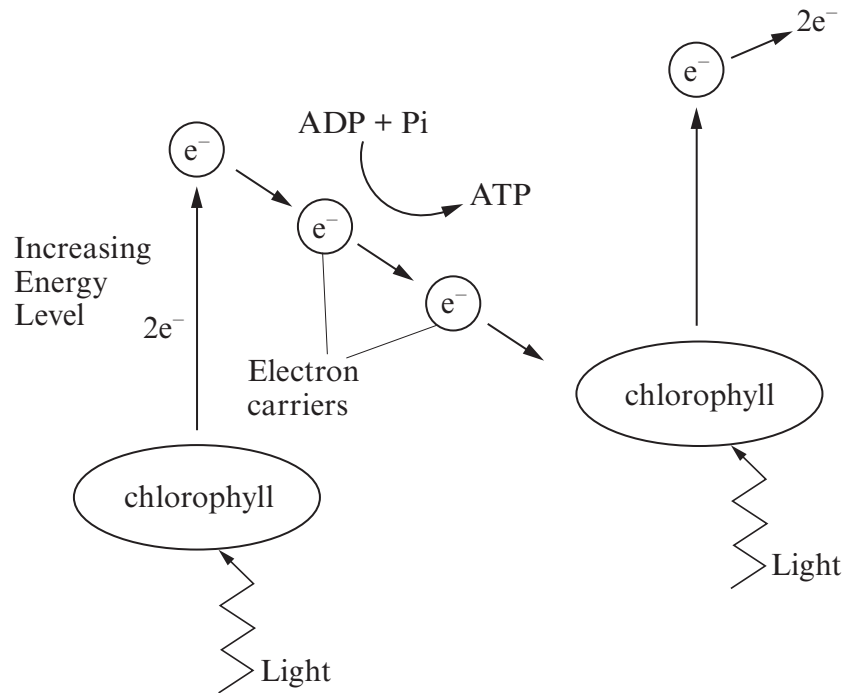
(ii) What is the function of feature Y?

[1]

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**(Total 6 marks)**

2. The diagram summarises the light dependent stage of photosynthesis.

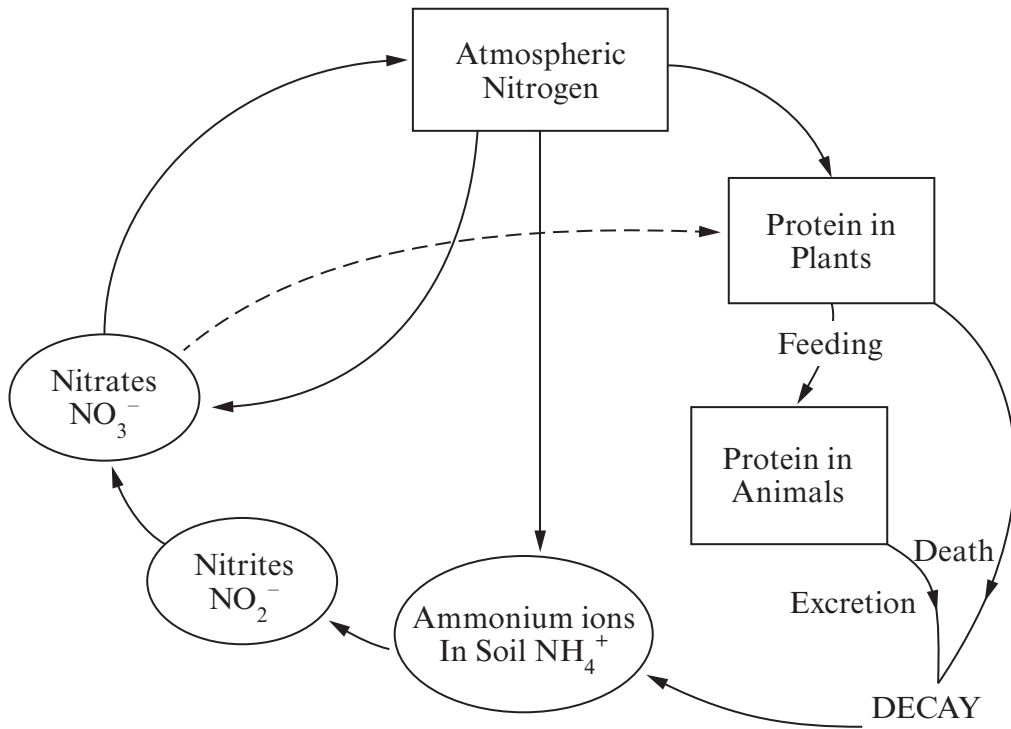


- (a) State **precisely** where the light dependent stage takes place. [1]
- .....
- (b) Name the process by which ADP is converted into ATP as shown in the diagram. [1]
- .....
- (c) Name the group of biological molecules to which ATP belongs. [1]
- .....
- (d) Explain the role of water in the light dependent stage. [3]
- .....
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**(Total 6 marks)**

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3. The following diagram shows steps in the Nitrogen Cycle.



(a) Name the **processes** by which:

(i) Ammonia is converted into nitrates by bacteria in the soil; [1]

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(ii) Nitrates are converted into atmospheric nitrogen. [1]

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(b) Describe how atmospheric nitrogen can be converted directly into nitrogen compounds for plants. [3]

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(c) Explain why farmers regularly plough their fields to improve the nitrogen content of the soil. [3]

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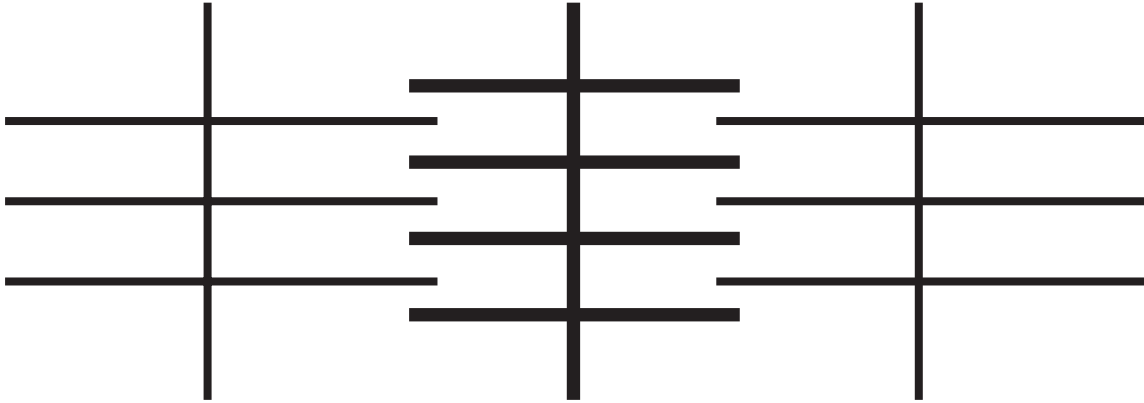
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**(Total 8 Marks)**

4. The following diagram shows a section through skeletal muscle.



(a) Label the diagram above to clearly show:

(i) M line

(ii) Z line

(iii) I band

(iv) **One** sarcomere

[3]

(b) In the space below draw the muscle section shown above as it would appear following contraction, clearly labelling the actin **and** myosin filaments.

[3]



(c) Describe **two** differences between slow twitch and fast twitch muscle fibres. [2]

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(d) The type of training used by marathon runners has been shown to increase the relative proportions of slow twitch fibres. State **one other** change that occurs in muscles during endurance training and explain the benefit to a marathon runner. [2]

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**(Total 10 Marks)**

5. In order to identify bacteria, a student transferred a sample of bacteria from a liquid culture to a glass slide using aseptic technique.

(a) Describe the precautions the student should have taken to ensure the process was carried out aseptically. [2]

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(b) The student used the Gram stain to view the bacteria under a light microscope. The bacteria were all spherical in shape but some appeared purple, others pink.

(i) Identify **precisely** the type of bacteria viewed which retained the purple stain. [2]

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(ii) Explain why some bacteria stained purple whilst others stained pink. [3]

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**(Total 7 Marks)**

6. Aerobic respiration occurs in a number of stages.

(a) Complete the table using a tick (✓) to indicate which statements apply to the following stages in respiration, or a cross (X) if they do not. [4]

<i>Statement</i>	<i>Glycolysis</i>	<i>Link reaction</i>	<i>Krebs Cycle</i>	<i>Electron Transport Chain</i>
Occurs in the mitochondrial matrix				
ATP produced by substrate level phosphorylation				
FAD reduced				
NADH <sub>2</sub> oxidised				

(b) Explain the role of ATP in glycolysis. [3]

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(c) During strenuous exercise muscles may temporarily respire anaerobically. Explain why it is important for the muscles of an athlete to convert pyruvate into lactate (lactic acid). [2]

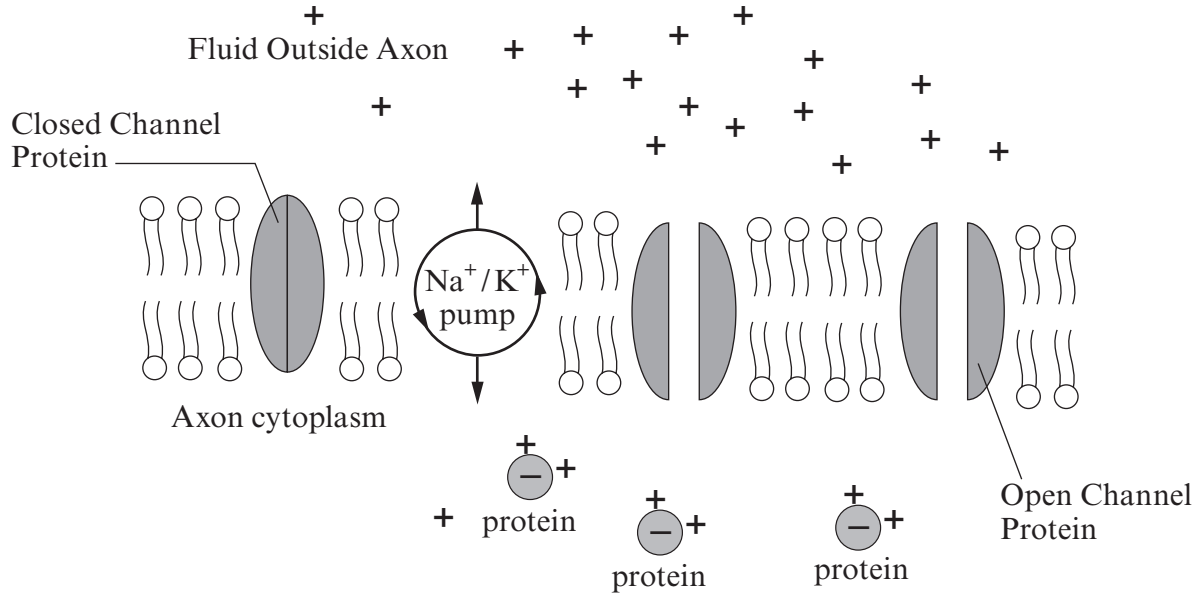
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**(Total 9 Marks)**

7. The following diagram shows how the resting potential is maintained across a neurone membrane.



- (a) Describe what is meant by the term *resting potential*. [2]

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- (b) Explain how the resting potential is maintained across a neurone. [3]

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- (c) Demyelination is the loss of the myelin sheath, which occurs in some neurodegenerative autoimmune diseases, including multiple sclerosis. This condition damages the myelin sheath of neurones in the brain, spinal cord and optical nerves. The reaction times of Multiple Sclerosis sufferers were compared with healthy individuals, together with the percentage of correct responses to a visual stimulus. The results are shown below;

<i>Group</i>	<i>Reaction time / ms</i>	<i>Correct responses / %</i>
Multiple Sclerosis Sufferers	549	81
Control group (Healthy)	443	96

Adapted from Gonzalez-Rosa et al. BMC Neuroscience 2006 7:39

- (i) Calculate the percentage increase in reaction time of a person with multiple sclerosis compared to a healthy individual. Show your working. [2]

Answer .....

- (ii) Explain the difference in the reaction time results seen. [3]

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- (d) Suggest a reason for decreased correct responses in Multiple Sclerosis sufferers. [1]

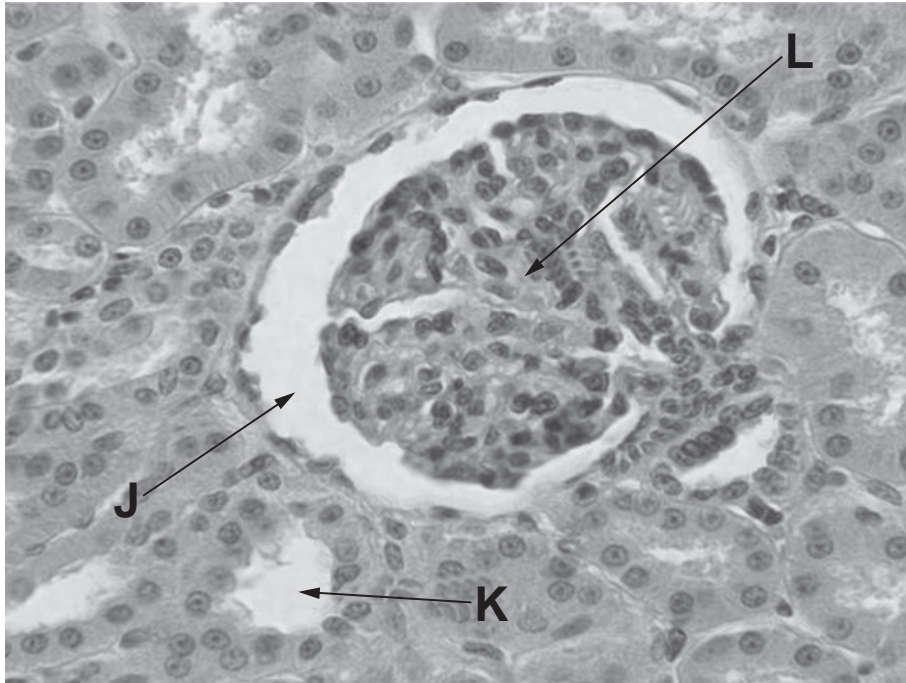
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**(Total 11 Marks)**

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8. The photograph below shows a high power light microscope image of a transverse section from part of the mammalian kidney.



- (a) Name the part of the kidney from which the specimen was taken. [1]

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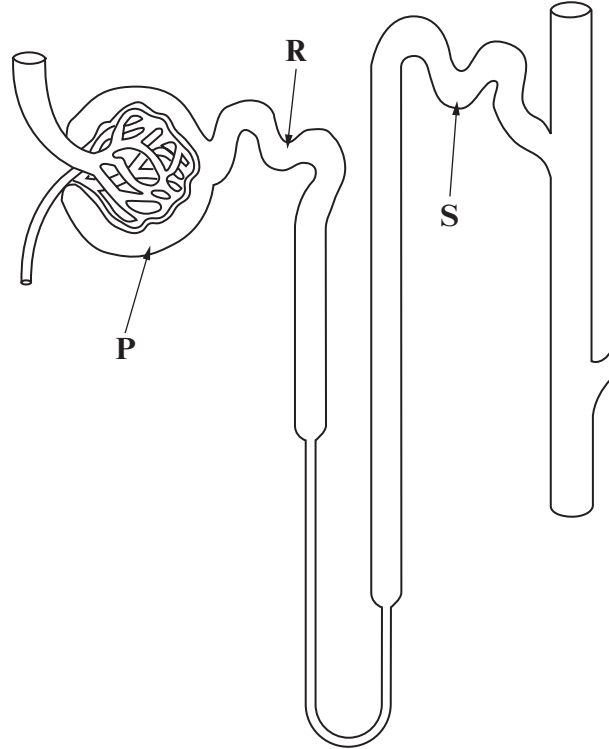
- (b) Identify the **three** structures labelled **J**, **K** and **L** that are visible in the photograph. [2]

**J** .....

**K** .....

**L** .....

- (c) The table below shows the typical concentrations of three solutes (glucose, urea and sodium ions) in three different regions of the kidney nephron, labelled **P**, **R** and **S**, in the diagram below.



<i>Solute</i>	<i>Mean concentration of solute / g dm<sup>-3</sup></i>		
	<b>P</b>	<b>R</b>	<b>S</b>
<i>Glucose</i>	<i>0.12</i>	<i>0.00</i>	<i>0.00</i>
<i>Urea</i>	<i>0.35</i>	<i>0.65</i>	<i>6.25</i>
<i>Sodium ions</i>	<i>0.28</i>	<i>0.28</i>	<i>0.02</i>

- (i) Explain how cells lining region **R** are adapted to reabsorb glucose. [4]

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- (ii) Explain how the change in concentration of urea is brought about between regions **P** and **R**. [2]

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- (iii) The concentration of urea in the urine of an athlete varied over a weekly period between  $2 \text{ g dm}^{-3}$  and  $12 \text{ g dm}^{-3}$ . Suggest a possible explanation for;

I. a low concentration of urea; [1]

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II. a high concentration of urea. [1]

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- (d) Suggest why cells in region **S** can often become damaged in diabetic patients with high blood glucose levels. [2]

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**(Total 13 Marks)**



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