

Surname	Centre Number	Candidate Number
Other Names		2



GCE A level

1074/02

HUMAN BIOLOGY – HB4

P.M. FRIDAY, 13 June 2014

1 hour 45 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	8	
2.	12	
3.	12	
4.	12	
5.	10	
6.	16	
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.

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Answer all questions.

1. Use your biological knowledge to explain the following :

(a) People suffering from motor neurone disease develop wasting, weakness and cramps of muscles but there is no loss of feeling from the affected areas. [1]

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(b) The symptoms of Parkinson's disease can be treated using drugs containing synthetic neurotransmitters. [1]

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(c) Suggest why people with hypertension have an increased risk of suffering a stroke (cerebro vascular accident). [1]

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(d) Bacteria cultured on agar plates in the school laboratory should not be cultured at a temperature of 37°C. [1]

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(e) Aseptic conditions are maintained in industrial fermenters. [1]

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(f) A constant pH is maintained in industrial fermentation. [1]

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(g) Many psychoactive drugs can cause hallucinations. [1]

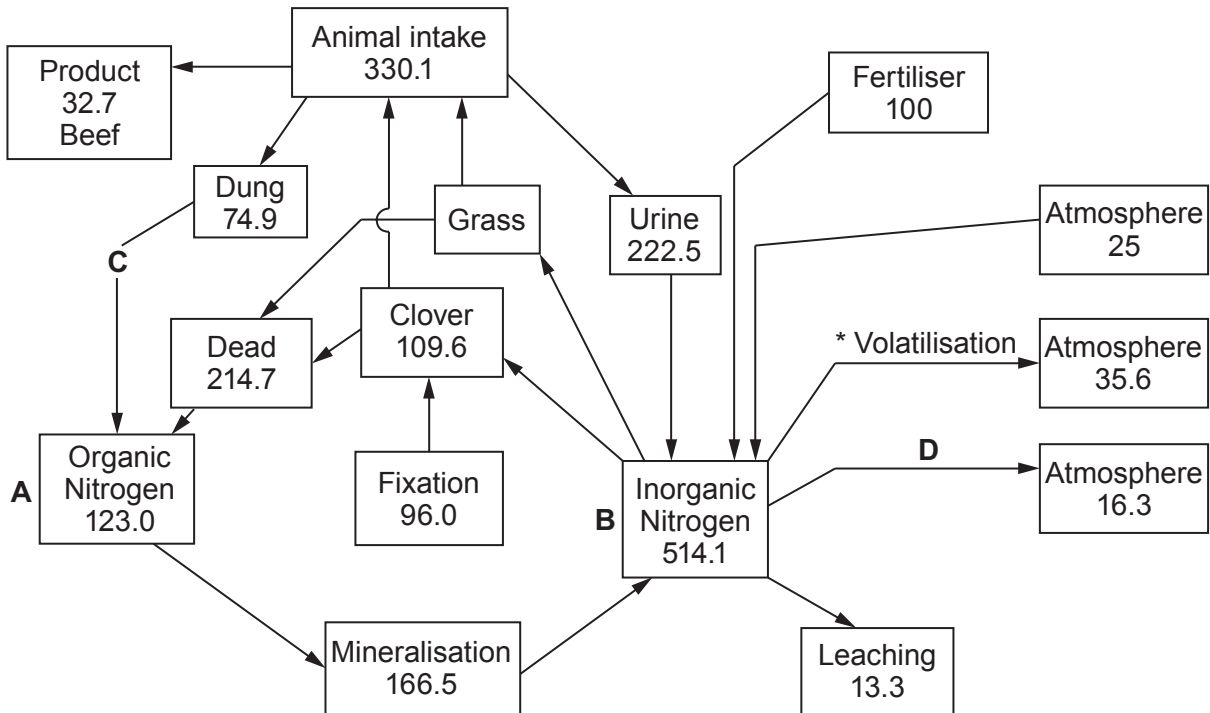
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(h) Suggest why some bacteria are initially Gram positive but as they age become Gram negative. [1]

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2. Computer modelling is being used increasingly to represent aspects of the nitrogen cycle. One programme describes the annual flow of nitrogen in grazed grassland.



Annual flow of nitrogen through the nitrogen cycle (kg/ha)

* The term volatilisation is the natural loss of ammonia gas derived from faeces and urine to the atmosphere.

- (a) (i) Give **one** example of an organic nitrogen compound and **one** example of an inorganic form of nitrogen which could be referred to in boxes **A** and **B**. [1]

Organic

Inorganic

- (ii) Name the process referred to by arrows **C** and **D**. [2]

C

D

(iii) Explain **one** way by which the farmer could decrease the effect of process **D**. [2]

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(iv) Clover has bacteria living in root nodules.

I. Name the genus of these bacteria. [1]

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II. State how these bacteria increase the availability of compounds of nitrogen in the soil. [3]

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(b) Calculate the annual mass of nitrogen flowing into clover from inorganic nitrogen. [1]

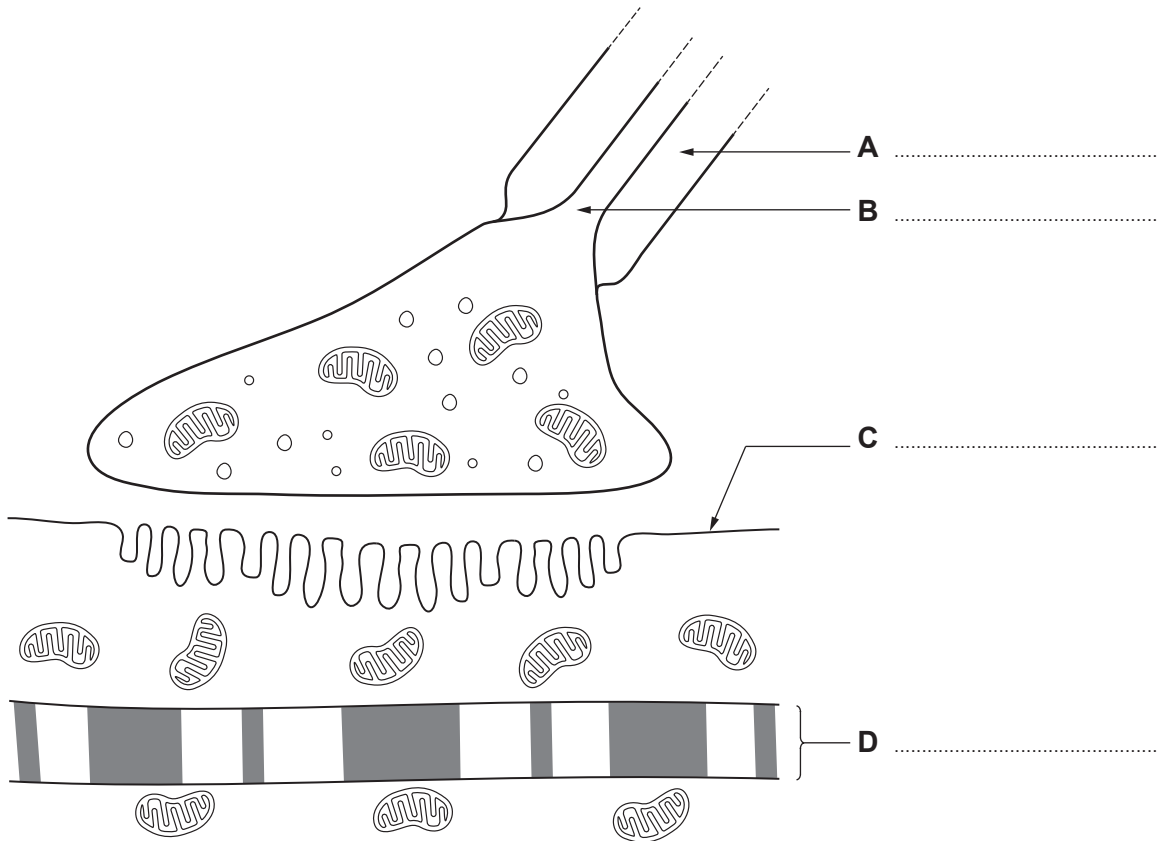
Answer = kg/ha

(c) The average application of nitrogen to fields growing wheat in the UK is 190kg/ha. Dairy grassland farmers need to add less (about 170kg/ha). Suggest **two** reasons to account for the difference. [2]

1.

2.

3. (a) The following diagram represents a neuromuscular junction.



(i) Label structures **A – D** on the diagram above. [4]

(ii) Describe the events which normally occur between the arrival of an action potential at the synaptic knob and its transmission across a neuromuscular junction. [5]

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(b) Botulinum toxin is a poison produced by the bacterium *Clostridium botulinum*. It is responsible for a condition called botulism, associated with spoiled canned food. Botulinum toxin causes muscular paralysis but it can be used as an injectable medication for the treatment of facial wrinkles (botox treatment). The toxin attacks a protein in the membrane of the synaptic vesicles preventing them fusing with the presynaptic membrane at a neuromuscular junction.

(i) Suggest how botulinum toxin leads to muscular paralysis. [2]

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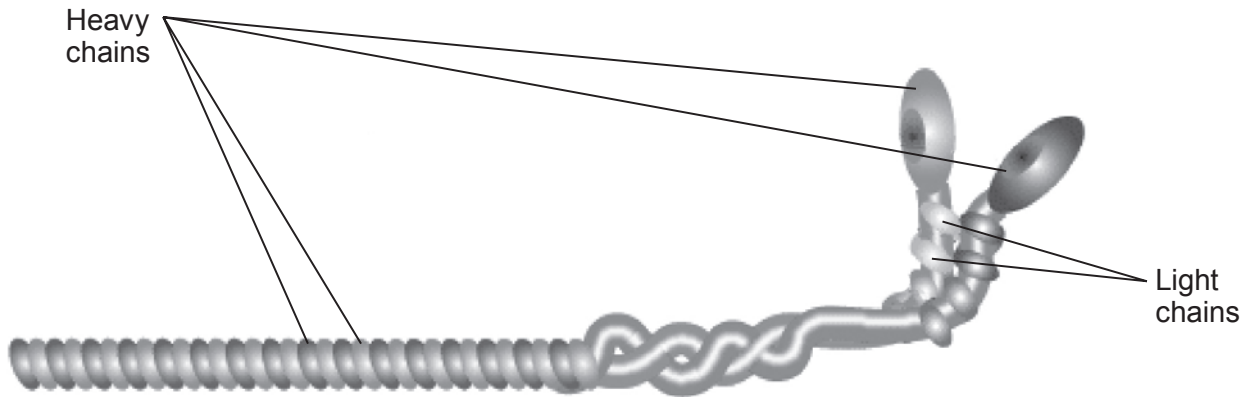
(ii) The effect of botox treatment can wear off over weeks to months. Suggest **one** reason which would lead to this loss of effect. [1]

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4. The A band in a sarcomere is made from many thousands of protein molecules called myosin. The structure of one myosin molecule is shown in the diagram below.



- (a) (i) State what is meant by the term '*primary structure*' of a protein. [1]

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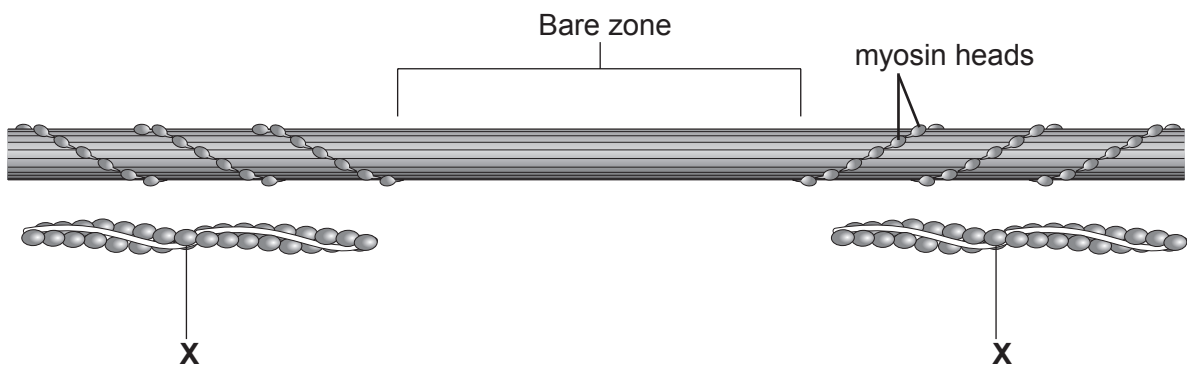
- (ii) The myosin molecule has a quaternary structure. State what is meant by the term '*quaternary structure*'. [1]

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- (b) The myosin molecules are arranged as shown in the diagram below with the heads projecting to the outside.



- (i) State the name of the protein **X** shown in the diagram above. [1]

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- (ii) Draw arrows on the diagram to show the direction of movement of protein **X** when contraction of the muscle takes place. [1]

(iii) The myosin head is a site of the hydrolysis of ATP. What are the products of this hydrolysis? [1]

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(iv) Explain how the myosin molecules and protein X move past each other. [3]

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

Slow twitch muscles	Fast twitch muscles

5. (a) Skeletal muscle fibres can respire aerobically and anaerobically.

(i) State precisely where in a muscle fibre aerobic respiration and anaerobic respiration take place. [1]

Aerobic

Anaerobic

(ii) State when a muscle fibre would respire anaerobically. [1]

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(b) (i) Describe the process by which lactic acid (lactate) is produced in muscle fibres. [4]

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(ii) Suggest why the lactic acid is removed from the muscle fibre. [1]

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(c) What is meant by the term 'oxygen debt'? [1]

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(d) Other organisms can respire anaerobically. What are the terms used to describe the following? [2]

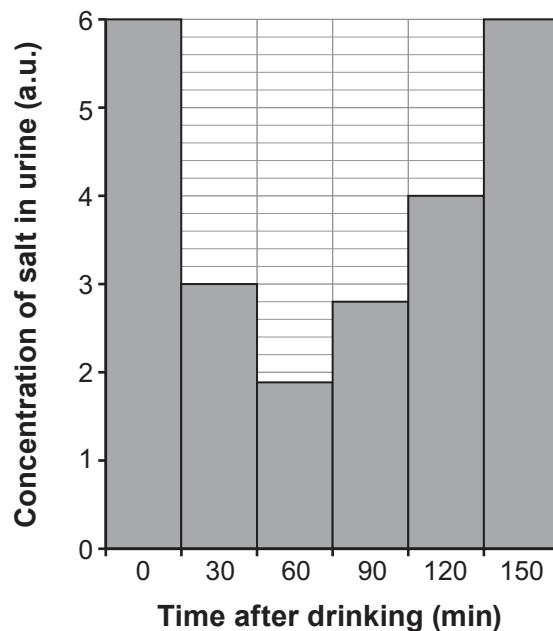
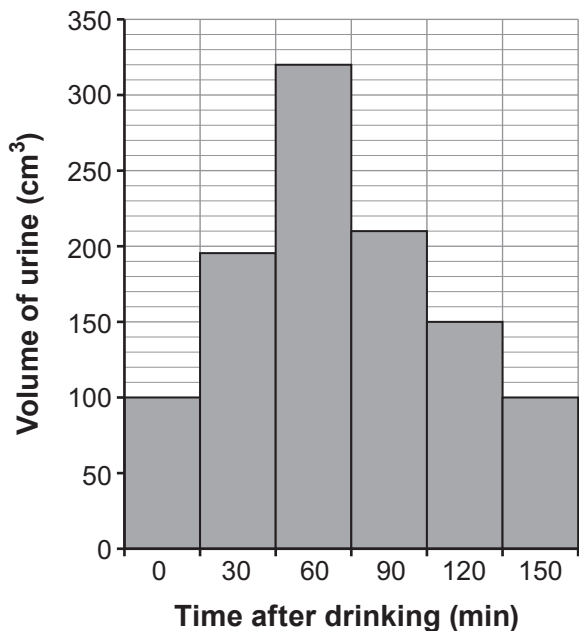
I. bacteria which only survive in the absence of oxygen

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II. bacteria which grow in the presence or absence of oxygen

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6. A student gave a sample of urine and then drank 1000 cm^3 of distilled water rapidly. Urine was then collected at regular intervals and measurements made of the volume of each sample and its salt concentration. The results are shown on the following graphs.



- (a) (i) Using your knowledge of osmoregulation, explain the change in the volume of urine between 0 - 60 minutes. [4]

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- (ii) Explain the change of concentration of salt in the urine between 0 and 60 minutes. [1]

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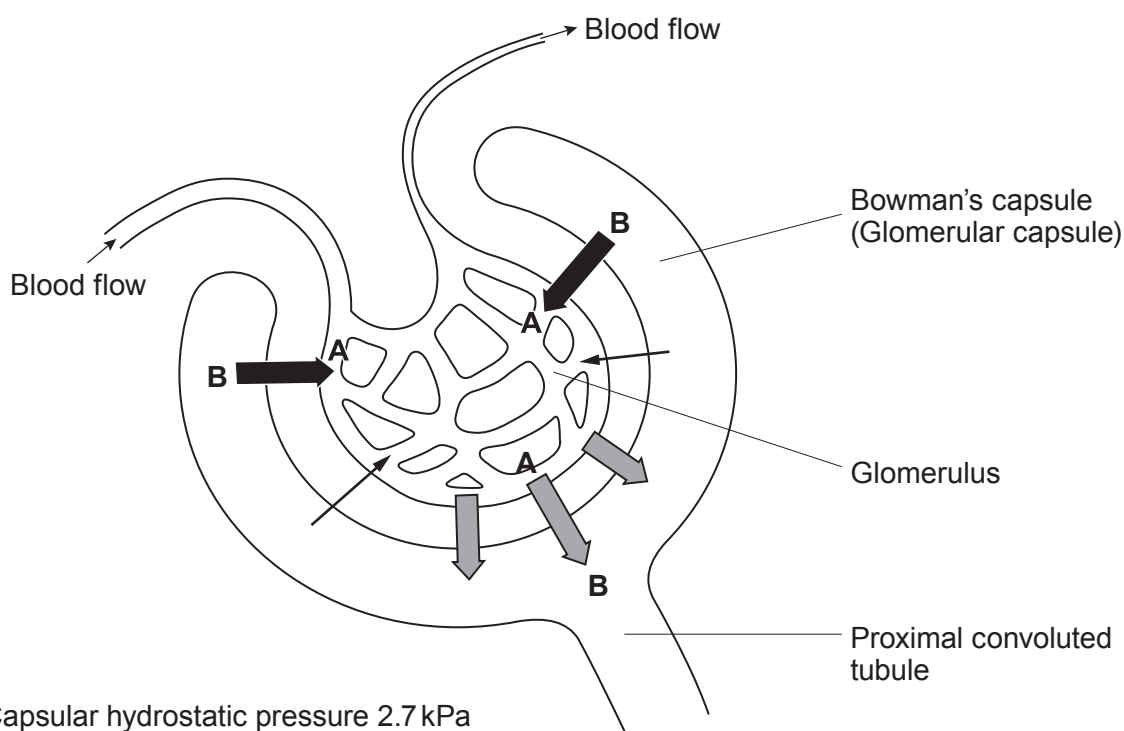
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- (iii) State **two** variables which would need to be considered when comparing results from a number of people who had drunk similar volumes of water. [2]

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(b) The diagram below represents part of a kidney nephron showing a glomerulus and Bowman's capsule.



- Capsular hydrostatic pressure 2.7 kPa
- Blood colloid osmotic pressure 4 kPa
- Glomerular (blood) hydrostatic pressure 10 kPa

(i) Explain how the high hydrostatic pressure (10 kPa) is achieved in the glomerulus. [1]

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(ii) Suggest which type of organic molecule in the blood is responsible for maintaining the blood osmotic pressure at 4 kPa. [1]

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(iii) The net movement of water is from A to B. Explain the process by which **some** water molecules will move from B to A. [2]

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- (iv) The net filtration pressure is the overall pressure responsible for ultrafiltration. From the data shown on the diagram calculate this value. Show your working include units with your answer. [2]

Answer

- (c) There is a feedback system in the kidneys which maintains the hydrostatic pressure in the glomerulus at a constant level despite changes in the arterial blood pressure. The regulatory mechanism involves the contraction of the circular muscles in the afferent arteriole.

- (i) Explain how this prevents changes in the hydrostatic pressure in the glomerulus. [2]

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- (ii) Suggest what would happen in the body if the arterial blood pressure increased and the feedback system in the kidney described did not function. [1]

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