Rewarding Learning

Centre Number

71

Candidate Number

ADVANCED
General Certificate of Education
2010

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

AB211

[AB211]

TUESDAY 25 MAY, MORNING

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all nine** questions.
You are provided with **Photograph 4.6** for use with Question 6 in this paper.
Do not write your answers on this photograph.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Section A carries 72 marks. Section B carries 18 marks.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You are reminded of the need for good English and clear presentation in your answers. Use accurate scientific terminology in all answers.
You should spend approximately **25 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in **Section B** and awarded a maximum of 2 marks.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Section A

1 The ABO blood grouping system is based on the presence of certain antigens.

(a) (i) Describe the precise location of the blood antigens.

_____

_____ [1]

(ii) State the antigen present when the blood plasma contains antibody b.

_____ [1]

(iii) Describe the process of agglutination.

_____

_____

_____

_____

_____

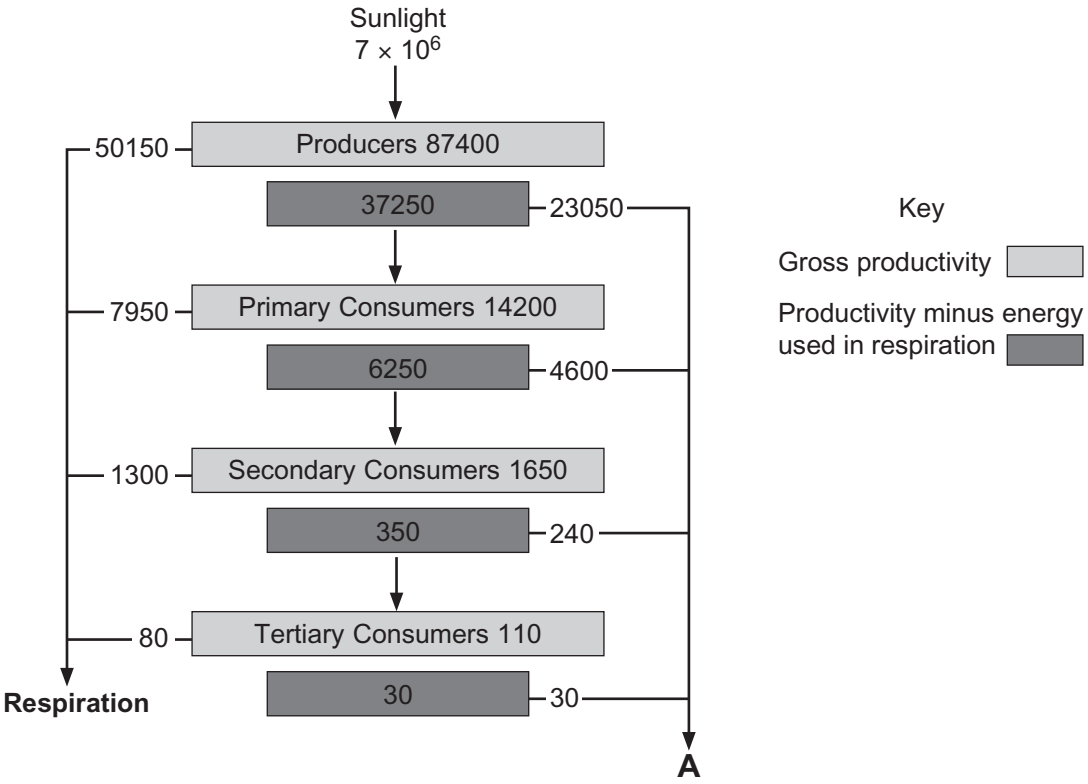
_____ [3]

(b) Antibodies to the ABO system are used to identify different blood groups. The table below shows the results of testing for four different blood groups. The first one, blood group A, has been identified. Identify the other three blood groups and name them in the spaces provided.

Blood Group	Antibody added to the sample of blood	
	Antibody a	Antibody b
A	Agglutination	No agglutination
	No agglutination	Agglutination
	Agglutination	Agglutination
	No agglutination	No agglutination

[3]

2 The diagram below shows the productivity at various trophic levels in an ecosystem. All productivity values are in kJ $m^{-2}y^{-1}$.



(a) (i) Using the information in the diagram, state the following values.

- NPP (net primary productivity) _____ $kJm^{-2}y^{-1}$
- The energy available to carnivores _____ $kJm^{-2}y^{-1}$

[2]

(ii) State **two** processes which may result in the losses shown by arrow **A**.

1. _____

2. _____ [2]

(b) The energy transfers shown in the diagram are for a natural meadow ecosystem. Suggest how energy transfer would differ in a field of grass cut, on several occasions during the year, and removed for the production of silage.

_____

_____

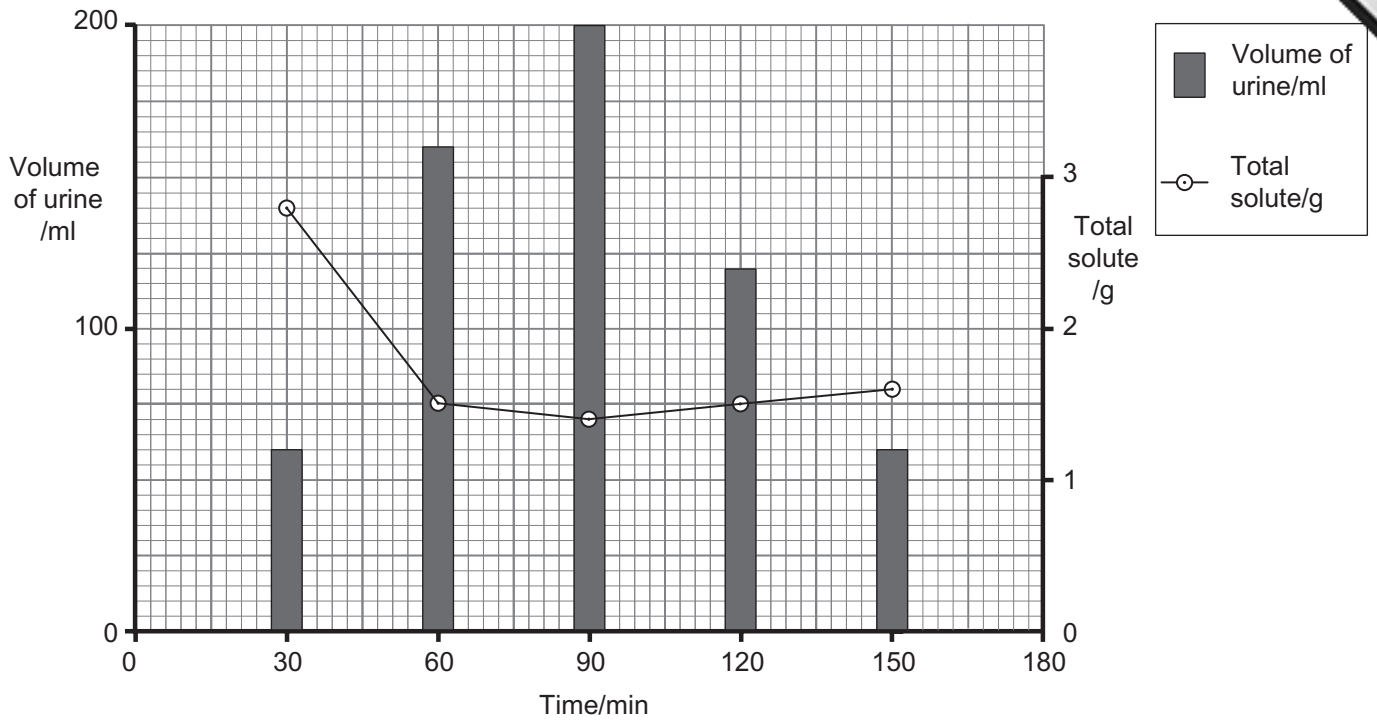
_____

_____

_____

_____ [3]

3 **(a)** In an experiment on kidney function, a student drank 700 ml of water. After drinking the water the student produced a sample of urine at 30 minute intervals for a period of 3 hours. The volume of each sample of urine and the mass of solute in each sample were measured. The results are shown in the graph below.



(i) Using the information in the graph, determine which sample was the most concentrated.

_____

_____ [1]

(ii) Compare the samples taken after 60 minutes and 120 minutes and determine which of the two samples has the lower solute potential. Explain your answer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(b) Explain the process of osmoregulation in the body after drinking a large volume of water.

_____

_____

_____

_____

_____

_____

_____

_____ [4]

4 Crop rotation is used by farmers to maintain the fertility of the soil.

Often crop rotation includes the planting of a grass–clover mixture. Clover is a legume with root nodules rich in amino acids and protein. In the autumn the grass–clover crop is ploughed into the soil as 'green manure' before the planting of winter wheat.

(a) (i) Explain why clover root nodules are rich in amino acids and protein.

_____

_____

_____

_____ [2]

(ii) Following the ploughing of the grass–clover crop into the soil, the plants die and the soil subsequently becomes rich in nitrates. Describe the processes involved in the soil becoming rich in nitrates.

_____

_____

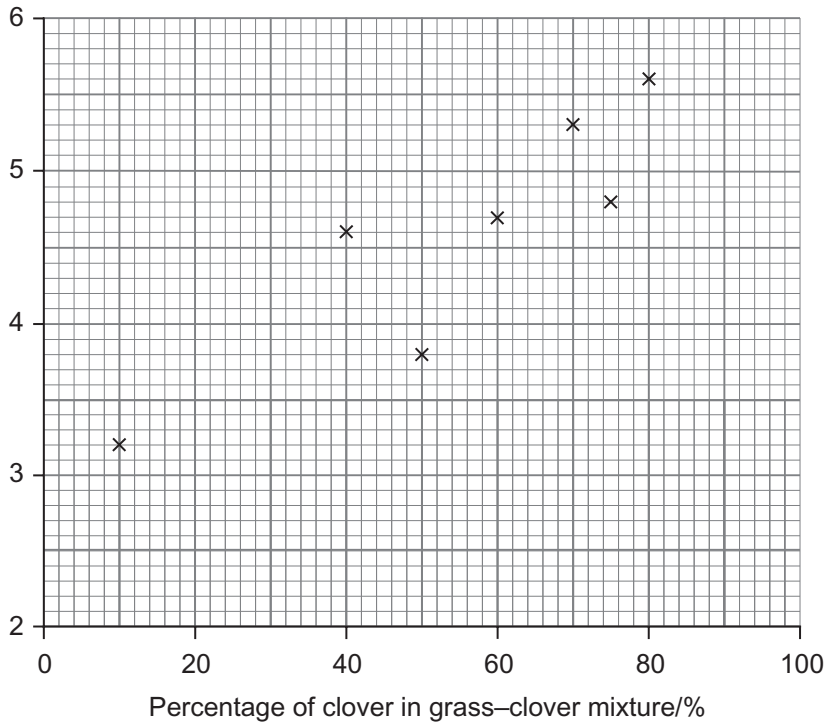
_____

_____

_____

_____ [3]

(b) The graph below shows the influence of different mixtures of grass–clover on the yield of wheat grain following the ploughing-in of the grass–clover crop.



(i) Explain the trend evident in the graph.

_____

_____

_____

_____ [2]

(ii) Describe and explain **one** additional benefit of crop rotation.

_____

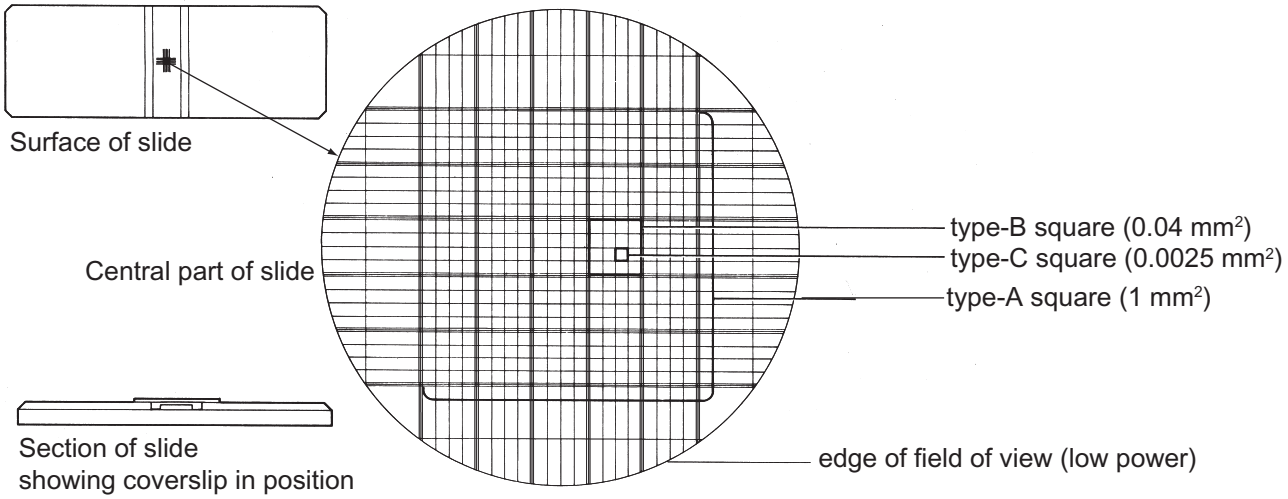
_____

_____

_____ [2]

5 An experiment was set up to investigate the growth of a yeast population.

A small number of yeast cells was allowed to multiply in a nutrient medium. The number of cells was estimated by removing a sample of the population at regular intervals and counting the yeast cells using a haemocytometer slide (shown below).



Source: Practical Biology for Advanced Level, M. Roberts, T. King, M. Reiss, Nelson, 1994

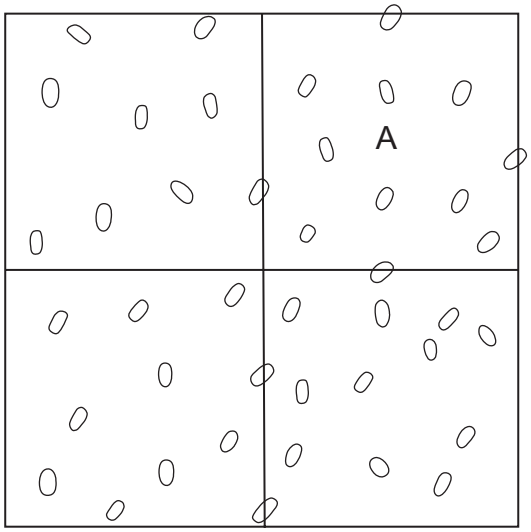
Examiner Only	
Marks	Remark

(a) The samples removed need to be representative of the yeast population at the time of sampling. Suggest how this is achieved.

_____

_____ [1]

The diagram below represents four type-C squares from a haemocytometer slide. The distance between the surface of these type-C squares and the overlying coverslip is 0.1 mm.



(b) (i) Count the number of yeast cells in the type-C square marked **A**.

_____ [1]

(ii) Using your answer from **(b)(i)** above, calculate the number of yeast cells per mm^3. (Show your working.)

Answer _____ [2]

(c) Towards the end of the experiment there may be too many yeast cells to clearly see the grid lines on the haemocytometer slide.

Suggest how such a dense population might be treated to enable a count to be made, and how this count would subsequently be used to obtain an estimate of the population size.

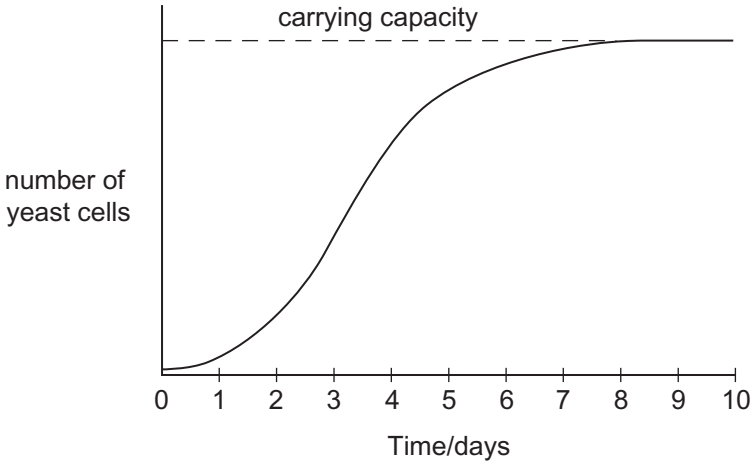
_____

_____

_____

_____ [2]

The population was sampled daily and the results are shown in the graph below.



(d) (i) Suggest an appropriate title for the graph shown above.

_____

_____ [1]

(ii) Indicate **on the graph** with the letter **X**, the point at which the growth rate of the population was greatest. [1]

(iii) Explain what is meant by the term 'carrying capacity' shown on the graph.

_____

_____ [1]

6 The **Photograph 4.6** shows the eye of a young mammal with the eyelids closed.

(a) Identify the structures labelled **A** to **D**.

A _____

B _____

C _____

D _____ [4]

(b) Describe the operation of the iris in bright sunlight.

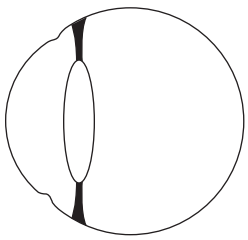
_____

_____

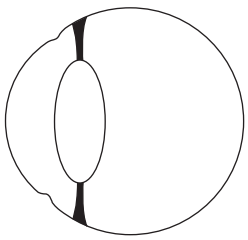
_____ [2]

(c) The diagrams **E** and **F** below show eyes with different lens thicknesses and so adapted differently for the accommodation (focusing) of light.

E



F



(i) State which of these shows an eye adapted for accommodation of light from a near object. Explain your answer.

_____

_____ [1]

(ii) Explain how the lens shape in **E** is produced within the eye.

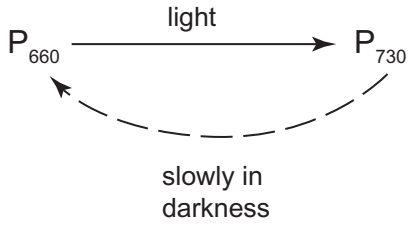
_____

_____

_____

_____ [2]

7 The importance of the photoperiod in the control of flowering has been known since the early 1900s and phytochrome, the plant pigment responsible, was eventually discovered in 1960. Phytochrome exists in two interchangeable forms P_{660} (P_R) and P_{730} (P_{FR}). The conversion between the two forms is illustrated below.



(a) (i) State **one** other treatment that would cause the conversion of P_{660} to P_{730}.

_____ [1]

(ii) State which of the two forms of phytochrome is the active form.

_____ [1]

(iii) Describe in detail how phytochrome controls flowering in a long-day plant.

_____

_____

_____

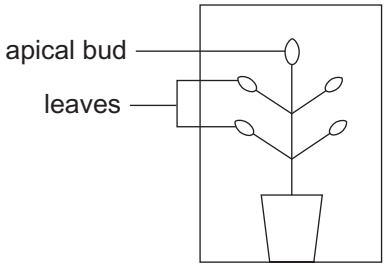
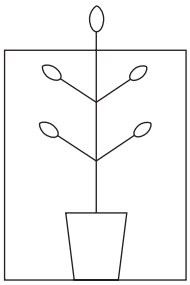
_____

_____

_____ [3]

Experiments were designed to investigate whether it is the leaves or the apical bud which are sensitive to the photoperiod. In each experiment, the entire plant or a portion of the plant was placed in a light-proof box which allowed the period of light and darkness to be controlled. The plants used were short-day plants.

The experiments are shown in the diagram together with the results obtained.

Experiment one	**Experiment two**
• Entire plant receives a short-day light treatment within the box 	• Leaves receive a short-day light treatment within the box • Apical bud receives a long-day light treatment outside the box 
Result: plant flowers	Result: plant flowers

(b) (i) How do the results of **Experiment two** suggest that the photoperiod is perceived by the leaves and not the apical bud?

_____

_____

_____

_____

_____

_____ [3]

(ii) What is the purpose of **Experiment one** in this investigation?

_____

_____ [1]

The results suggest that a chemical messenger is involved in flowering. This is supported by the fact that plants, given light treatments to inhibit their flowering, can be caused to flower by grafting or attaching leaves from plants that are already flowering.

(c) How do such grafting experiments suggest that a chemical messenger is involved?

_____

_____

_____ [2]

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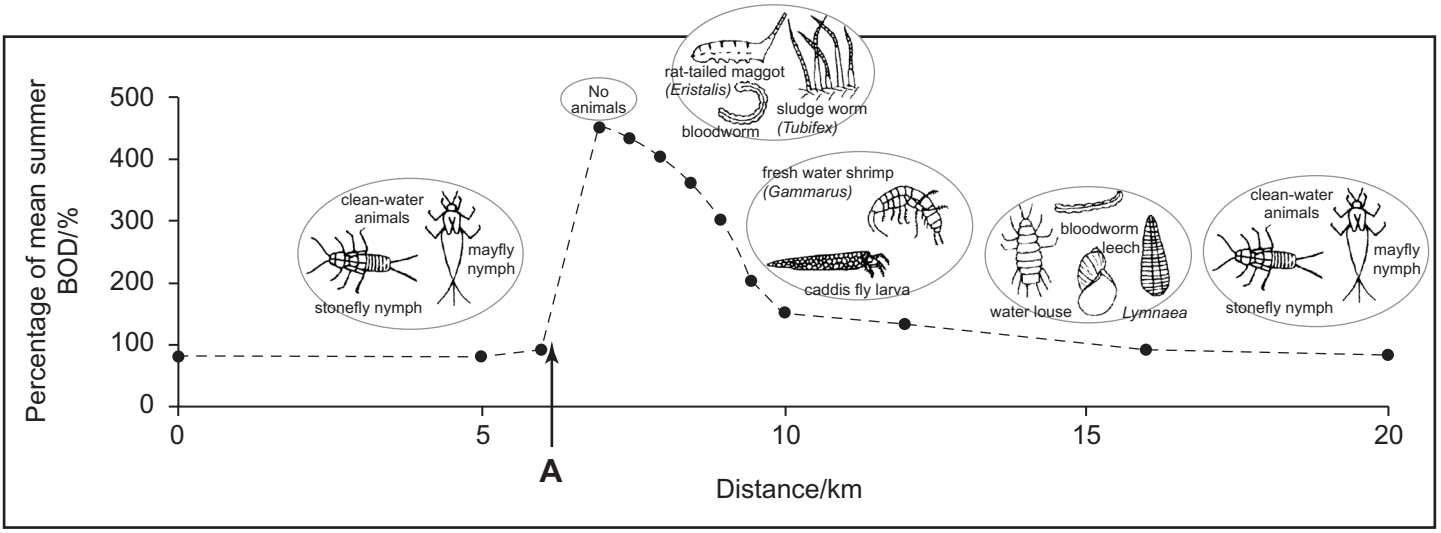
(Questions continue overleaf)

8 Rivers in Northern Ireland have a wide biodiversity of over 1500 invertebrate aquatic species. However pollution reduces biodiversity.

The diagram below illustrates a river in which an organic discharge entered at point **A** and its subsequent effect on the BOD (Biological Oxygen Demand) downstream. Some of the aquatic animals (Indicator species) sampled along the river are also illustrated.



Examiner Only	
Marks	Remark

(a) Organic discharges, such as slurry, contain many bacteria and fungi as well as dead organic matter.

(i) Explain the huge increase in the BOD immediately after the organic discharge at **A**.

_____

_____ [1]

(ii) Describe what happens to cause a decrease in the BOD downstream.

_____

_____

_____

_____ [2]

(b) The first animals sampled after the discharge include the rat-tailed maggot (*Eristalis*) and the sludge worm (*Tubifex*). These animals have adaptations: the rat-tailed maggot can extend its tail to the surface of the water and the sludge worm possesses haemoglobin within its tail.

(i) Suggest how these adaptations increase their tolerance of the organic pollution.

_____

_____

_____

_____

_____

_____ [3]

(ii) Explain the change in the aquatic communities with distance from the organic discharge.

_____

_____

_____

_____ [2]

(c) (i) Explain why eutrophication may occur downstream from the source of this organic pollution.

_____

_____ [1]

(ii) Explain the consequences of eutrophication.

_____

_____

_____

_____

_____

_____ [3]

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(Questions continue overleaf)

Section B

Quality of written communication is awarded a maximum of 2 marks in this question. [2]

9 Give an account of the generation of an action potential, impulse transmission along an axon and subsequent transmission to a post-synaptic neurone. [16]

THIS IS THE END OF THE QUESTION PAPER

110010

GCE Advanced Biology (A2)
New Specification
Assessment A2 1
Physiology and Ecosystems
Summer 2010

Photograph 4.6
(for use with Question 6)