

Candidate Name	Centre Number	Candidate Number
		2



GCE A level

1074/02

HUMAN BIOLOGY – HB4

P.M. MONDAY, 24 January 2011

1³/₄ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	5	
2	8	
3	16	
4	12	
5	6	
6	17	
7	6	
8	10	
Total	80	

1074/02/0001

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 following list of terms refers to the nitrogen cycle.

A	legume
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B	nitrogen fixation
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C	denitrification
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D	<i>Nitrobacter</i>
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E	nitrification
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F	putrefaction
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G	<i>Nitrosomonas</i>
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H	ploughing
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I	<i>Rhizobium</i>
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Below are five statements. Select from the above list the **letter** for the appropriate term that matches the statement. [5]

- (i) The conversion of ammonium ions to nitrate ions.
- (ii) A means of improving the aeration of the soil.
- (iii) The decomposition of dead plants and animals.
- (iv) The conversion of atmospheric nitrogen into nitrogen compounds.
- (v) A bacterium found in the root nodules of clover.

(Total 5 marks)

2. *Staphylococcus aureus* is a Gram positive, facultative anaerobe. It is the cause of various diseases including blood poisoning and food poisoning.

(a) (i) What shape are the cells of *Staphylococcus aureus*? [1]

.....

(ii) The bacterium is described as ‘Gram positive’. What does this mean in relation to the structure of its cell wall? [2]

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.....
.....
.....

(iii) What is meant by the term ‘facultative anaerobe’? [1]

.....
.....

(b) In order to monitor the population growth of bacteria, a number of different methods may be used. One method is to use a **viable** count.

(i) What assumption must be made when using this method? [1]

.....
.....

(ii) State **one** limitation of using this method. [1]

.....
.....

(c) Another method uses a **total** count. Suggest why this method gives a higher estimate of the population than the viable count. [1]

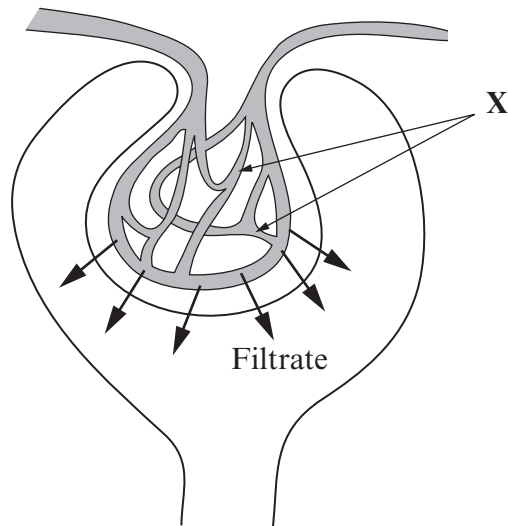
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(d) In both the above cases the original culture requires a procedure in order to provide a final number within a countable range. Name this procedure. [1]

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(Total 8 marks)

3. The diagram shows part of a kidney tubule or nephron.



(a) (i) Name the network of capillaries labelled **X**. [1]

.....

(ii) Apart from water and glucose, name **two** substances which will be present in the filtrate. [1]

.....

(iii) Name the process that separates these molecules from the blood plasma. [1]

.....

(iv) The filtration rate is the total volume of filtrate formed per minute.
Explain the effect of a large loss of blood from the body on the filtration rate. [2]

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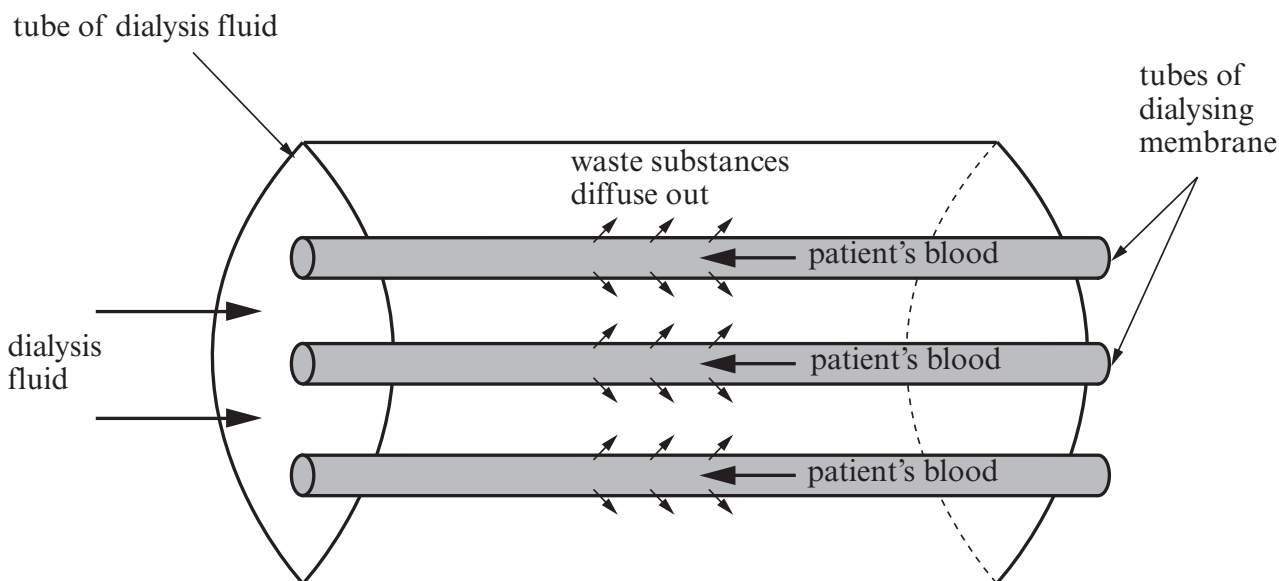
(b) (i) Selective reabsorption occurs in the proximal convoluted tubule. Describe **two** ways in which the cells of the proximal convoluted tubule are adapted for reabsorption. [2]

1.

2.

- (ii) Much of the water in the kidney filtrate is reabsorbed from the collecting duct. Name the part of the nephron which provides the osmotic gradient for reabsorption. [1]
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- (c) (i) With reference to the diagram below, explain the principle of dialysis as used in kidney machines. [4]



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.....

- (ii) Suggest what would happen if the glucose concentration of the dialysis fluid were to be a **lower** concentration than in the patient's blood. [1]
-

- (iii) State **one** advantage of providing patients with transplanted kidneys compared with providing them with kidney dialysis machines. [1]
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- (iv) State **two** problems associated with kidney transplants. [2]

1.

2.

(Total 16 marks)

4. (a) Describe the reactions that link glycolysis to the Krebs cycle. [3]

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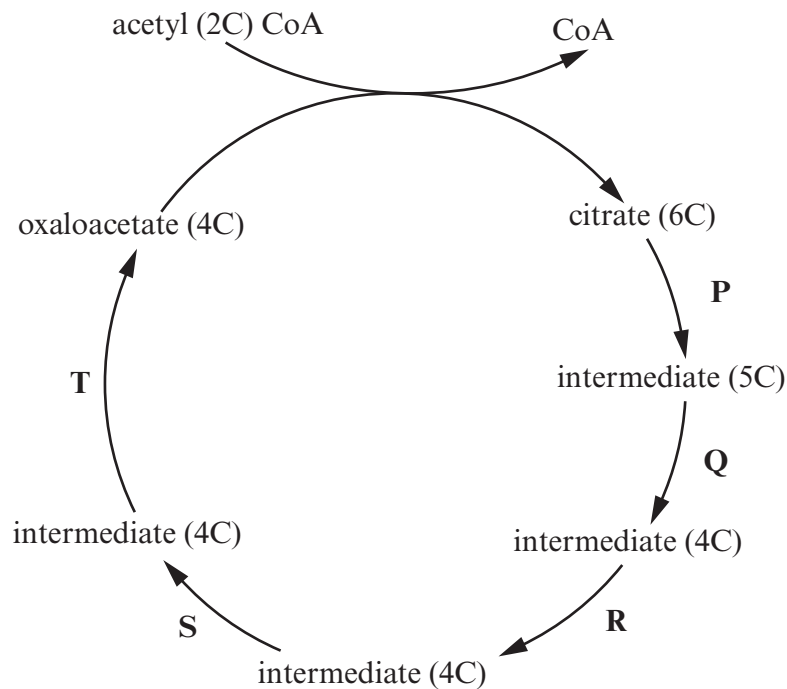
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- (b) Where precisely in the cell does each of the following occur? [2]

(i) Glycolysis

(ii) Krebs cycle

- (c) The diagram shows an outline of the Krebs cycle.



A two carbon acetyl group enters the cycle by combining with a molecule of oxaloacetate (4C) with the formation of a molecule of citrate (6C). This is then decarboxylated and dehydrogenated to regenerate the oxaloacetate.

- (i) Explain the following terms. [2]

I Decarboxylation

.....

II Dehydrogenation

.....

- (ii) State the **letters** showing the individual steps in the cycle where decarboxylation is taking place. [1]
-

(d) ATP is made directly by substrate level phosphorylation in the Krebs cycle.

- (i) State the number of ATP molecules that are made directly **per 'turn'** of the cycle. [1]
-

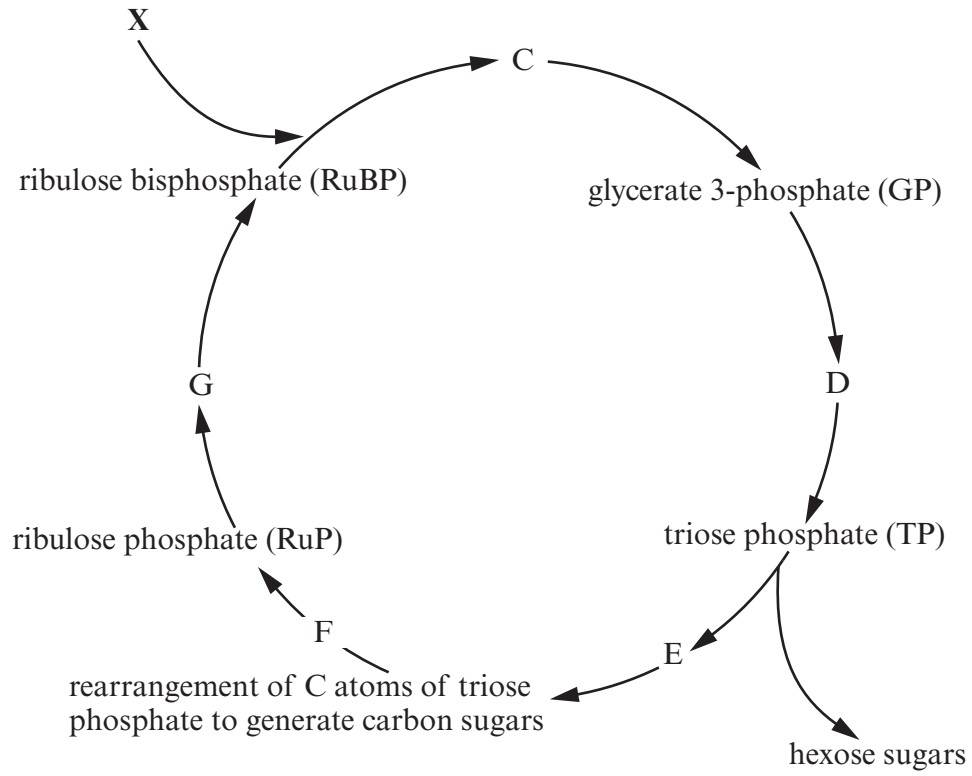
- (ii) Complete the table to show the number of ATP molecules that are made in the electron transport chain **per 'turn'** of the cycle. [2]

	<i>In the link reaction using NADH</i>	<i>In the Krebs cycle using NADH</i>	<i>In the Krebs Cycle using FADH</i>
Number of molecules of ATP formed			

- (iii) Explain why the two hydrogen acceptors NAD and FAD lead to the production of different numbers of ATP molecules. [1]
-
-

(Total 12 marks)

5. The diagram summarises the light independent reactions of photosynthesis (Calvin cycle).



- (a) Name the molecule which enters the cycle at point X. [1]

.....

- (b) State the **two** products of the light dependent stage of photosynthesis that are required in the Calvin cycle. [2]

.....

.....

- (c) Using the above diagram, give the letters of the two steps where the chemicals named in (b) are required. [2]

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- (d) State **one** possible fate of the hexose sugars produced. [1]

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(Total 6 marks)

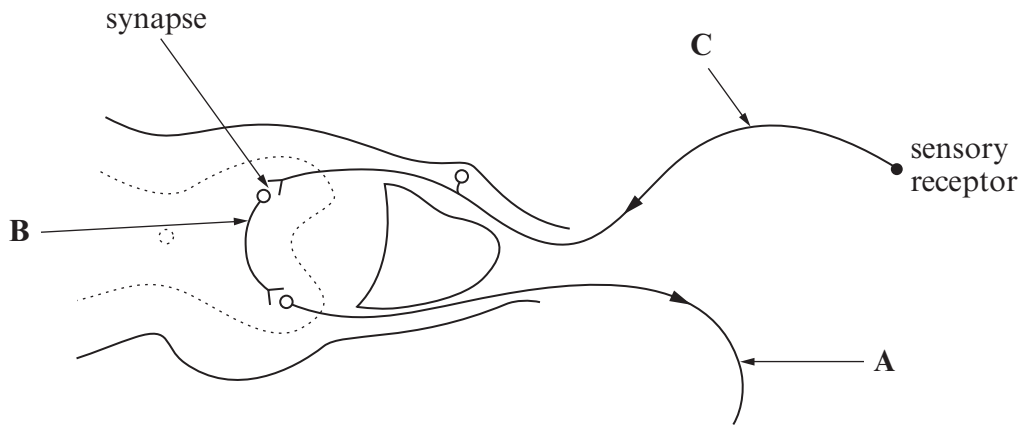
6. (a) What is a reflex action?

[2]

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.....

(b) The diagram shows the neurones in a reflex arc.



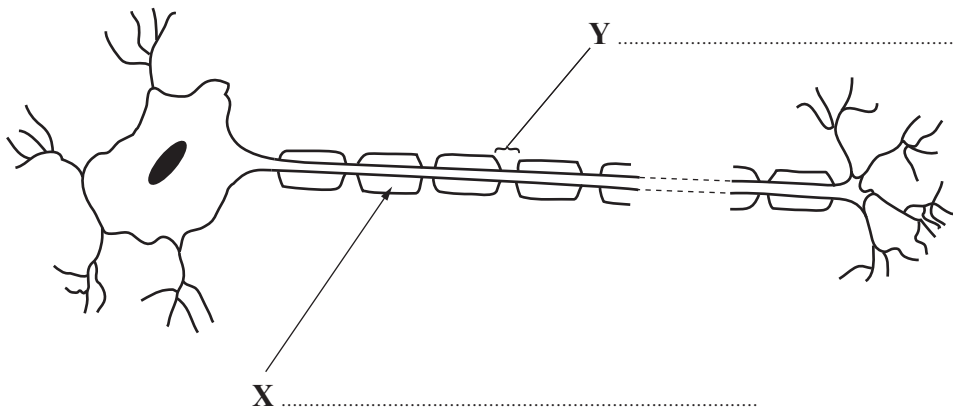
Name the types of neurone labelled **A**, **B** and **C**.

[1]

- A**
- B**
- C**

(c) The diagram below represents a neurone. On the diagram, label the structures **X** and **Y**.

[2]



(d) (i) Describe how a resting potential is maintained in a neurone. [2]

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.....

.....

(ii) Describe how the potential across the membrane is reversed when an action potential is produced. [2]

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(e) One symptom of Alzheimer's disease is a reduction in the level of an enzyme in the brain that synthesises acetylcholine.

(i) Describe the function of acetylcholine at a synapse. [5]

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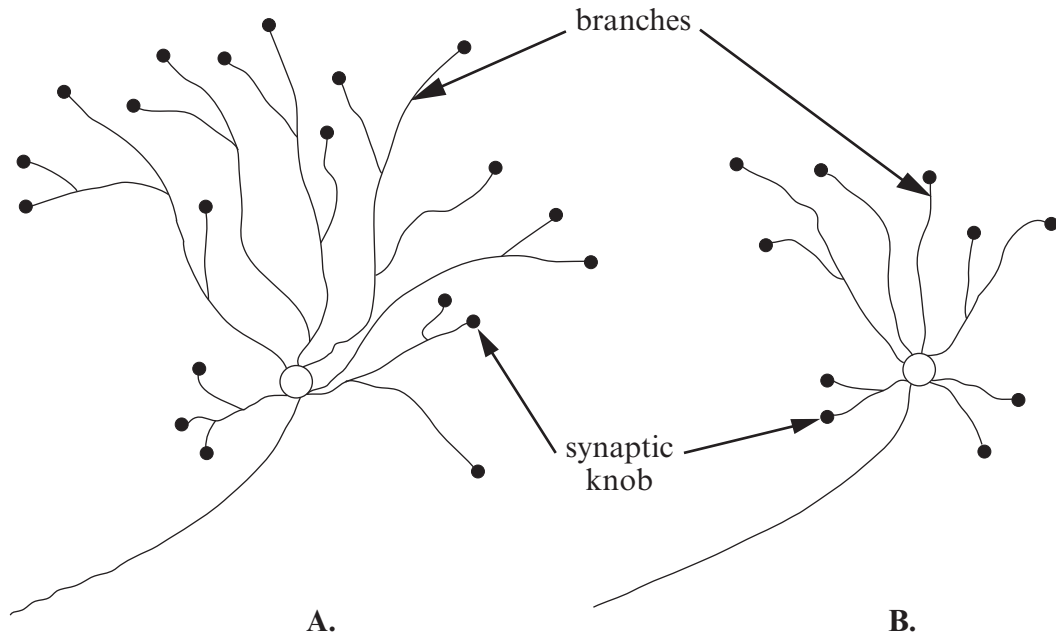
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The diagram below shows neurones from the brains of a healthy 70 year old, **A**, and a 70 year old with Alzheimer's disease, **B**.



(ii) State **two** differences between the neurones shown in the diagram. [2]

- 1.
- 2.

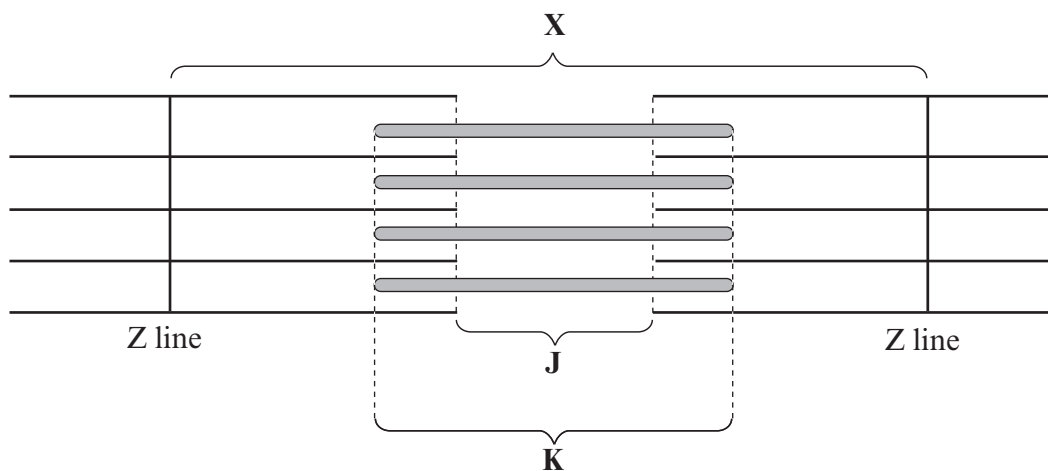
(iii) Suggest how **one** of the differences could account for the reduction in acetylcholine in a patient with Alzheimer's disease. [1]

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(Total 17 marks)

7. The diagram shows the arrangement of protein filaments in a muscle myofibril.



(a) (i) Name the functional sub-unit of a muscle myofibril labelled **X** in the diagram. [1]

.....

(ii) Name the regions labelled **J** and **K** on the diagram. [1]

J

K

(iii) If the muscle fibre contracted, how would the appearance of regions **J** and **K** compare with the diagram? [1]

.....

(b) With reference to the proteins actin and myosin, describe the changes that can be seen when the myofibril contracts? [3]

.....

(Total 6 marks)

