Rewarding Learning

Centre Number

71	

Candidate Number

ADVANCED
General Certificate of Education
2012

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

AB211

MONDAY 14 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.
There is an extra lined page at the end of the paper if required.
Answer **all nine** questions.
You are provided with **Photograph 1.4** for use with Question 4 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	

Section A

Examiner Only	
Marks	Remark

1 **(a)** The table below concerns two plant hormones and their functions. Complete the table.

Hormone	Function
Cytokinin	
	promotes elongation of internodal regions

[2]

(b) Many people grow plants in pots on window ledges. The plants will only grow straight if they are turned frequently.

A particularly fast-growing plant was placed on a window ledge and turned occasionally. It did not grow straight but developed a 'corkscrew' appearance as shown in the diagram below.

Suggest an explanation for the corkscrew appearance.

Examiner Only	
Marks	Remark

[3]

Examiner Only	
Marks	Remark

2 Skeletal (voluntary) muscle makes up a large proportion of our body weight and is essential for movement. Skeletal muscle is also called striated muscle as it has alternating light and dark bands.

(a) Explain precisely what causes the alternating light and dark band pattern in skeletal muscle.

_____

_____ [1]

(b) Muscle is also important in the functioning of the eye.

(i) Suggest **one** difference between the control of muscle in the iris and skeletal muscle in the arm.

_____

_____ [1]

(ii) Describe the role of muscle in the functioning of the iris.

_____

_____

_____

_____

_____

_____

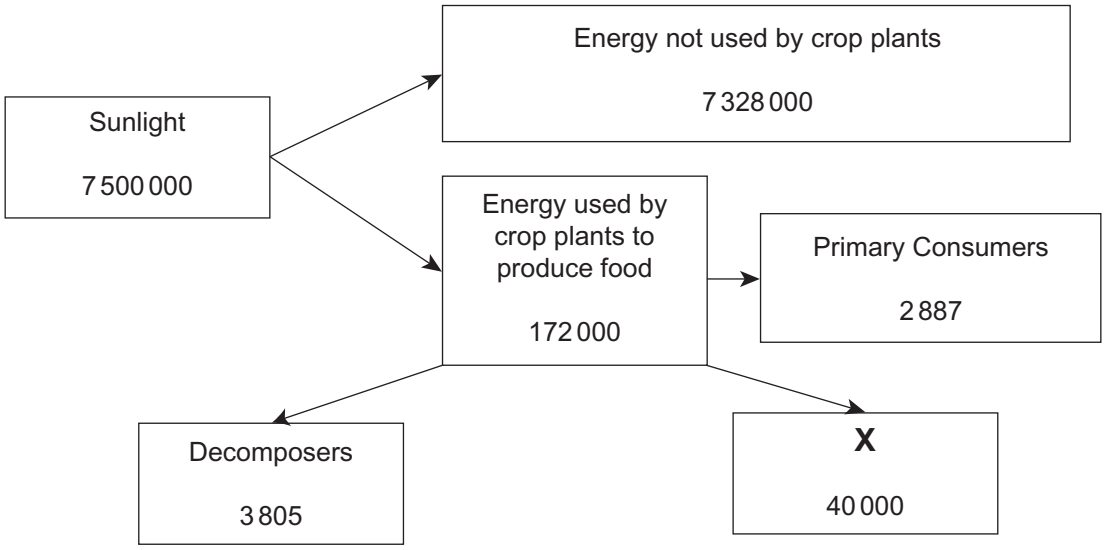
_____ [3]

(iii) Name **one** other muscle in the eye that is important in producing a clear image.

_____ [1]

Examiner Only	
Marks	Remark

3 The diagram below shows the transfer of energy in an agricultural ecosystem prior to harvesting. The figures are in kJ m^{-2} $year^{-1}$.



(a) (i) Calculate the percentage of sunlight trapped as GPP. (Show your working.)

_____ % [2]

(ii) State **two** reasons why the energy transfer from sunlight to the producers (crop plants) is so low.

1. _____

_____

2. _____

_____ [2]

(iii) Suggest what process **X** represents.

_____ [1]

(b) The data in the diagram was obtained from a crop-based agricultural ecosystem. Using the information in the diagram, identify **one** piece of evidence for this and explain your reasoning.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

4 **(a)** **Photograph 1.4** is a photomicrograph that shows part of a motor neurone cell.

(i) Identify the features labelled **X** and **Y**.

X _____

Y _____ [2]

(ii) Suggest which part of the body this photomicrograph was taken from.

_____ [1]

(b) Attention-deficit disorder (ADD) is relatively common and is caused by a malfunctioning in neurotransmitter action. Recently it has been widely accepted that this disorder is genetic in origin as opposed to being a consequence of an individual's environment. Research published in *The Lancet* in October 2010 indicated that patients who had been given a clinical diagnosis of ADD were over twice as likely to have abnormalities in chromosome 16 compared with individuals without the condition. The data used in the research was based on 366 patients diagnosed with ADD with a control group of 1000.

(i) Outline the role of neurotransmitters in the functioning of the nervous system.

_____

_____

_____

_____ [2]

(ii) State **one** reason why the conclusions of this research could be considered reliable.

_____ [1]

Research in scientific journals is 'peer-reviewed'. This means that other scientists working in the same field review the procedures used and the conclusions derived from the research.

(iii) Explain the importance of peer review in reviewing scientific research.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Scientists discovered a new species of grasshopper in a meadow habitat. The grasshoppers were difficult to spot, being well camouflaged in the leaves of the tall grass and herbs typical of the habitat. The grasshoppers of this species appeared to be particularly mobile. Although poor fliers, they frequently 'hop' between the leaves and stalks of the meadow plants, often moving considerable distances. When not feeding on plant leaves, or moving between plants, they often rest on the leaves and use the heat from the sun to raise their body temperature.

The scientists wanted to estimate the population size of the grasshoppers belonging to the new species in the meadow by using a mark/recapture technique. This involved taking an initial sample, marking the grasshoppers and releasing them back into the population; followed by taking a subsequent sample to determine the number of those recaptured.

(a) Suggest how the scientists could capture and mark the initial sample of grasshoppers. Your answer should describe the sampling procedure used, the technique used to capture the insects and the marking procedure.

[4]

(b) Having released the marked grasshoppers, the scientists collected a subsequent sample for analysis the following day.

(i) Explain why the subsequent sample should not be taken **immediately** after the initial sample.

[1]

Examiner Only

Marks	Remark

(ii) Suggest **two** distinct reasons for obtaining a subsequent sample for analysis so quickly (one day later) after the initial sample was taken.

1. _____

_____

2. _____

_____ [2]

(c) The table below shows the results obtained from the survey.

Sample	Total number of grasshoppers	Number of marked grasshoppers
Initial sample (caught and marked)	64	64
Subsequent sample (caught for analysis)	42	8

Calculate the estimated population size of grasshoppers in the meadow. (Show your working.)

_____ [2]

(d) It was proposed that the meadow be designated as a nature reserve since it contained a new species of grasshopper.

Suggest what further work should be carried out by the scientists before recommending special protection for the grasshoppers.

_____

_____ [1]

(e) It was noted that the grasshoppers “use the heat from the sun to raise their body temperature”.

Suggest reasons for this behaviour.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

6 The famous environmental scientist, James Lovelock proposed the Gaia hypothesis. In this he referred to the Earth and its atmosphere as a self-regulating system that has allowed life to thrive through biological processes maintaining an atmosphere that supports life.

Lovelock and other scientists have since suggested that the Earth is at serious risk due to global warming. In his book, *The Revenge of Gaia (2006)*, Lovelock concludes that the only hope for the planet lies in dramatic reductions in both habitat destruction and the use of fossil fuels.

(a) (i) State **two** biological processes that contribute to the "self-regulating system" of the Earth and its atmosphere.

_____ and _____ [1]

(ii) Explain the link between increasing atmospheric carbon dioxide levels and global warming.

_____

_____

_____

_____ [2]

(iii) Suggest how an increased reliance on farming has contributed to global warming.

_____

_____

_____

_____

_____ [2]

(b) Willow is a fast-growing biofuel that can be harvested after as little as three year's growth.

Explain why the growing of willow plants and its use as a biofuel is advantageous to the environment.

[4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 Medium- and long-distance runners often use isotonic sports drinks before, during, and after their events.

A typical male runner can have around 90 g of stored glycogen reserves in the liver and a further 350–400 g stored in the muscles at the start of a race. During a race, up to 4 g of this reserve can be used up each minute. In addition, distance runners lose considerable quantities of sweat, rich in sodium, potassium, calcium, magnesium and other ions.

The isotonic drink *Powerade* provides the following nutritional information.

Nutrition Information – typical values per 100 ml			
Energy	70 kJ	Fat	0 g
Protein	0 g	Of which saturates	0 g
Carbohydrate	3.9 g	Fibre	0 g
Of which sugars	3.9 g	Sodium	0.05 g
Other added nutrients per 100 ml			
Potassium 12.5 mg	Calcium 1.3 mg	Magnesium 0.6 mg	

Source: Powerade – The Coca Cola Company

Isotonic drinks have many advantages. They replace ions lost in sweat and can reduce the depletion of glycogen reserves. The uptake of the ions into the cells also reduces dehydration.

(a) (i) How does the data for *Powerade* suggest that sodium is the principal ion lost in sweat?

_____

_____ [1]

(ii) Suggest why all the carbohydrate in *Powerade* is in the form of sugars.

_____

_____ [1]

(b) Explain why the uptake of ions into the body cells reduces dehydration in these cells.

_____

_____

_____

_____ [2]

Many manufacturers claim that drinking an isotonic drink during a race, as opposed to drinking water only, reduces the need for runners to go to the toilet (to urinate) while running.

(c) Explain the reasoning for this claim.

_____

_____

_____

_____

_____

_____ [3]

(d) The absorption of the sugars in the isotonic drinks takes place in the ileum.

(i) Describe the process of sugar absorption in the ileum.

_____

_____

_____

_____ [2]

The process of absorption is aided by the presence of villi and microvilli.

(ii) Give **one** similarity and **one** difference between villi and microvilli.

- similarity _____

  _____

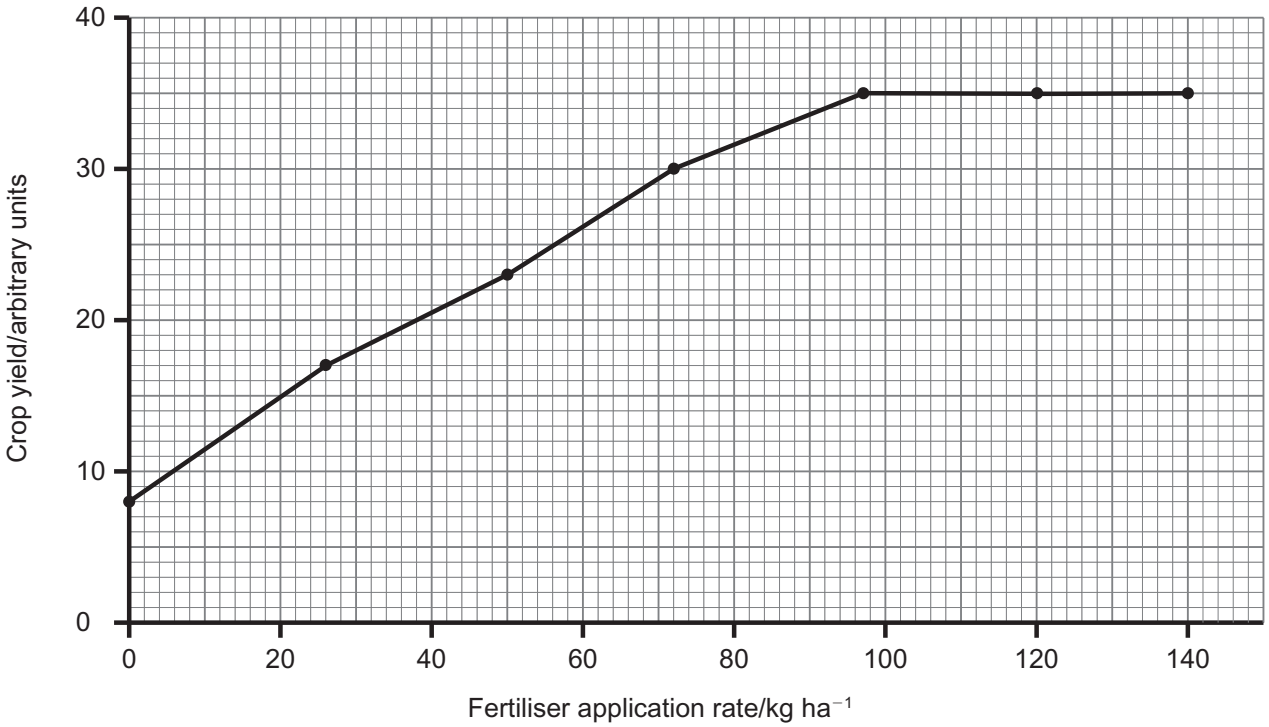
- difference _____

  _____ [2]

Examiner Only	
Marks	Remark

8 It is important that fertiliser is applied to farmland in appropriate concentrations to maximise productivity and profit, and also at levels that are not harmful to the environment.

The graph below shows the relationship between levels of application of artificial fertiliser and crop yield for maize.



(a) (i) Using the graph, state the optimum fertiliser application rate for this crop. Explain your answer.

_____

_____

_____

_____ [2]

(ii) Suggest **one** reason why the crop yield would decrease if the fertiliser application was significantly increased above 140 kg ha^{-1}.

_____

_____ [1]

Examiner Only	
Marks	Remark

(iii) The use of organic fertiliser (farmyard manure), as opposed to artificial fertiliser, helps improve soil crumb structure.

Explain, as fully as possible, **two** distinct ways in which an improved soil crumb structure can improve crop yield.

1. _____

_____

2. _____

_____ [2]

(b) Maize and other crops are subject to attack by pests.

(i) Describe and explain **two** ways in which pests can reduce crop yield.

1. _____

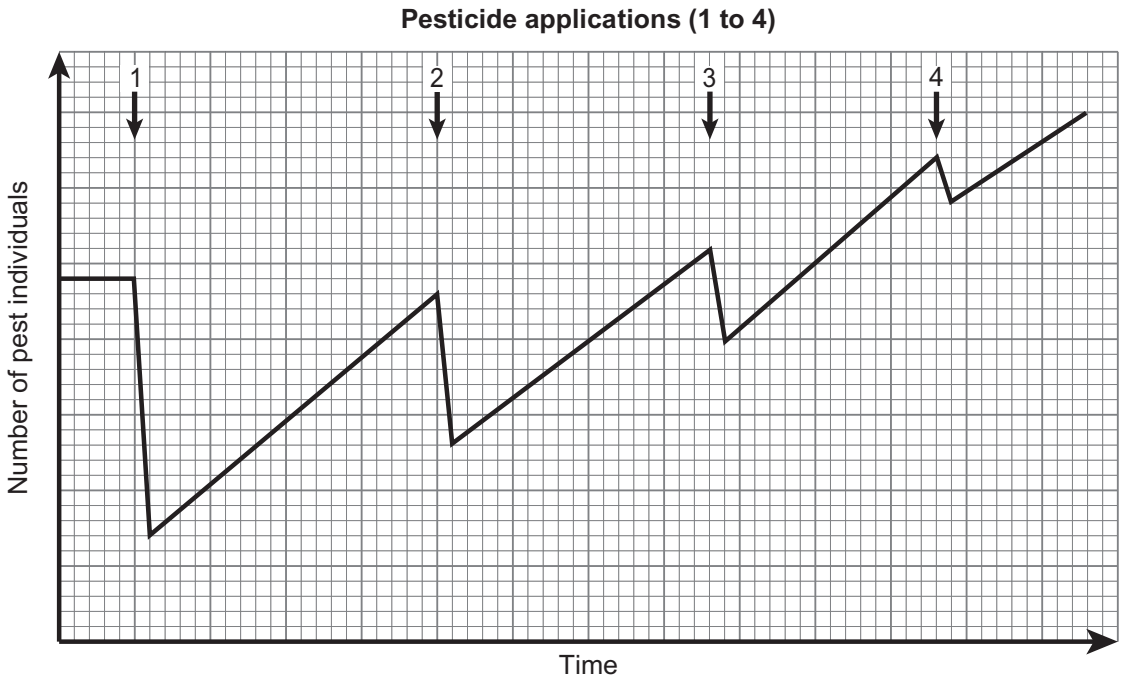
_____

2. _____

_____ [2]

Examiner Only	
Marks	Remark

Many pesticides kill a wide range of insects. The graph below shows the effect of a series of pesticide applications on the numbers of a common pest of maize plants.



(ii) Describe and explain the trends evident in the graph.

[4]

Examiner Only	
Marks	Remark

Integrated Pest Management Systems involve the use of a range of strategies to combat pests.

(c) Explain how the use of crop rotation and the sterilisation of the males of pest species can reduce the damage caused by pests.

- crop rotation _____

  _____

- sterilisation of the males of pest species _____

  _____ [2]

Examiner Only	
Marks	Remark

Section B

Examiner Only	
Marks	Remark

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

9 An immune response is the way in which the body responds to invasion by a specific antigen. Modern medicine has further developed procedures to influence the body's ability to respond to invading antigens.

(a) With reference to antibody-mediated immunity, acquired naturally and artificially, describe how humans are protected against disease. [10]

(b) Tissue to be transplanted (e.g. donor kidneys) contain antigens which may promote an unwanted immune response. Outline the process of transplant rejection and discuss the strategies used to reduce rejection. [6]

Quality of written communication [2]

(a) With reference to antibody-mediated immunity, acquired naturally and artificially, describe how humans are protected against disease.

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(b) Tissue to be transplanted (e.g. donor kidneys) contain antigens which may promote an unwanted immune response. Outline the process of transplant rejection and discuss the strategies used to reduce rejection.

Examiner Only	
Marks	Remark

Extra lined page

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Photograph 1.4
(for use with Question 4)