



GCE A level

1074/01

BIOLOGY – BY4

P.M. FRIDAY, 13 June 2014

1 hour 45 minutes plus your additional time allowance

Surname _____

Other Names _____

Centre Number _____

Candidate Number 2 _____

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, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

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. **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]

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

1(c) State PRECISELY where RHIZOBIUM would be found in the legume. [1]

(d) Suggest how the relationship between RHIZOBIUM and a legume species is beneficial to BOTH organisms. [2]

1(e) What are PLASMIDS? [1]

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

(i) obligate aerobe

(ii) obligate anaerobe

(iii) facultative anaerobe

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

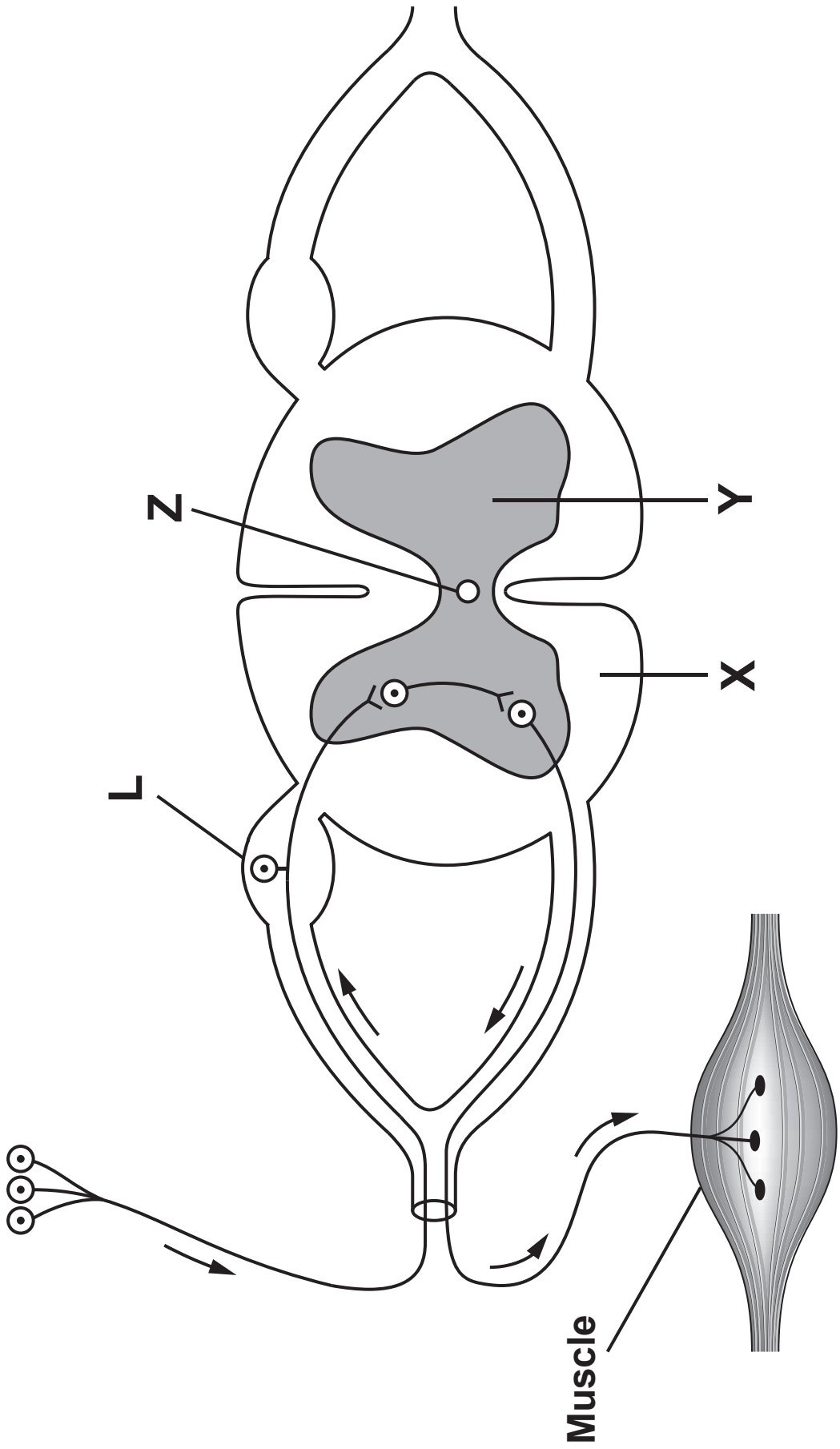
2(c) Most pathogens in humans are Gram-positive organisms. Six Gram-positive genera are typically pathogenic in humans. Two of these, STREPTOCOCCUS and STAPHYLOCOCCUS, are cocci. The remaining organisms are bacilli.

What THREE DIMENSIONAL SHAPE would the cocci and bacilli be? [1]

cocci _____

bacilli _____

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

(a) (i) Identify **X** and **Y** shown on the diagram opposite 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 opposite. [2]

L _____

Z _____

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

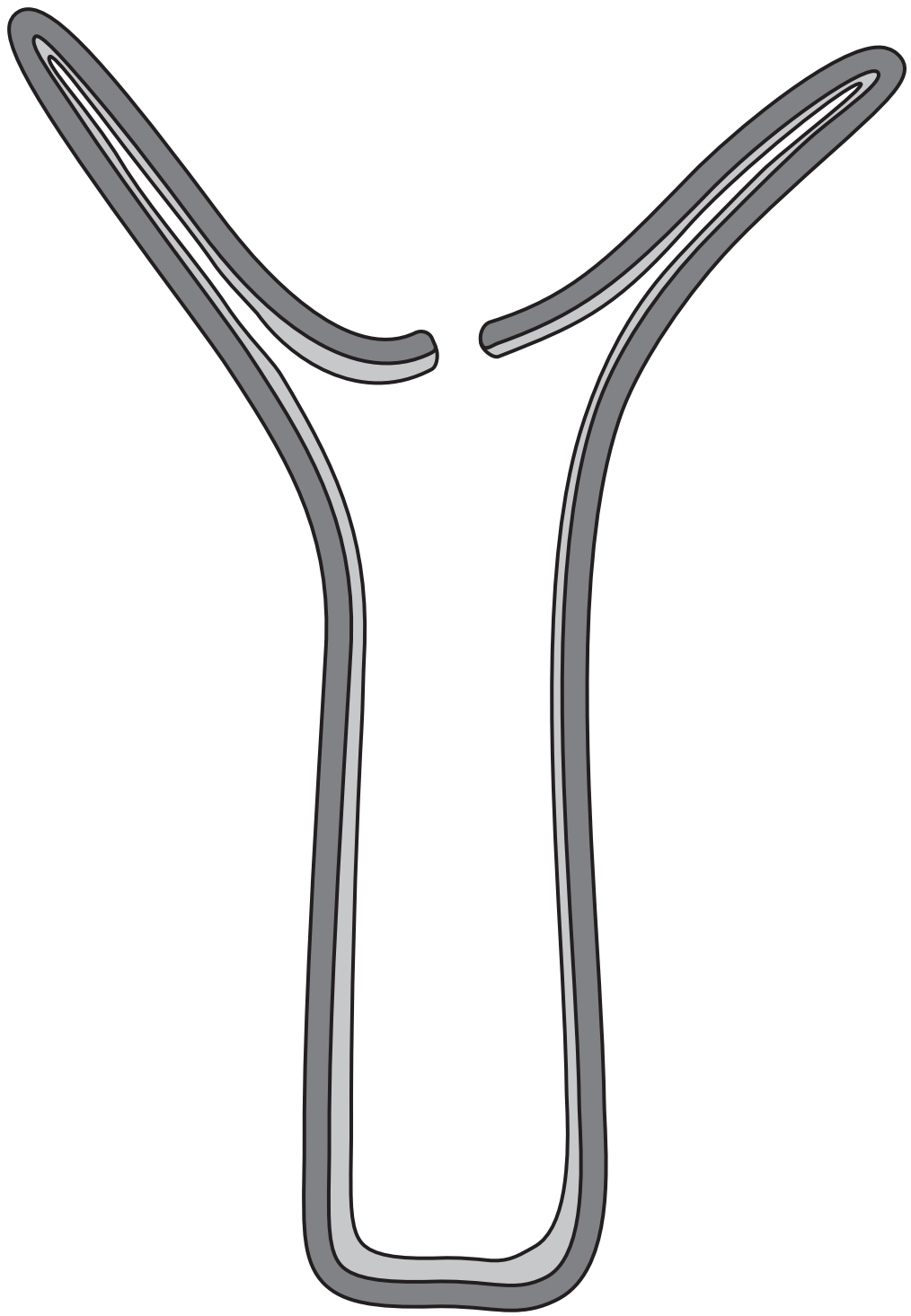
I the cells which partially cover neurons

II the material which the cells produce to cover the axon

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

3(b) (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]

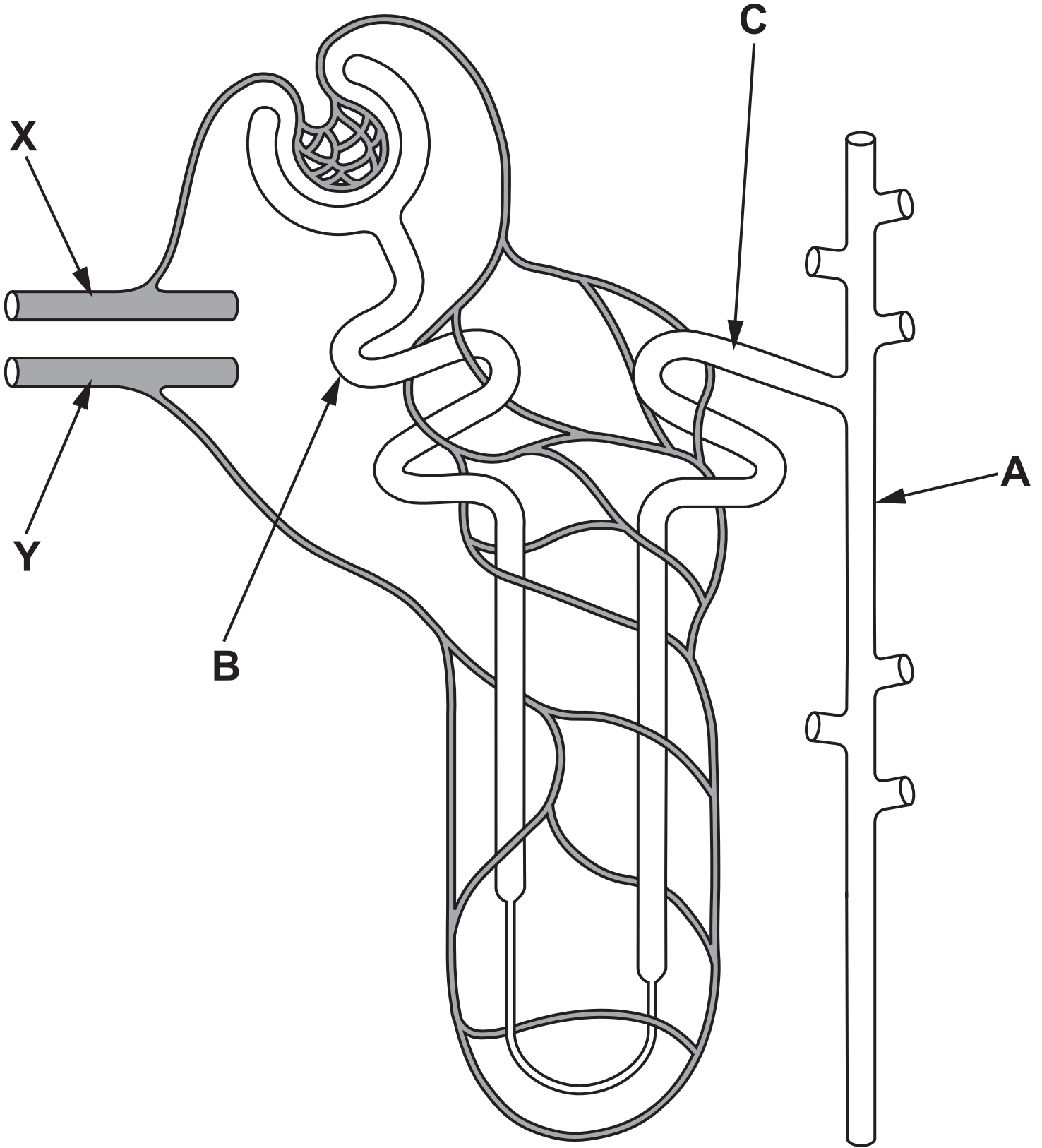
(iv) Suggest a possible medical treatment for multiple sclerosis. [1]



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

(i) Complete the diagram opposite 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]



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

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

A _____

B _____

C _____

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

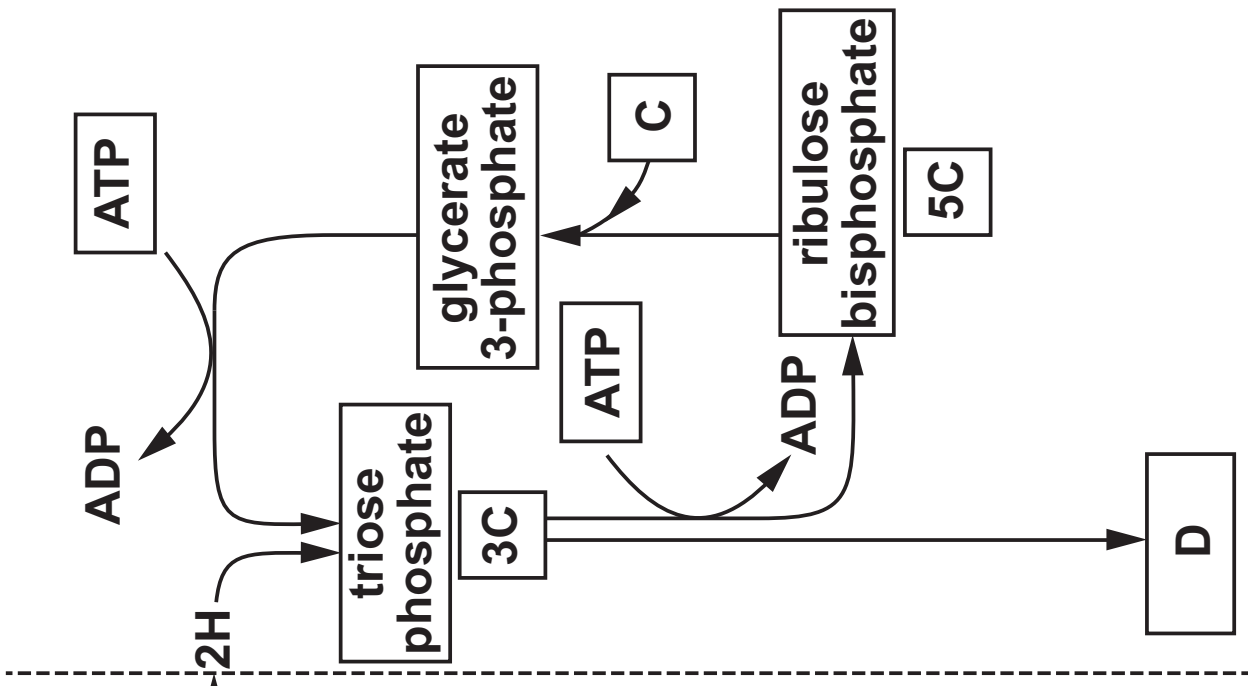
I ultrafiltration;

II selective reabsorption.

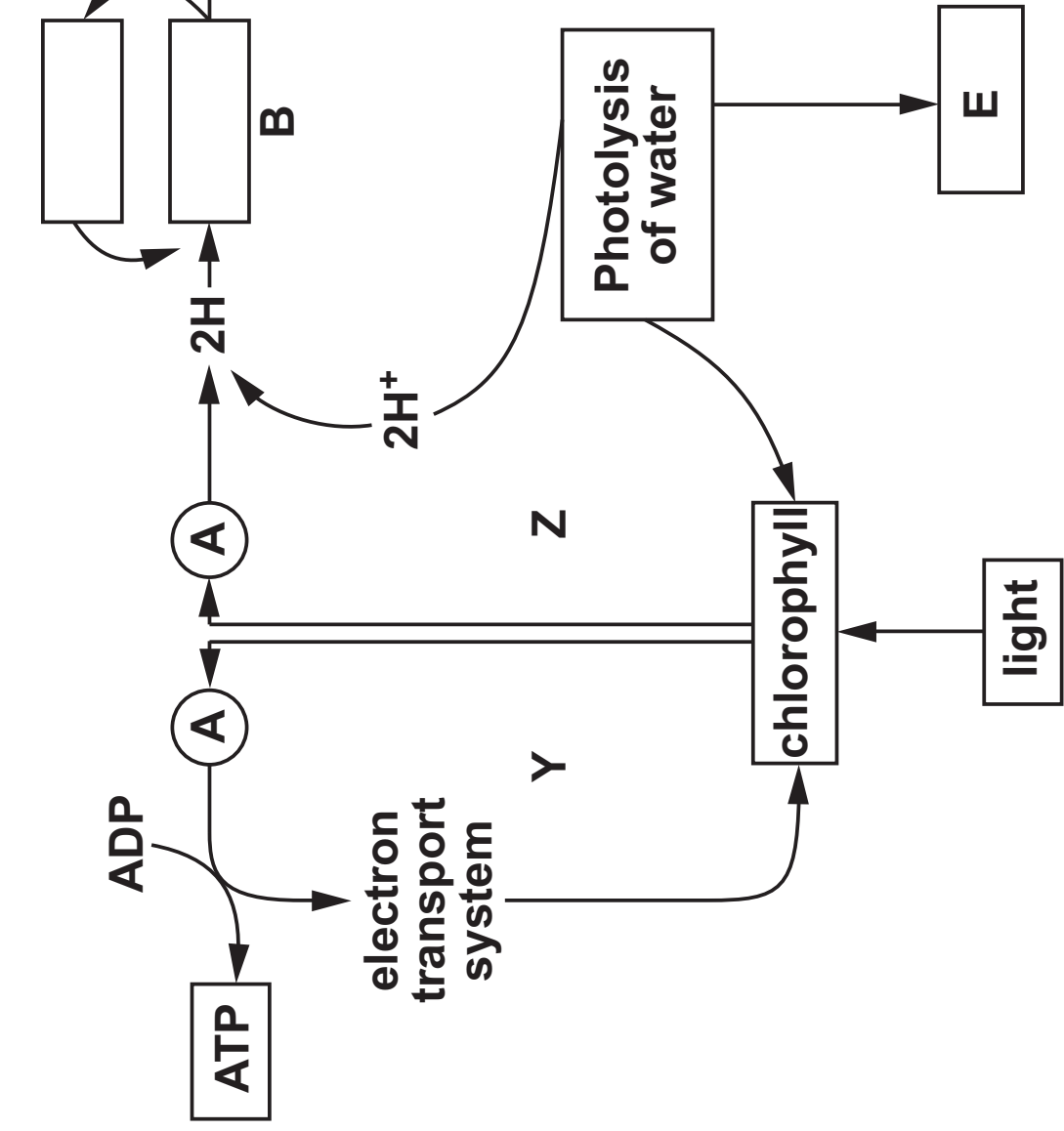
4(d) Describe how hormonal control affects the final concentration and volume of urine produced when someone is dehydrated. [4]

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**CALVIN CYCLE
LIGHT INDEPENDENT STAGE**



LIGHT DEPENDENT STAGE



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

(a) (i) Name stages **Y** and **Z** in the light dependent stage. [1]

Y _____

Z _____

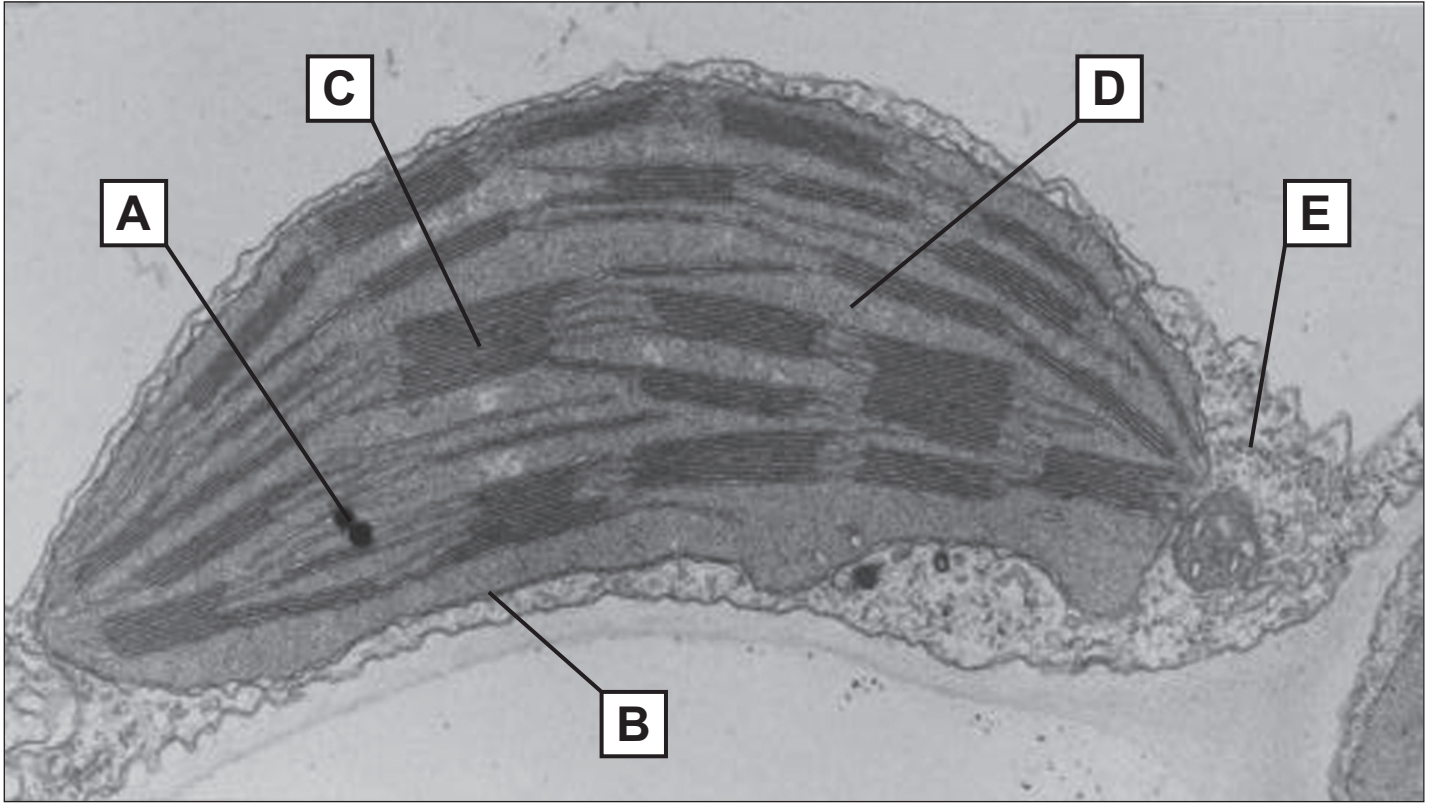
(ii) What is represented by circles **A**? [1]

(iii) Complete the boxes opposite to show the reactions occurring at point **B**. [1]

(iv) What is being produced at **E**? [1]

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

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

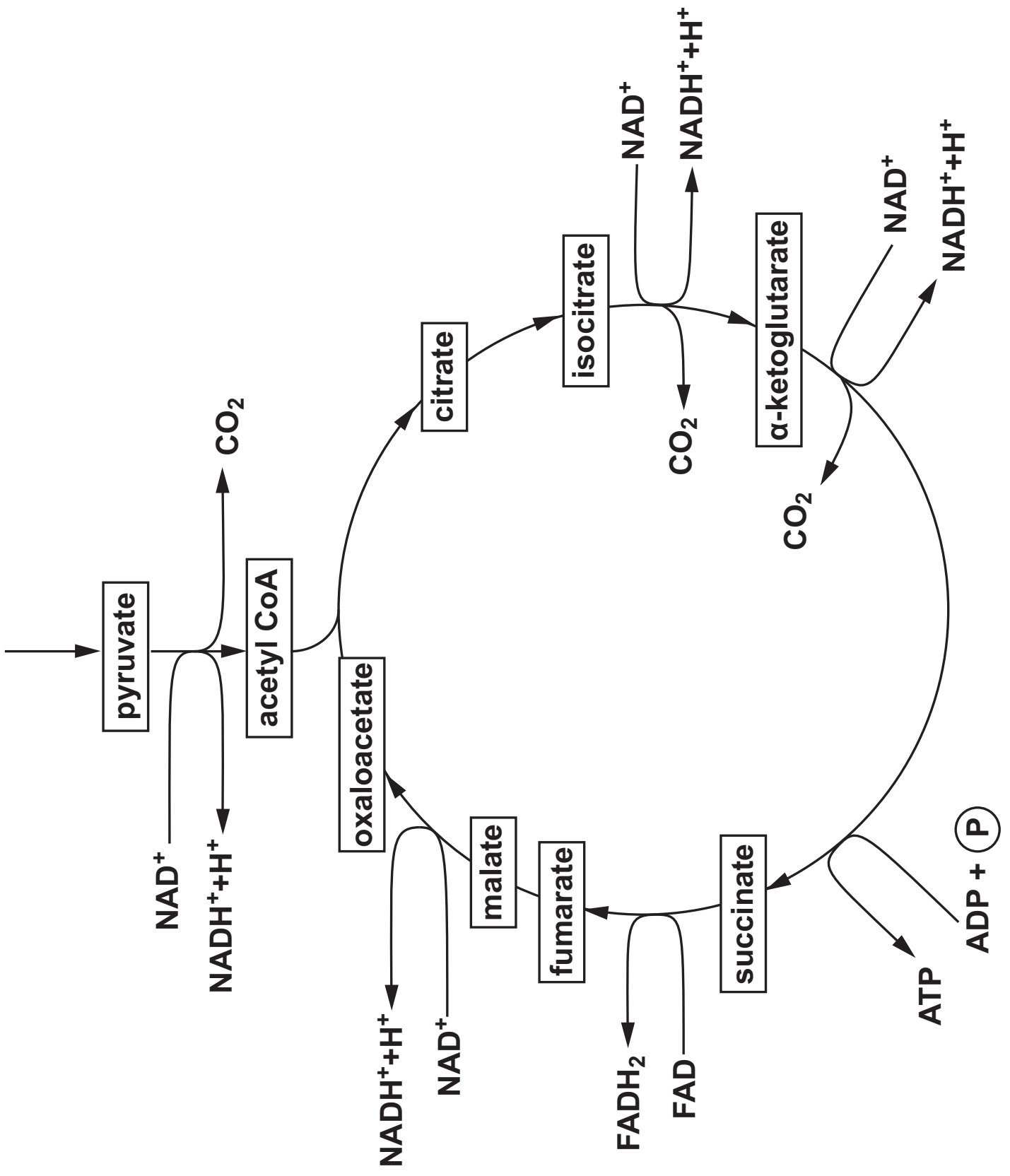


5(b) The photomicrograph opposite is of a chloroplast.

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		

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

(a) (i) Using the diagram opposite, 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]

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.

6(c) Name the TWO enzyme TYPES involved in the conversion of pyruvate to acetyl CoA. [2]

Using the diagram opposite page 22, the text on page 24, and your own knowledge, answer the following questions.

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

[2]

6(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]

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

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

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7. Answer ONE of the following questions.

Any diagrams included in your answer must be fully annotated.

EITHER,

(a) Explain the role of photosynthetic pigments in a green plant and how the use of chromatography allows these pigments to be separated and identified. [10]

OR

(b) Using **SUITABLE EXAMPLES THROUGHOUT**, describe the way in which populations grow and the factors affecting population growth. [10]
