Candidate Name	Centre Number	Candidate Number
		2

GCE A level

1074/01

BIOLOGY – BY4

P.M. MONDAY, 24 January 2011

1¾ hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**5**	
2	**10**	
3	**12**	
4	**11**	
5	**6**	
6	**12**	
7	**14**	
8	**10**	
Total	**80**	

1074
010001

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.

Examiner only

1. State the name of the term used to describe each of the following.

(a) The use of biological control agents, together with the minimal, well-targeted application of highly selective pesticides. [1]

.....

(b) Microorganisms that grow best in the presence of oxygen, but can also survive in its absence. [1]

.....

(c) Receptors responsible for detecting changes in the solute concentration of the blood, as it flows through the hypothalamus of the brain. [1]

.....

(d) Simple nerve cells, found in hydra, with short extensions joined to each other and branching in a number of different directions. [1]

.....

(e) The influence of relative periods of light and darkness on flowering. [1]

.....

(Total 5 marks)

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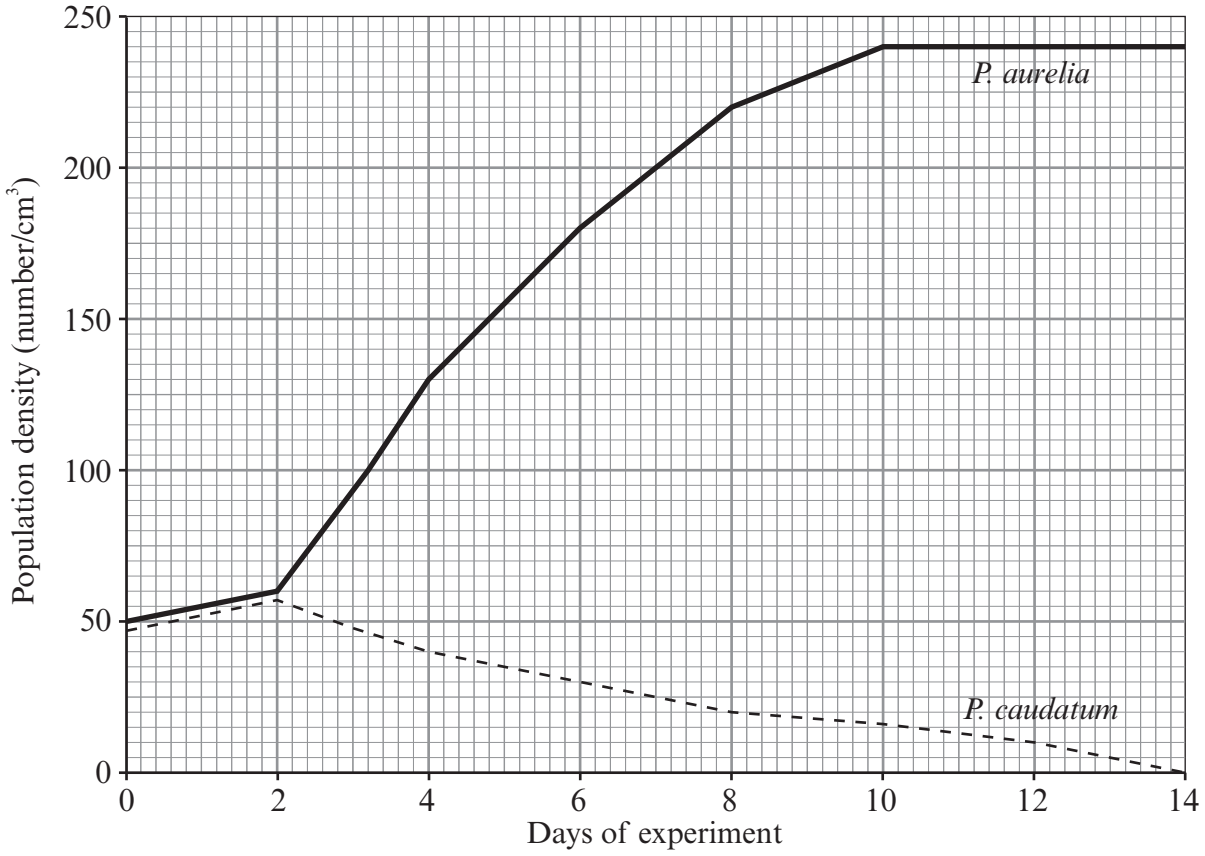
Examiner only

2. *(a)* Two species of a single celled organism called *Paramecium*, *P. aurelia* and *P. caudatum* were grown together in a single culture of the bacterium *Bacillus pyocyaneus*, on which they both feed. Their population densities were measured every two days and the results are shown in the graph below.



(i) For *P. aurelia* on which day of the experiment did the population growth enter the stationary phase? [1]

day .....

(ii) On which days of the experiment is the population growth of *P. caudatum* in the death phase? [1]

days ..... to .....

(b) The experiment shows both interspecific and intraspecific competition.

(i) Which type of competition is most likely to have caused the population of *P. caudatum* to decrease after day 2? [1]

.....

(ii) What was the carrying capacity for *P. aurelia* in this experiment? [1]

.....

(iii) How might the carrying capacity have been increased in this experiment? [1]

.....

(iv) Suggest, with an explanation, what would happen to the numbers of *P. caudatum* if *P. aurelia* became infected with a parasitic microorganism at day eight. [2]

Suggestion .....

Explanation .....

.....

(c) (i) Distinguish between the terms *density dependent* and *density independent* factors. [2]

.....

.....

.....

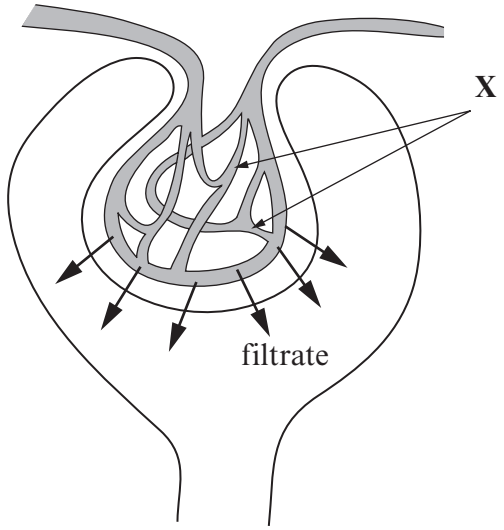
(ii) Name **one** density independent factor that could have changed in the experiment. [1]

.....

(Total 10 marks)

Examiner only

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]

.....

.....

.....

(b) Much of the water in the kidney filtrate is reabsorbed from the collecting duct.

(i) Name the part of the nephron which provides the osmotic gradient for reabsorption. [1]

.....

(ii) Suggest **one** way in which this part of the nephron might be modified in desert animals. [1]

.....

(c) The environment in which an animal lives plays a part in the type of nitrogenous waste produced.

(i) For the animals listed in the table below name the excretory products and place the products in the appropriate boxes. [3]

Animal	*Main excretory product*	*Toxicity*	*Solubility*
Freshwater fish		high	high
Bird		low	low
Mammal		medium	medium

(ii) Which excretory product requires the least volume of water for its excretion? [1]

.....

(iii) Explain **one** *further* advantage of the excretory product you have named in *(c)* (ii) [1]

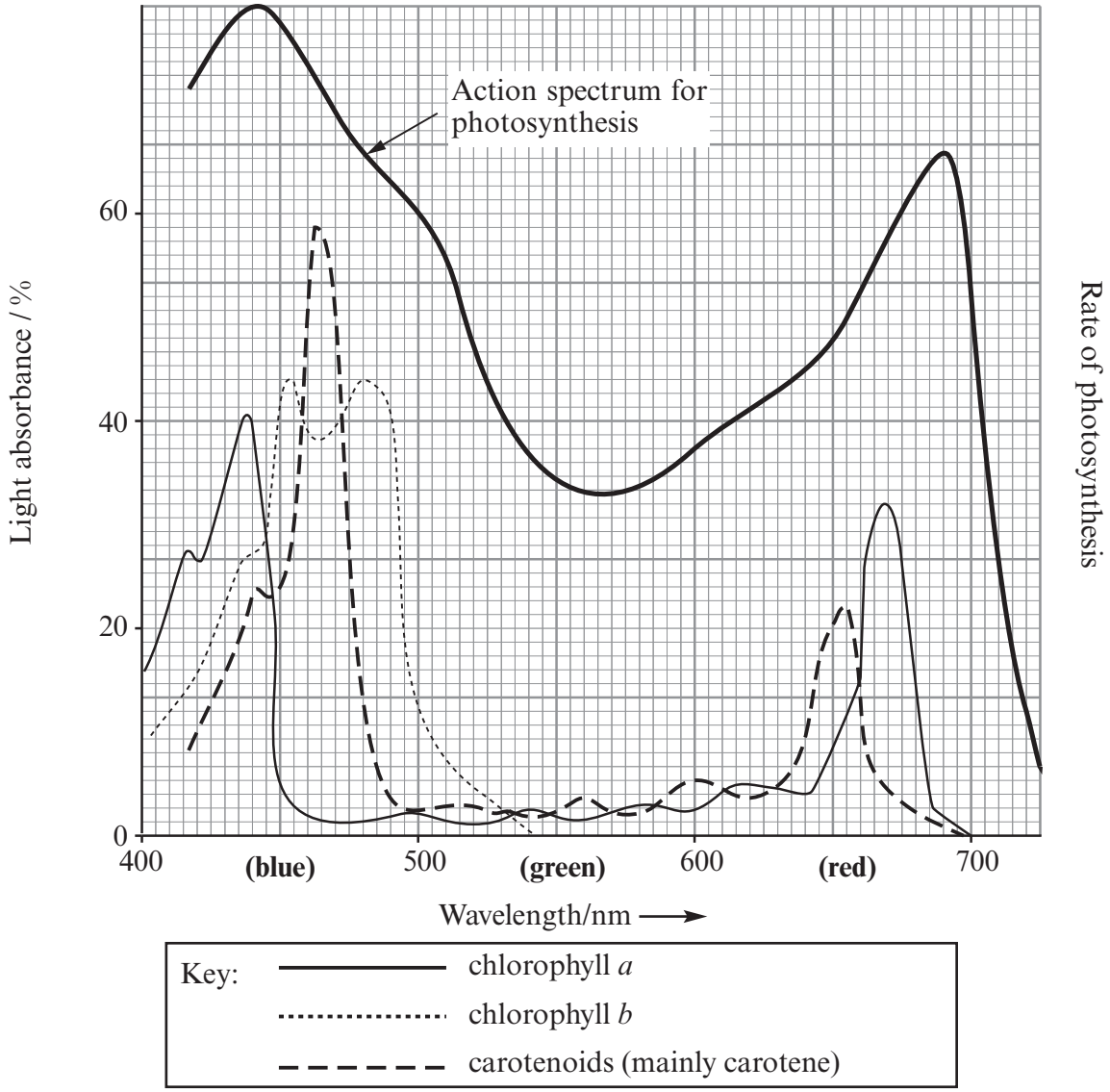
.....

.....

(Total 12 marks)

Examiner only

4. The important pigments in most chloroplasts are chlorophyll *a*, chlorophyll *b*, and carotene. The graph below shows the absorbtion spectrum of these pigments along with the action spectrum for photosynthesis.



(a) Describe the function of chlorophyll *a*. [1]

.....

.....

(b) (i) State the wavelength which is most effectively absorbed by chlorophyll *a*. [1]

.....

(ii) Use the information in the graph to explain why it is an advantage for a leaf to contain more than one pigment. [2]

.....

.....

.....

(c) Why do most leaves characteristically have a green colour? [1]

.....

(d) The graph also shows the *action spectrum* for photosynthesis.
Describe the relationship between the absorption spectrum and the action spectrum and explain what this relationship tells us about light absorption and photosynthesis. [2]

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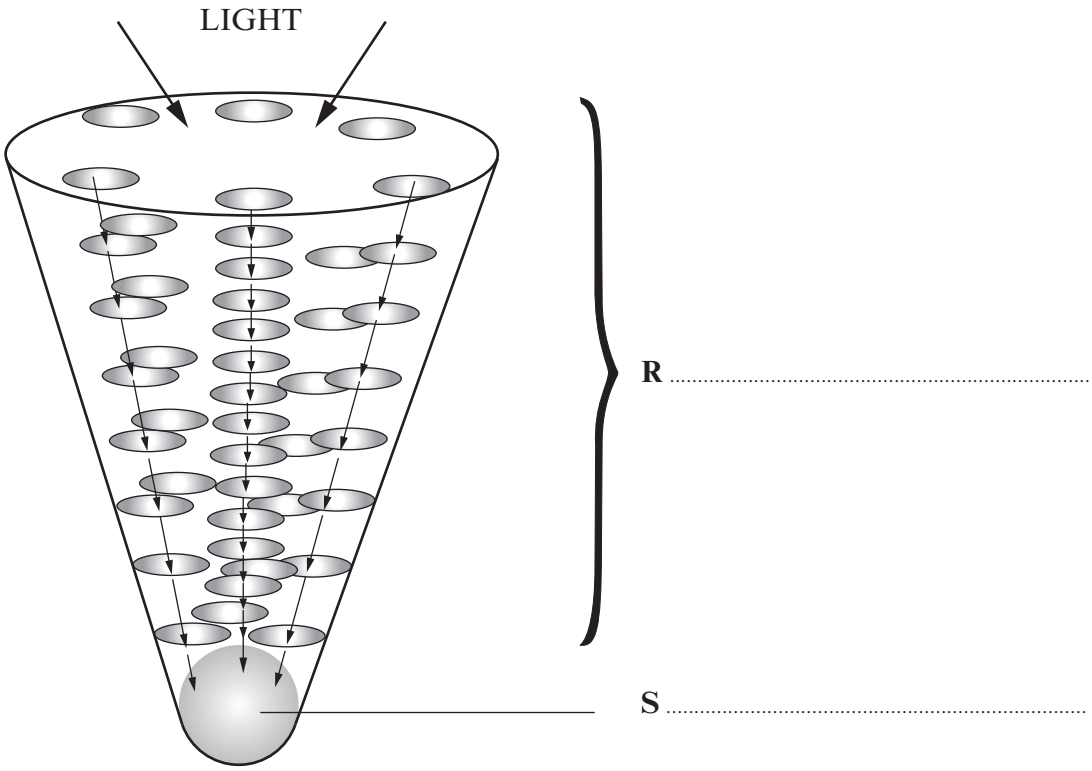
.....

.....

(e) The following diagram is of a photosystem.



(i) Identify regions **R** and **S** shown on the diagram. [2]

(ii) Indicate, with a cross (×) on the diagram, where you would expect to find chlorophyll *a*. [1]

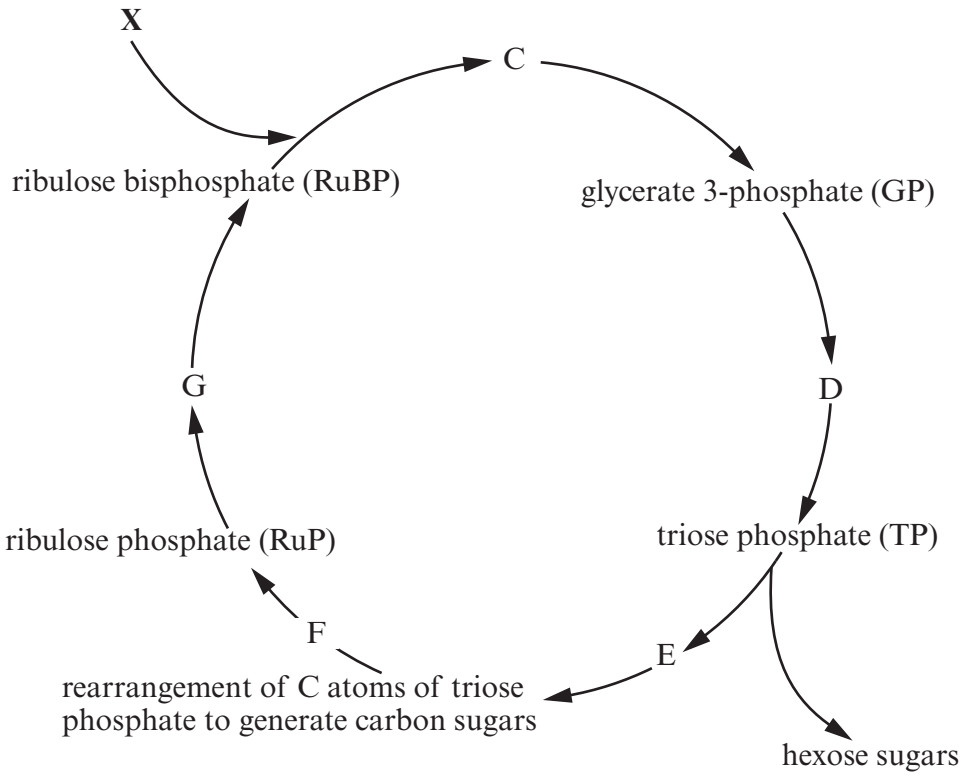
(iii) State exactly where in the chloroplast you would expect to find photosystems. [1]

.....

(Total 11 marks)

Examiner only

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]

.....

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

.....

(Total 6 marks)

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Turn over.

Examiner only

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

.....

.....

.....

.....

.....

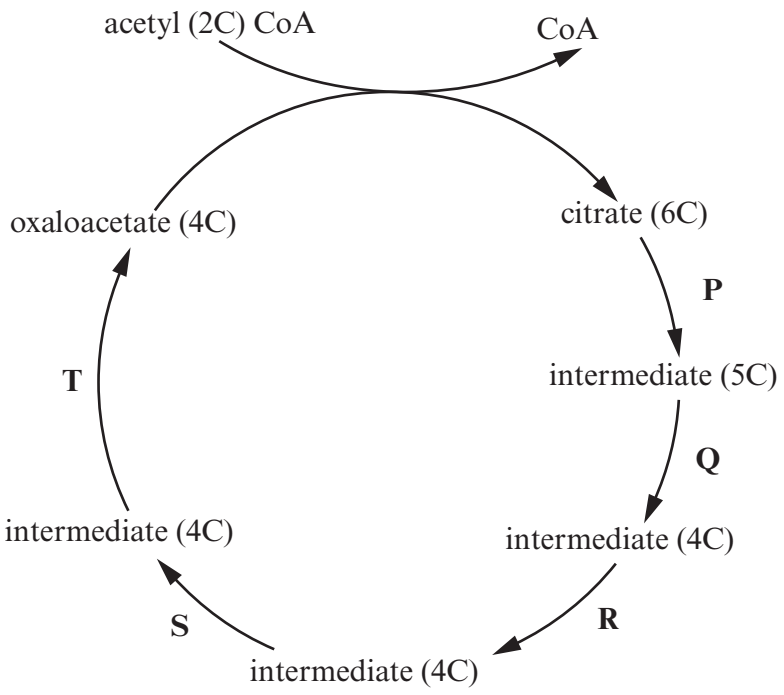
.....

(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]

	In the link reaction using NADH	*In the Krebs Cycle using NADH*	*In the Krebs Cycle using FADH*
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)

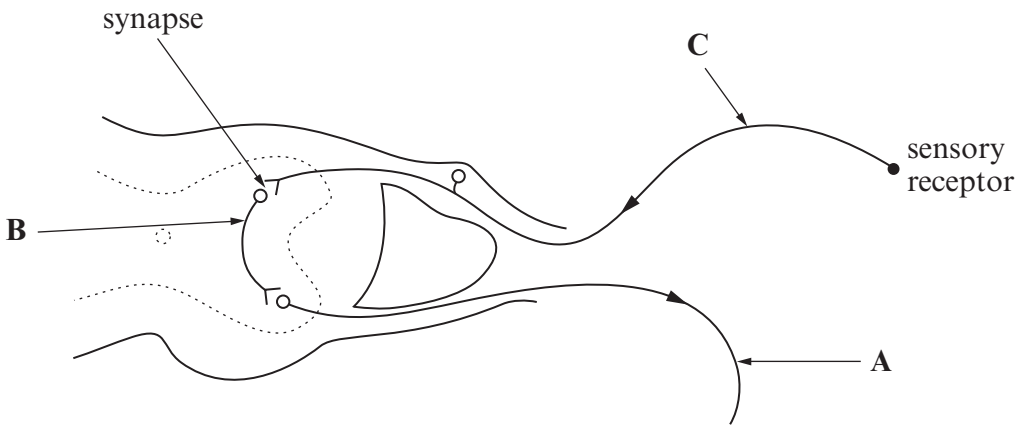
Examiner only

7. *(a)* What is a reflex action? [2]

.....

.....

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



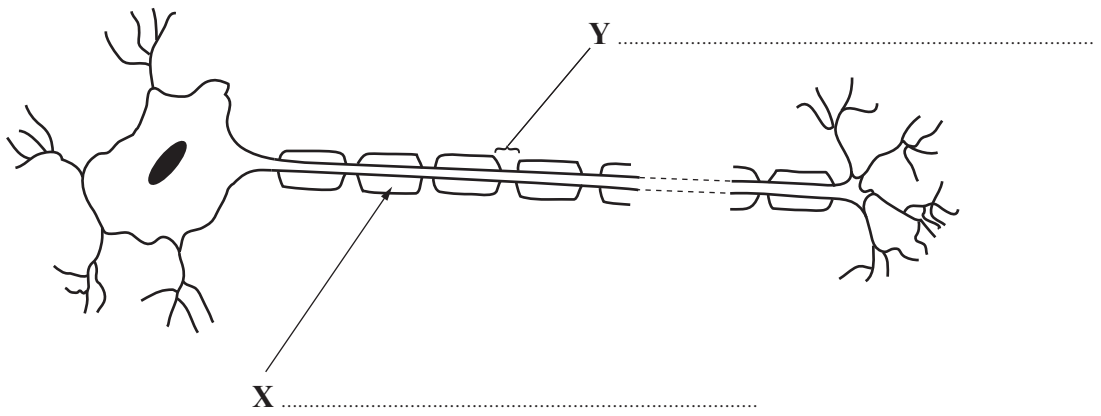
Name the types of neurone labelled **A, B** and **C**. [1]

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]

.....

.....

.....

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

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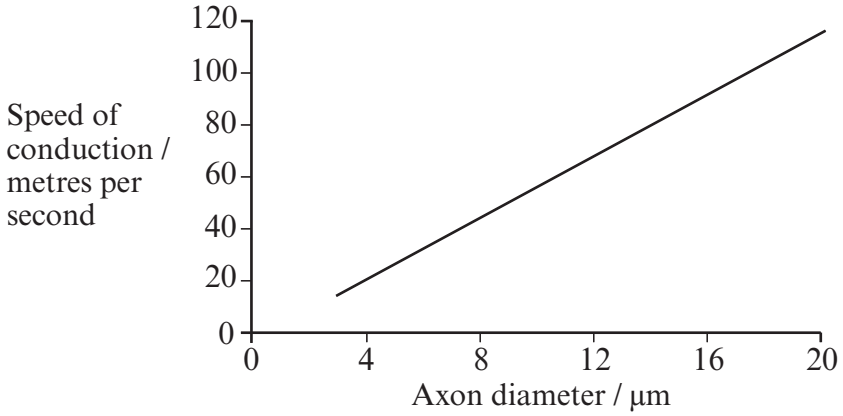
(e) The graph shows the relationship between the diameter of the axon and the speed of conduction of nerve impulses in myelinated axons of a cat.



(i) Describe the relationship between the diameter of the axon and the speed of conduction. [1]

.....

.....

(ii) Suggest an explanation for this increase in speed of conduction. [2]

.....

.....

(iii) Explain why a myelinated axon uses less ATP to transmit a nerve impulse than a non-myelinated axon of the same diameter. [2]

.....

.....

.....

(Total 14 marks)

Examiner only

8. Answer **one** of the following questions.
Any diagrams included in your answer must be fully annotated.

Either, *(a)* Give an account of anaerobic respiration in organisms. [10]

Or *(b)* Describe how the principles of using a batch culture fermenter are applied to the industrial production of penicillin. [10]

Examiner only

Turn over.

Examiner only

(Total 10 marks)