

Surname	Centre Number	Candidate Number
Other Names		2



GCE A level

1074/01

BIOLOGY – BY4

P.M. FRIDAY, 13 June 2014

1 hour 45 minutes

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

Answer all questions.

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1. **Nitrogenases** are enzymes used by some organisms to fix atmospheric nitrogen gas (N_2) into a form of nitrogen available to plants.

The **nif gene** is the gene coding for the synthesis of nitrogenases, found in nitrogen fixing bacteria.

Rhizobium is a mutualistic nitrogen fixing bacteria forming a relationship with legume species. In some species of *Rhizobium*, the nif genes are located on plasmids.

- (a) Name the *form* of nitrogen produced by *Rhizobium* that is '*available to plants*'. [1]

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- (b) Name *another* genus of nitrogen fixing bacteria. [1]

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- (c) State *precisely* where *Rhizobium* would be found in the legume. [1]

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- (d) Suggest how the relationship between *Rhizobium* and a legume species is beneficial to **both** organisms. [2]

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- (e) What are *plasmids*? [1]

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2. (a) Define the following terms with reference to bacterial growth. [3]

(i) obligate aerobe

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(ii) obligate anaerobe

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(iii) facultative anaerobe

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(b) Describe and explain the appearance of Gram positive and Gram negative bacteria following Gram staining. [3]

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(c) Most pathogens in humans are Gram-positive organisms. Six Gram-positive genera are typically pathogenic in humans. Two of these, *Streptococcus* and *Staphylococcus*, are cocci. The remaining organisms are bacilli.

What **three dimensional shape** would the cocci and bacilli be? [1]

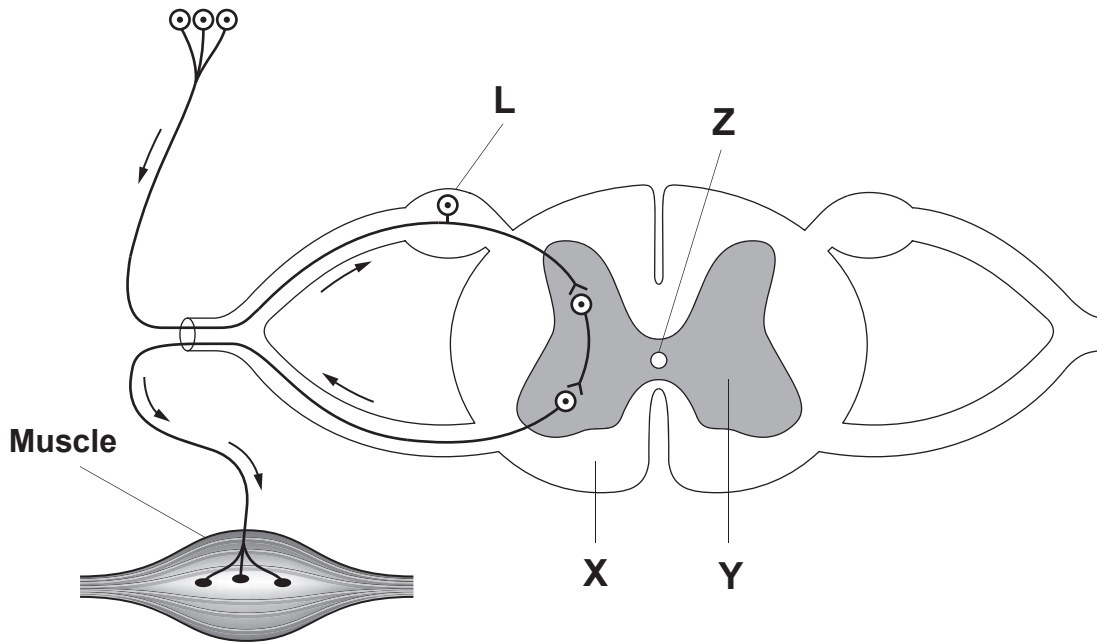
cocci

bacilli

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3. The diagram below shows a transverse section of spinal cord and an associated reflex arc.



(a) (i) Identify **X** and **Y** shown on the diagram above and explain why there is a difference in colour in these two areas. [2]

X

Y

Explanation

.....

(ii) Identify **L** and **Z** shown on the diagram above. [2]

L

Z

(b) (i) What is the name given to: [2]

I the cells which partially cover neurons

.....

II the material which the cells produce to cover the axon

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(ii) What is the function of this material in the conduction of an action potential? [2]

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(iii) Multiple sclerosis is a progressive, degenerative disease of the nervous system in which the material referred to in (b)(i) is destroyed. Symptoms include increasing muscle weakness and loss of vision. Suggest an explanation for these symptoms. [2]

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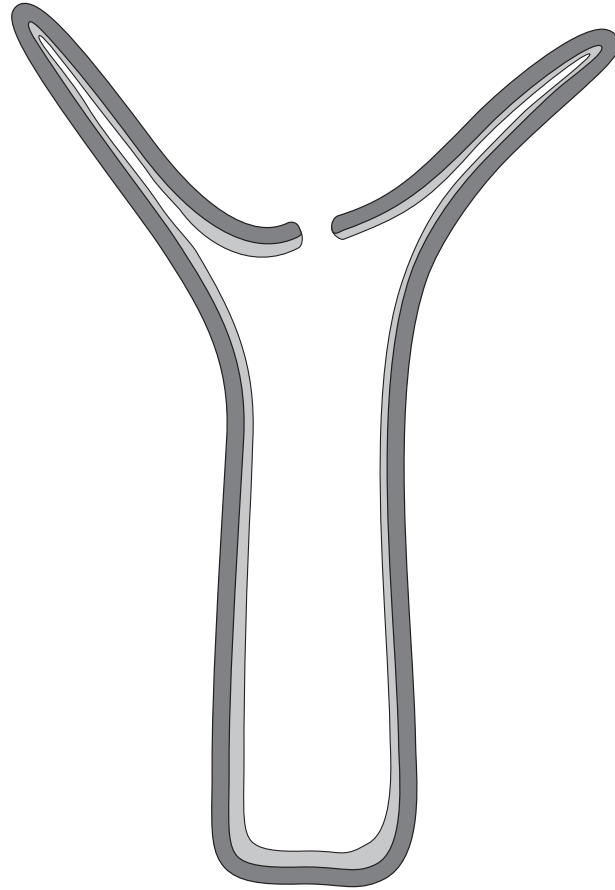
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(iv) Suggest a possible medical treatment for multiple sclerosis. [1]

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(c) Nerve nets are common in some animal groups.

(i) Complete the diagram below to show a nerve net as would be seen in *Hydra*. [1]



(ii) Give **two** ways in which the nerve net, as seen in *Hydra*, differs from that of the nervous system of a vertebrate. [2]

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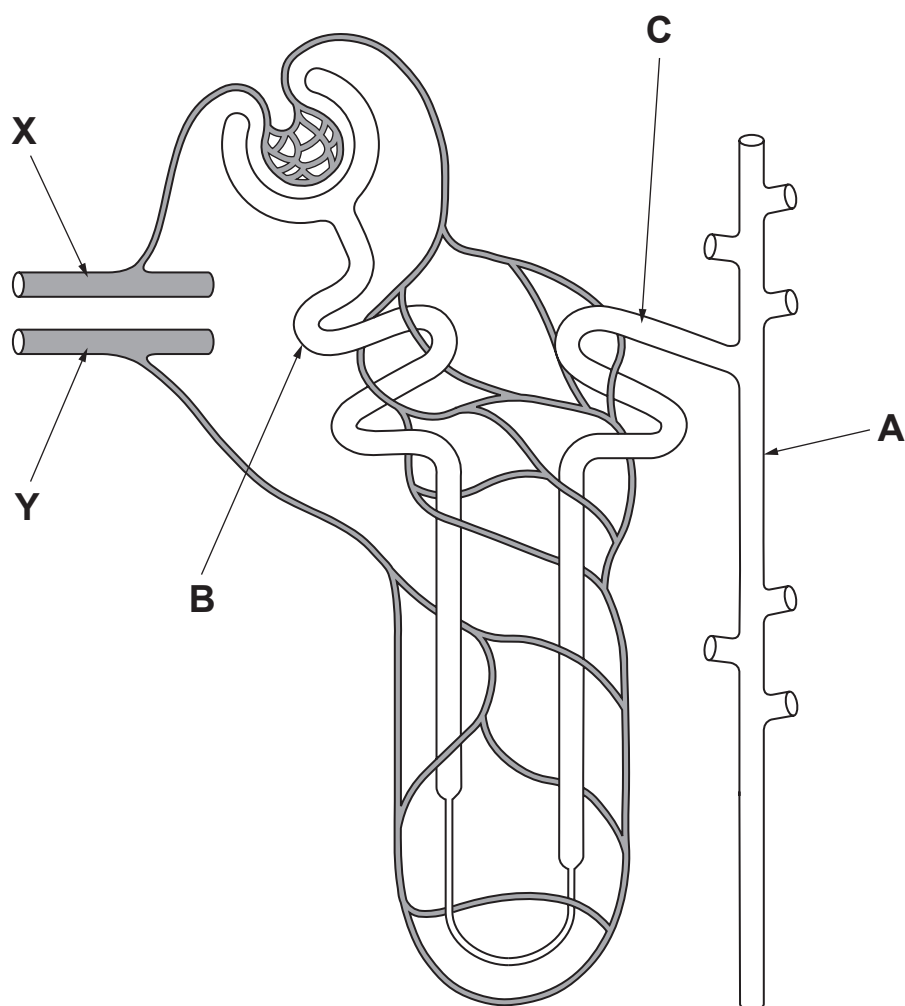
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4. The diagram below shows a single nephron, with its blood supply, from a kidney.



- (a) (i) Name **A**, **B** and **C** shown on the diagram above. [3]

A

B

C

- (ii) Use **two** arrows, clearly labelled, on the nephron above, to show where the following processes take place: [2]

- I ultrafiltration;
- II selective reabsorption.



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(b) Name the blood vessels supplying the kidney which would connect at points **X** and **Y** shown on the diagram opposite. [1]

X

Y

(c) Explain the function of the Loop of Henle in osmoregulation. [4]

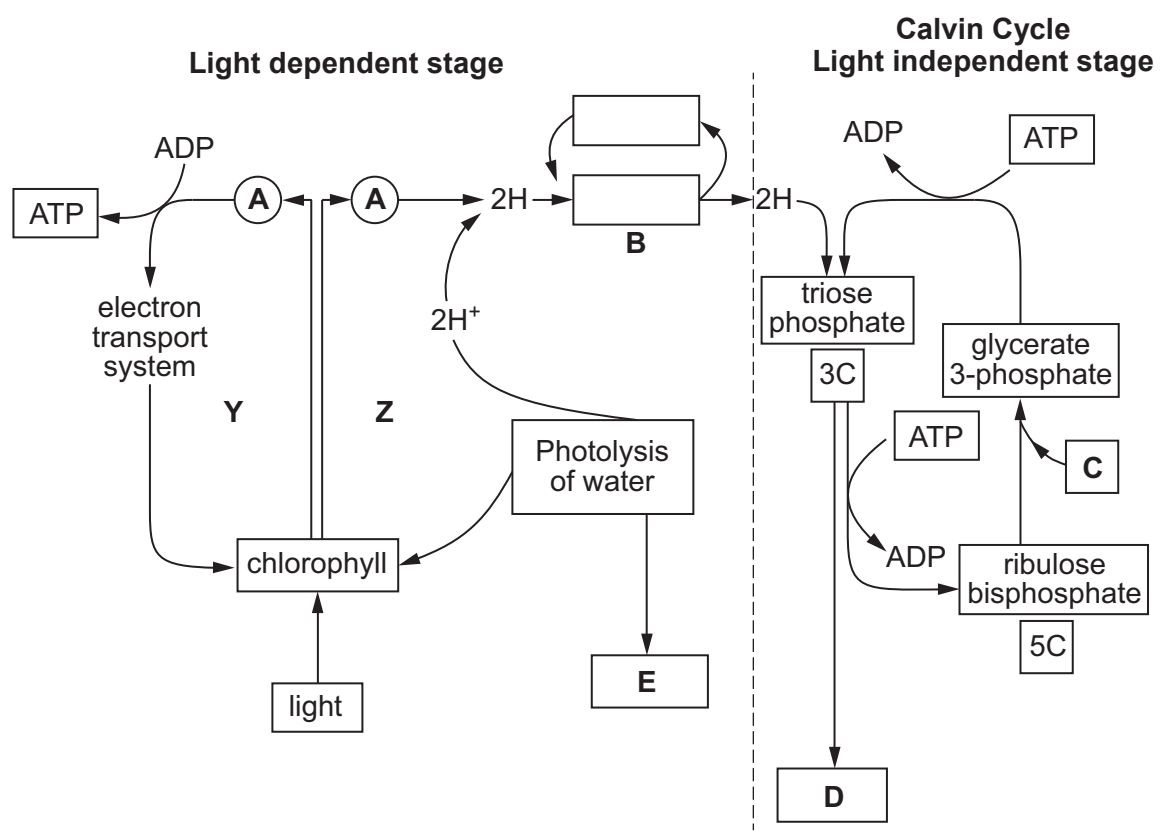
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(d) Describe how hormonal control affects the final concentration and volume of urine produced when someone is dehydrated. [4]

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5. The diagram below shows the events involved in photosynthesis.



- (a) (i) Name stages **Y** and **Z** in the light dependent stage. [1]
 - Y**
 - Z**
- (ii) What is represented by circles **A**? [1]

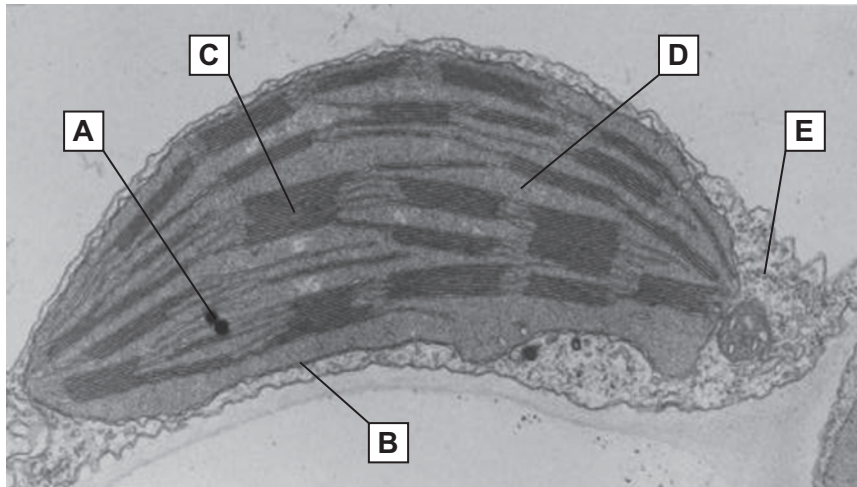
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- (iii) Complete the boxes above to show the reactions occurring at point **B**. [1]
- (iv) What is being produced at **E**? [1]

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- (v) Name the molecule entering at **C**. [1]

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- (vi) What compound is produced at **D**? [1]

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(b) The photomicrograph below is of a chloroplast.



Using the letters on the photomicrograph, complete the following table. [4]

Area	Letter	Name of region
Where the light dependent stage occurs		
Where the light independent stage occurs		

(c) Plants take up minerals from the soil. These are combined with the products of the light independent stage to produce other molecules needed by the plant.

Give **three** examples of minerals taken up from the soil and state what molecules are produced when each example combines with the products of the light independent stage. [3]

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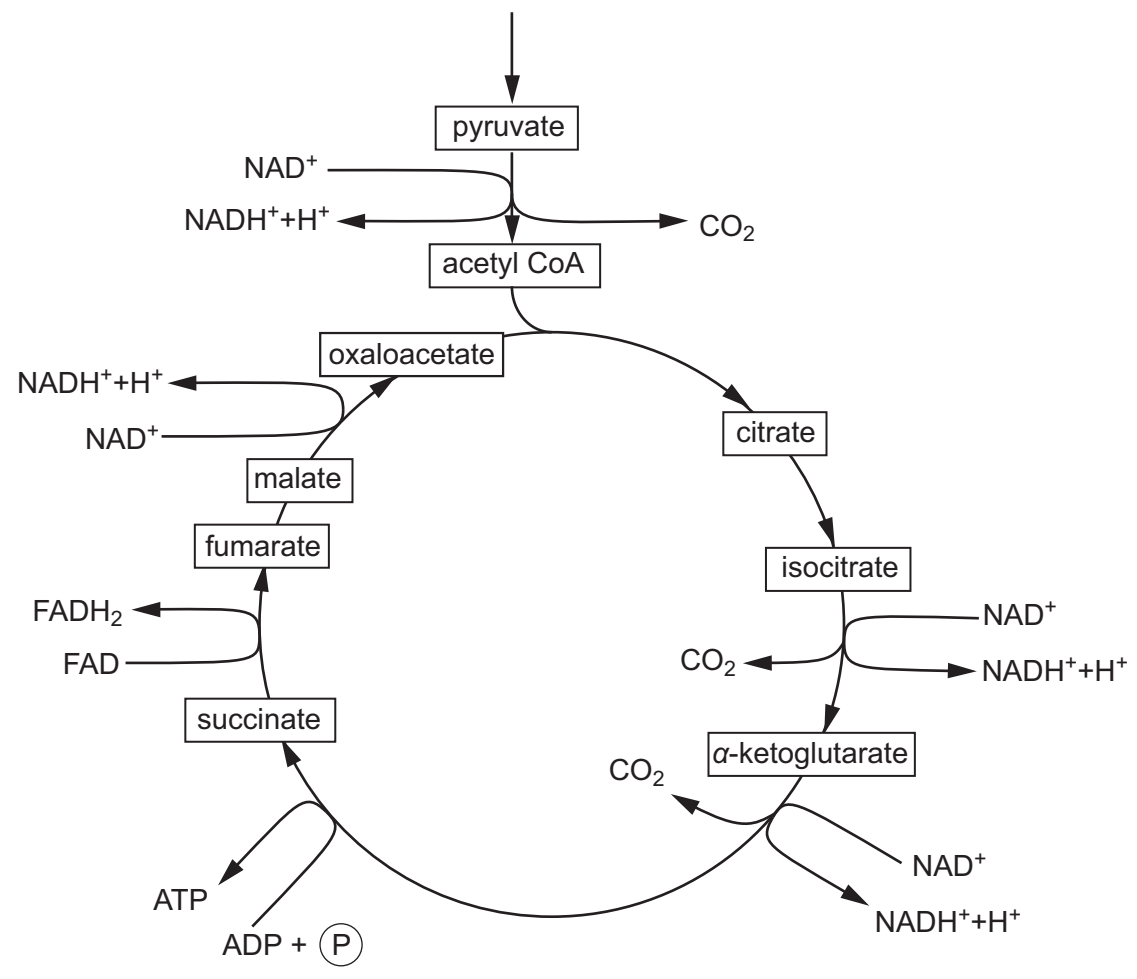
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6. The detailed diagram below shows the link reaction and Krebs cycle. Most of the intermediates involved are named.



(a) (i) Using the diagram above, and your own knowledge, determine how many carbons there are in the following Krebs cycle intermediates. [1]

citrate

α -ketoglutarate

succinate

(ii) Explain precisely how you have arrived at these figures. [2]

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- (b) Briefly describe how reduced FAD and reduced NAD are used to create an electrochemical gradient. [4]

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In patients with a suspected mitochondrial disorder a minimally invasive tissue biopsy provides the best opportunity to examine mitochondrial function, freezing the sample immediately after collection.

In addition to activity measurements of individual enzymes, analysis of mitochondrial respiration and ATP production rates are performed. This includes the measurement of mitochondrial oxygen consumption in the presence of different substrates, such as pyruvate and α -ketoglutarate. Analysis may show increased levels of a Krebs cycle intermediate, such as malate and succinate.

Defects in mitochondrial ATP synthesis may lead to high lactate levels in blood.

J Inherit Metab Dis. 2011 April; 34(2): 283–292.

- (c) Name the **two** enzyme **types** involved in the conversion of pyruvate to acetyl CoA. [2]

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Using the diagram opposite, the text above and your own knowledge, answer the following questions.

- (d) Suggest a suitable tissue to examine mitochondrial function and explain why you have chosen this tissue with respect to patient safety. [2]

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- (e) What could be deduced if the oxygen consumption was low with the pyruvate as a substrate but high with α -ketoglutarate as a substrate? [2]

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- (f) What could be deduced if there was a build up of any one of the Krebs cycle intermediates? [1]

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- (g) Explain why there is a raised blood lactate level in many patients with mitochondrial disease. [2]

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