Rewarding Learning

Centre Number	
71	

Candidate Number

ADVANCED
General Certificate of Education
January 2012

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

AB211

WEDNESDAY 25 JANUARY, 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.
There is an extra lined page at the end of the paper if required.
Answer **all nine** questions.
You are provided with **Photographs 1.6A and 1.6B** for use with Question 6 in this paper.
Do not write your answers on these photographs.

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.

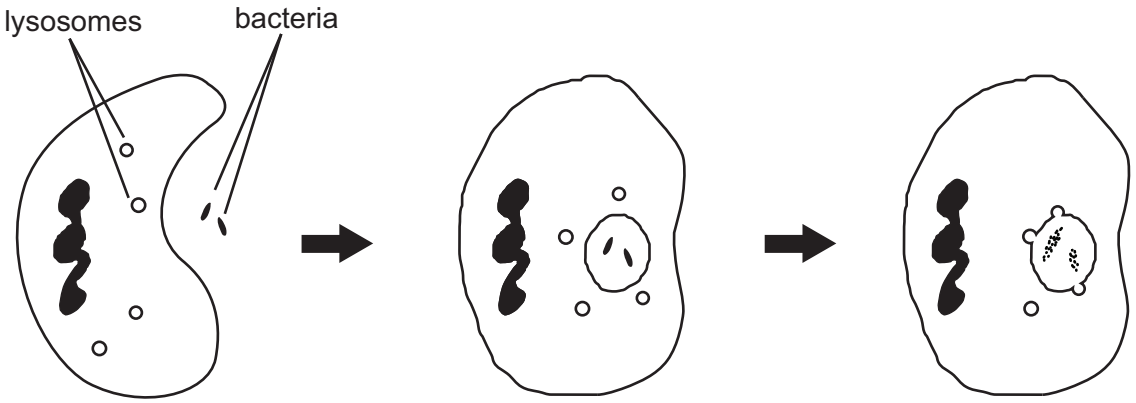
For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

BLANK PAGE

Section A

Examiner Only	
Marks	Remark

1 The diagram below summarises the process of phagocytosis.



Describe what is happening between stages 1 and 2, and between stages 2 and 3.

(a) Between stages 1 and 2

_____

_____ [1]

(b) Between stages 2 and 3

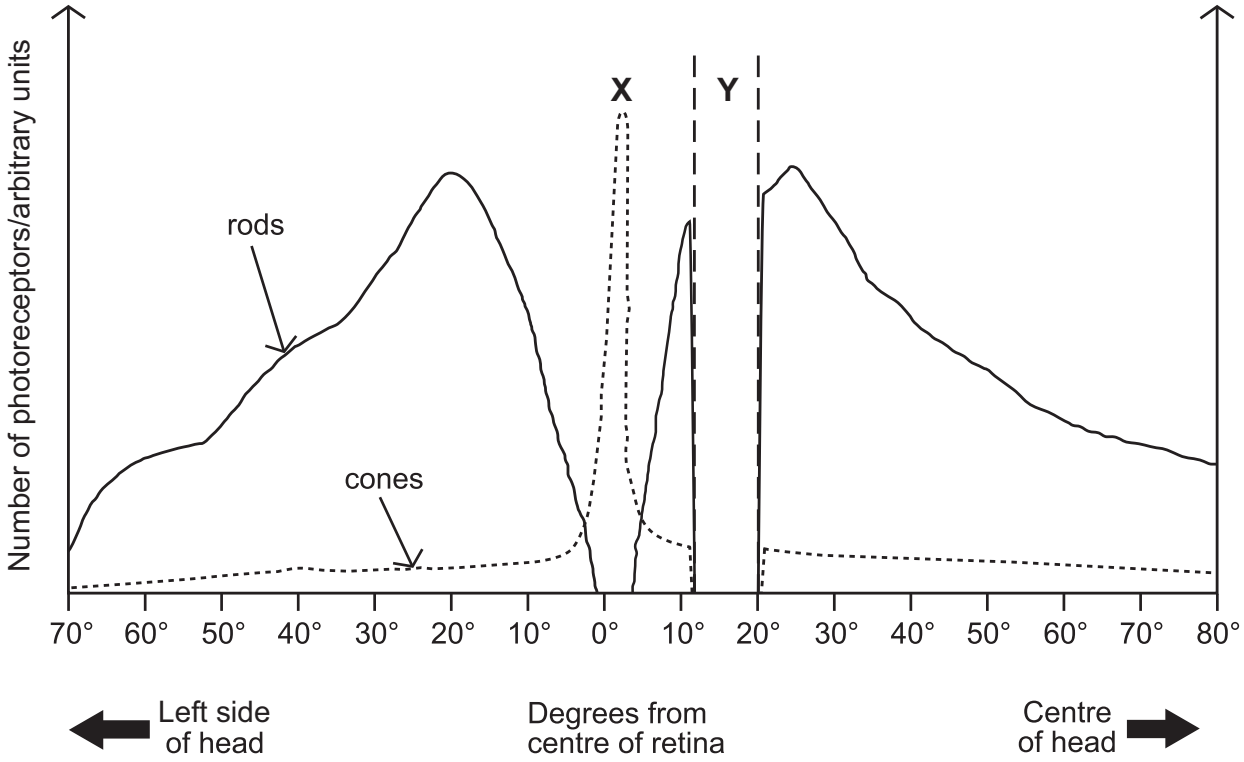
_____

_____

_____

_____ [2]

2 **(a)** Photoreceptor cells (rods and cones) are not distributed evenly across the retina. The diagram below shows the distribution of rods and cones across the retina of the human left eye.



(i) Name regions of the retina represented by **X** and **Y**.

X _____

Y _____ [2]

(ii) The diagram shows that there are more photoreceptor cells (rods and cones) at the edge of the retina closest to the centre of the head compared to the edge closest to the side of the head. Suggest a reason for this.

_____

_____ [1]

(iii) Peripheral vision can be described as vision at the limits of our field of view. With reference to both rods and cones, explain why peripheral vision has reduced visual acuity.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(b) The ability of the eye to focus on near and distant objects is called accommodation. Describe and explain the events that occur in the eye when accommodating a distant object.

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 In most of lowland Britain the natural climax community is broadleaf forest. In more mountainous regions it is mainly moorland.

(a) Define the term 'climatic climax community'.

_____

_____ [1]

(b) When an ecosystem such as a forest is destroyed by fire or storm damage, the resulting regrowth is an example of secondary succession.

(i) Suggest **two** reasons why secondary succession is usually a quicker process than primary succession.

1. _____

_____

2. _____

_____ [2]

Secondary succession in a wood destroyed by fire has been investigated over the 20 years immediately following the fire. The table below shows the biomass of a range of plant species (recorded as kg in a 25 m^2 section of woodland). The species were grouped as herbs, shrubs or trees.

Species	Group (herb, shrub, tree)	Biomass/kg 25 m^{-2} over time			
		5 yr	10 yr	15 yr	20 yr
Birch (*Betula spp.*)	Tree	0.7	5.2	8.9	14.8
Cow parsley (*Anthriscus sylvestris*)	Herb	1.2	0.4	0.2	0.1
Dandelion (*Taraxacum officinale*)	Herb	0.4	0.2	0.1	0.1
Goose grass (*Galium aparine*)	Herb	0.3	0.2	0.1	0.1
Gorse (*Ulex europaeus*)	Shrub	1.3	3.6	2.2	1.4
Hazel (*Corylus avellana*)	Tree	0.9	2.0	2.9	4.3
Heather (*Calluna vulgaris*)	Shrub	0.8	2.9	1.4	0.6
Lords and Ladies (*Arum maculatum*)	Herb	0.5	0.4	0.2	0.2
Nettle (*Urtica dioica*)	Herb	1.4	0.7	0.2	0.2
Rhododendron (*Rhododendron ponticum*)	Tree	0.6	4.2	8.4	12.4

(ii) Describe and explain the pattern of succession shown.

[4]

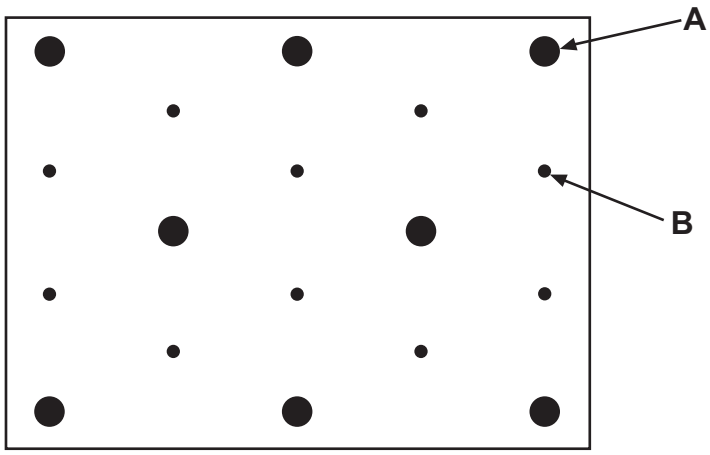
(iii) During the investigation, only plant biomass above the ground surface was measured. Suggest reasons for this.

[2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The diagram shows a representation of part of a myofibril in cross-section.



(i) Name the type of protein found in the structures represented by **A** and **B**.

A _____

B _____ [2]

(ii) Name the region (band) of the myofibril the section represents.

_____ [1]

(iii) Describe the sliding filament mechanism of muscle contraction.

_____

_____

_____

_____

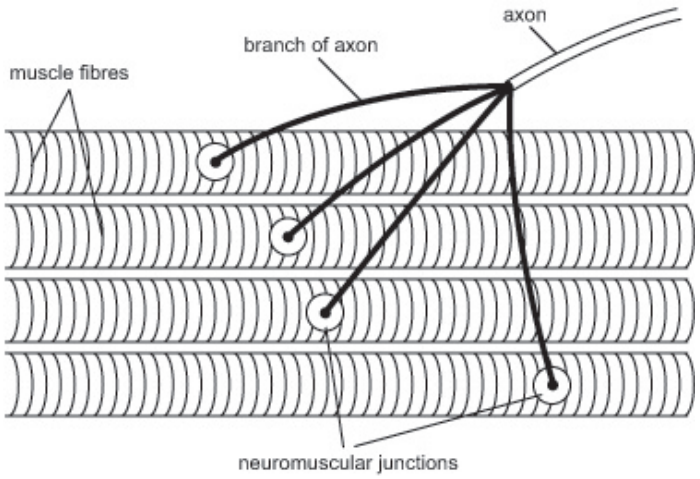
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(b) Neuromuscular junctions are specialised synapses that link neurones to muscle fibres. Each motor neurone subdivides into several branches, each with its own neuromuscular junction, as shown in the diagram below.



(i) In terms of outcome, identify the main difference between neuromuscular junctions and neurone to neurone synapses in the nervous system.

_____

_____ [1]

(ii) The diagram shows that the axon of one motor neurone branches to supply a number of muscle fibres. Suggest a reason for this.

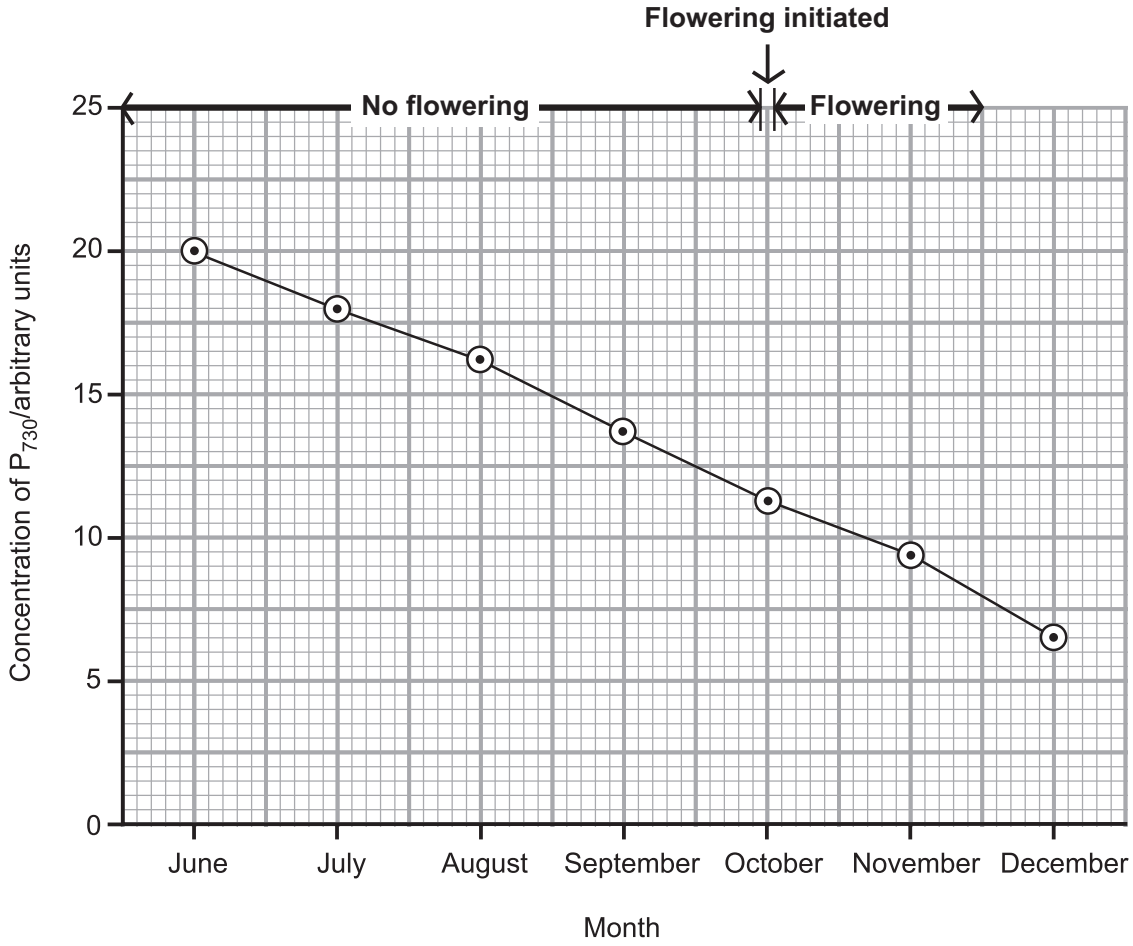
_____

_____ [1]

BLANK PAGE

Examiner Only	
Marks	Remark

5 **(a)** The concentration of phytochrome P_{730} in the leaves of a species of commercially grown, glasshouse plants was measured between June and December. The change in the level of P_{730} is shown in the graph below. The graph also shows that flowering is initiated in October and that flowering continues for a 6-week period.



(i) Explain how the results indicate that the plant species investigated is a short-day plant.

_____

_____ [1]

(ii) It is commercially important that fresh flowers are available at Christmas time. Describe how the photoperiod should be manipulated to ensure flowering is delayed until December. Explain why this would be effective.

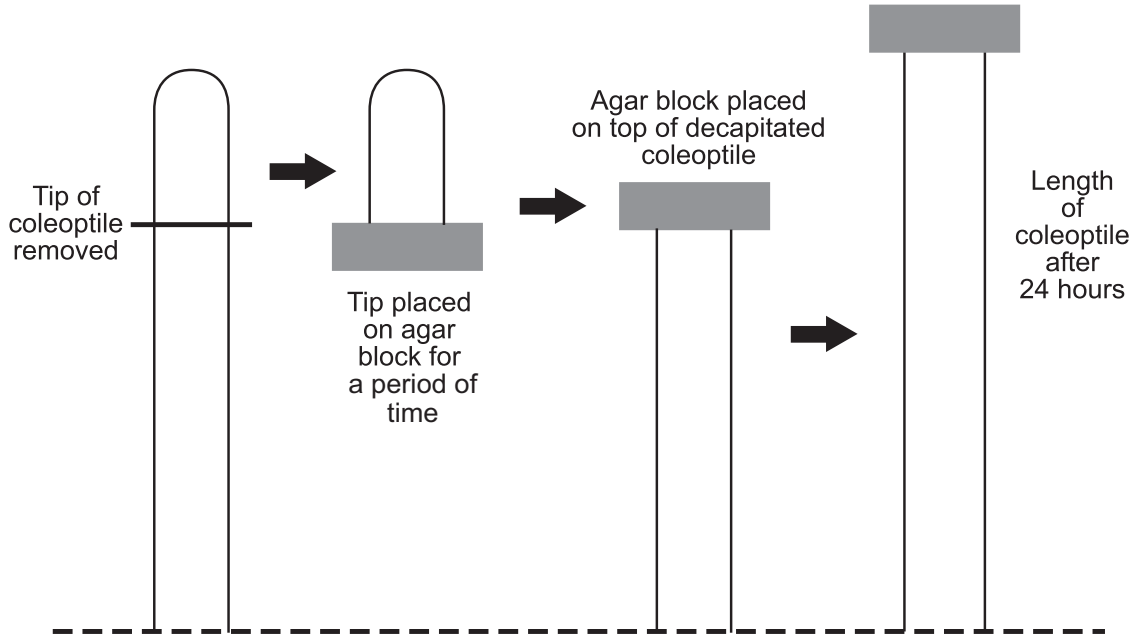
_____

_____

_____

_____ [2]

(b) Fritz Went was one of the scientists who investigated plant growth hormones. In 1928 he carried out the following experiment.



(i) Explain the change in the length of the coleoptile after 24 hours.

_____

_____

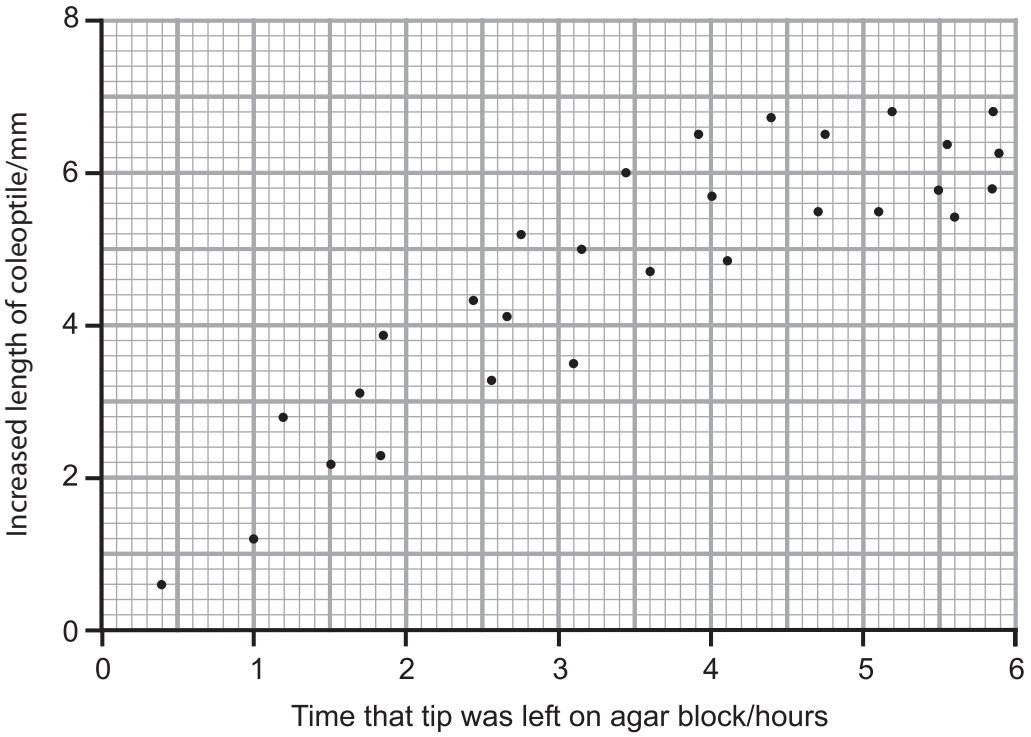
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Such experiments have indicated that the increased length of decapitated coleoptiles is dependent on the length of time that the coleoptile tip was left on the agar block. The results are shown on the graph below.



(ii) Describe and explain fully these results.

_____

_____

_____

_____

_____

_____

_____ [3]

(iii) Suggest **one** reason to account for the high degree of variability in the results.

_____

_____ [1]

Examiner Only

Marks	Remark

BLANK PAGE

Examiner Only	
Marks	Remark

6 **(a)** **Photographs 1.6A** and **1.6B** are from different regions of the kidney. Photograph **1.6B** is at a higher magnification than photograph **1.6A**.

(i) Identify the structures labelled **X** in **Photograph 1.6A**.

X _____ [1]

(ii) Identify the kidney regions that the photographs are taken from.

Photograph 1.6A _____

Photograph 1.6B _____ [2]

(b) The hormone ADH is involved in water reabsorption in the kidney. However, most of the water reabsorption in the kidney takes place independently of ADH being present.

(i) State precisely where ADH is produced in the body.

_____ [1]

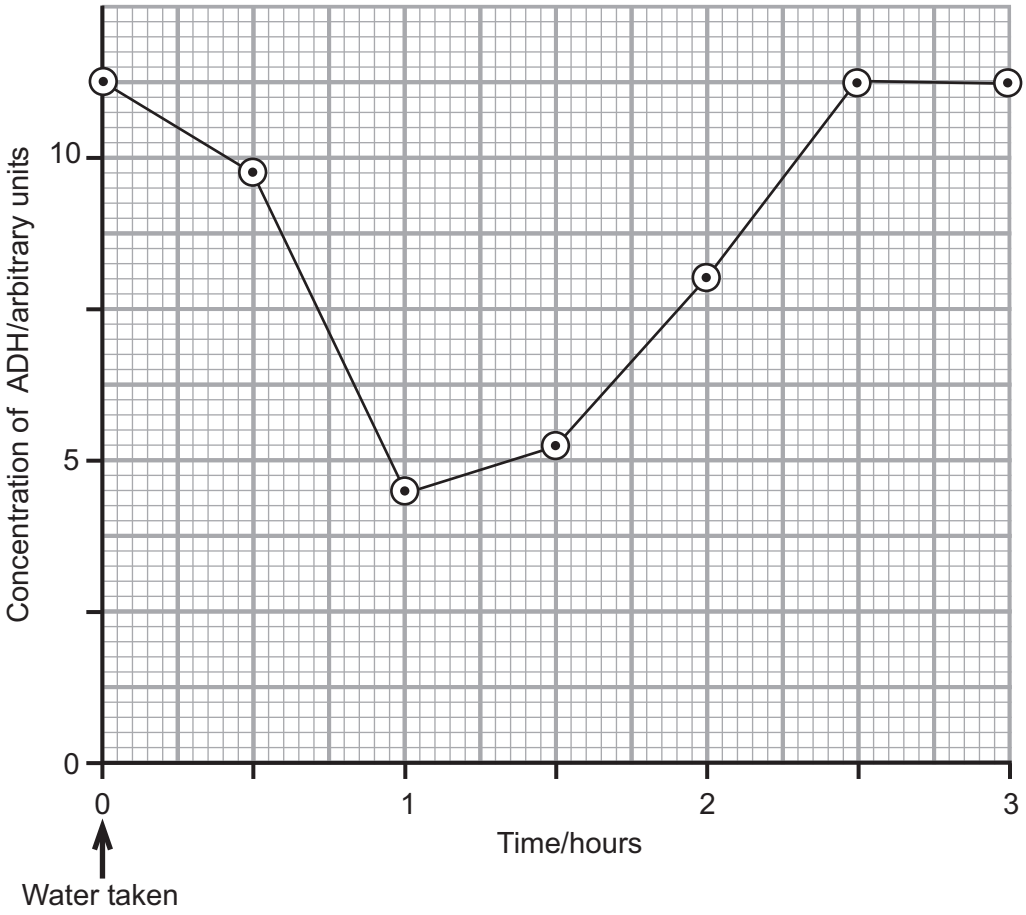
(ii) State where most water reabsorption takes place in the kidney. State also the process by which this water is reabsorbed.

_____

_____

_____ [2]

(c) The graph below shows the level of ADH in a student's blood over a three hour period after drinking 0.5 litres of water.



With reference to the process of osmoregulation, explain fully the changes in ADH concentration.

[4]

Examiner Only

Marks	Remark

(d) One symptom of diabetes is the higher than normal level of glucose in the blood which results in the appearance of glucose in the urine.

(i) State **one** specific test for the presence of glucose in a solution.

_____ [1]

(ii) Glucose is actively reabsorbed in the proximal tubule.
Using the information provided and your understanding of reabsorption, suggest an explanation for the presence of glucose in the urine of people with diabetes.

_____

_____

_____

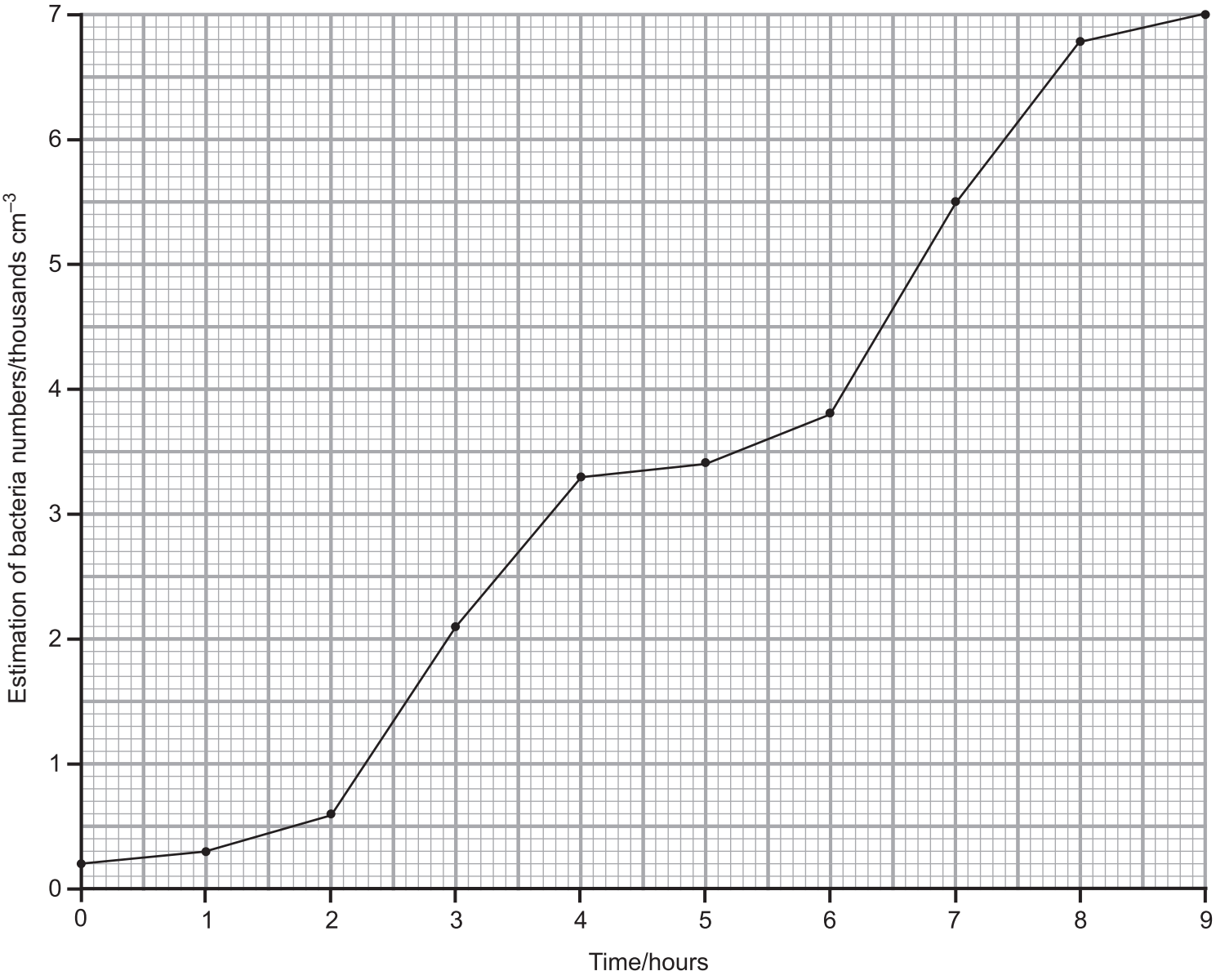
_____ [2]

Examiner Only	
Marks	Remark

7 Bacteria growing in laboratory cultures typically show an exponential growth pattern.

A particular species of bacterium was grown in culture with two food sources, glucose and maltose. The bacteria utilise the glucose first as a food source. However, they can use maltose as a food source when glucose supplies run low. Unable to use maltose directly, the bacteria produce enzymes to hydrolyse it into glucose.

The growth curve produced is shown on the graph below.



Examiner Only	
Marks	Remark

(a) Calculate the hourly rate of growth between 2 and 4 hours.
(Show your working.)

Answer _____ thousands cm^{-3} hr^{-1} [2]

(b) Using the information provided and your understanding of population growth, explain the growth pattern shown.

[4]

(c) Traditionally, bacterial numbers are counted using the technique of serial dilution and then counting the numbers of bacteria under the microscope. However, in this experiment the bacterial numbers were estimated using a colorimeter.

(i) Describe how a colorimeter could be used to estimate bacterial numbers.

[3]

(ii) Suggest **one** advantage of using a colorimeter in this experiment.

[1]

Examiner Only

Marks	Remark

8 The holly leaf miner (*Phytomyza ilicis*) is a small fly that completes much of its life cycle inside holly leaves. Up to a hundred or more leaves in a single holly tree can be affected by holly leaf miners. The trees are not harmed unless the proportion of leaves affected is very high.

In June, a female fly uses its egg-laying tube to penetrate the thick cuticle of the holly leaf to deposit an egg which quickly hatches into a larva (caterpillar). Over the summer and autumn, the larva feeds on the soft leaf tissue between the upper and lower surfaces and, in doing so, creates the characteristic mines that are visible as blotches on the leaf surface. Eventually the adult emerges, leaving the leaf through a small exit hole usually in the upper leaf surface.

Some species of wasps are parasitic on the holly leaf miners. These wasps also have an egg-laying tube by which an egg is deposited inside the holly leaf miner larva. After the wasp larva hatches from its egg it feeds on the miner larva for a period of time. As the holly leaf miner larva is consumed from within, it will eventually die. Just before this happens the wasp (now an adult) emerges from the leaf through its own exit hole which is distinctly different from the holly leaf miner exit hole. In any one holly tree, the number of miners subject to parasitic attack varies, but normally some miners survive to exit the leaf, mate, and continue the cycle.

(a) Draw a labelled pyramid of numbers representing the organisms listed in the passage.

[2]

(b) Using the information provided, state why the wasps are categorised as parasites and not predators.

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(c) Holly trees are valuable commercially and are frequent purchases in garden centres.

The following investigation shows the results from an analysis of holly leaves from the common holly tree and a variegated variety, not usually found in the wild, but very popular in garden centres and sold as an ornamental garden shrub. The holly trees were sampled in their usual settings – the common variety in woodland and the variegated variety in residential gardens.

Numbers of	Common holly	Variegated variety
leaves sampled	1200	800
leaves with mines	88	38
larvae killed by parasitic wasps	62	24
larval deaths for other reasons	8	5
holly leaf miners surviving (emerging)	18	9

(i) Using the information provided in the passage opposite and your understanding of ecological technique, suggest an appropriate investigative procedure for obtaining the data in the table.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(ii) How does the data suggest that the variegated variety is less prone to attack by holly leaf miner flies?

_____ [1]

(iii) Suggest **one** reason why the variegated variety is less prone to infection by the holly leaf miner.

_____

_____ [1]

(d) Pesticides have been used to further reduce the effect of holly leaf miner activity in the variegated variety.

Examiner Only	
Marks	Remark

(i) Suggest **one** reason why attempts are made to reduce holly leaf miner activity in the variegated variety.

_____

_____ [1]

(ii) Pesticides can be applied either directly to the leaves or to the soil around the holly tree roots (pesticides applied to the soil around the roots are carried to the leaves in the transpiration stream). Suggest one **disadvantage** of applying the pesticides:

- directly to the leaves _____

  _____

- to the soil around the roots _____

  _____ [2]

BLANK PAGE

(Questions continue overleaf)

Section B

Examiner Only	
Marks	Remark

Quality of written communication is awarded a maximum of 2 marks in this section.

9 **(a)** Describe and explain the link between human activity and water pollution. [10]

(b) Discuss the strategies used to minimise the effects of human activity on water pollution. [6]

Quality of written communication [2]

(a) Describe and explain the link between human activity and water pollution.

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(b) Discuss the strategies used to minimise the effects of human activity on water pollution.

Examiner Only	
Marks	Remark

Extra lined page

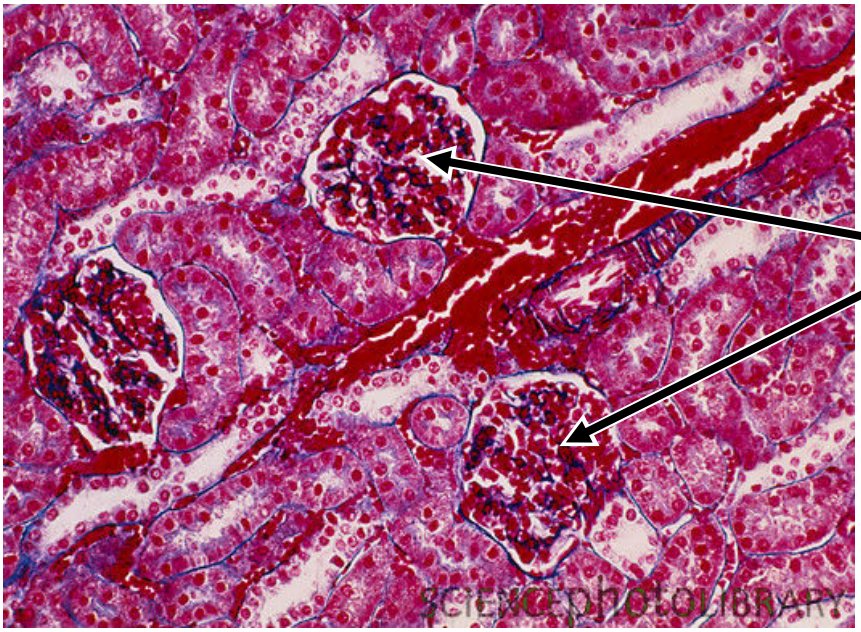
Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

GCE Biology Advanced (A2)
Assessment Unit A2 1
Physiology and Ecosystems
January 2012

Photographs 1.6A and 1.6B
(for use with Question 6)

Photograph 1.6A



Photograph 1.6B