Rewarding Learning

Centre Number

71	

Candidate Number

ADVANCED
General Certificate of Education
January 2011

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

AB211

MONDAY 24 JANUARY, AFTERNOON

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 4.5** for use with Question 5 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 Read the following passage about the development of a community over a period of time and write the most appropriate word(s) in the blank spaces to complete the account.

The initial colonisation of bare rock is by _____ species.

Over time as the soil develops, more species colonise the area, a process known as _____ succession. The final stable community is known as the _____ community. If this final community is destroyed by fire a more rapid _____ succession may take place.

[4]

Examiner Only	
Marks	Remark

2 **(a)** Auxins and gibberellins are both plant growth substances which promote cell elongation in different parts of the stem. State which parts of the plant stem are stimulated by

- Auxins _____
- Gibberellins _____ [1]

(b) Growth in plants involves the division of cells which subsequently increase in length.

In an experiment, the effects of two "growth substances" on both cell division and cell elongation were compared with an untreated control plant. Each treatment resulted in longer stems than the untreated control. The specific effects on cell division and cell elongation are shown in the table below.

	Untreated Control	**Treatment with an artificial growth substance**	
		1-naphthaleneacetic acid (NAA)	2,4-dichlorophenoxyacetic acid (2,4-D)
Cell division – average number of new cells produced /cells day $^{-1}$	3.9	3.8	5.9
Cell elongation – average increased length of each new cell/μm	30	48	24

Using the information in the table, explain the increase in stem elongation produced by each treatment.

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 Almost all drugs taken by humans, including nicotine and alcohol, affect the nervous system, especially synapses.

(a) The drug nicotine, found in the leaves of the tobacco plant, binds to the acetylcholine receptor sites in synapses. After binding to these receptor sites, nicotine acts in a similar way to acetylcholine.

(i) Using your understanding of the nerve synapse, describe precisely where nicotine would bind.

_____ [1]

(ii) Describe and explain the effect of nicotine on the nervous system.

_____

_____

_____

_____

_____

_____ [3]

(iii) Unlike acetylcholine, nicotine is not broken down within the synapse. Suggest **one** possible consequence of nicotine remaining in the synapse.

_____

_____ [1]

(b) The drug alcohol, binds with gamma aminobutyric acid (GABA) receptors in synapses. After binding, alcohol acts in a similar way to GABA – the inside of the neurone membrane becomes more negative, a state known as hyperpolarisation.

Examiner Only	
Marks	Remark

(i) Suggest **one** way in which alcohol causes the inside of the membrane to become more negative.

_____

_____ [1]

(ii) Alcohol is known to inhibit the nervous system. Suggest how this inhibition may be brought about.

_____

_____

_____

_____ [2]

(iii) Suggest **one** consequence of alcohol inhibition of the nervous system.

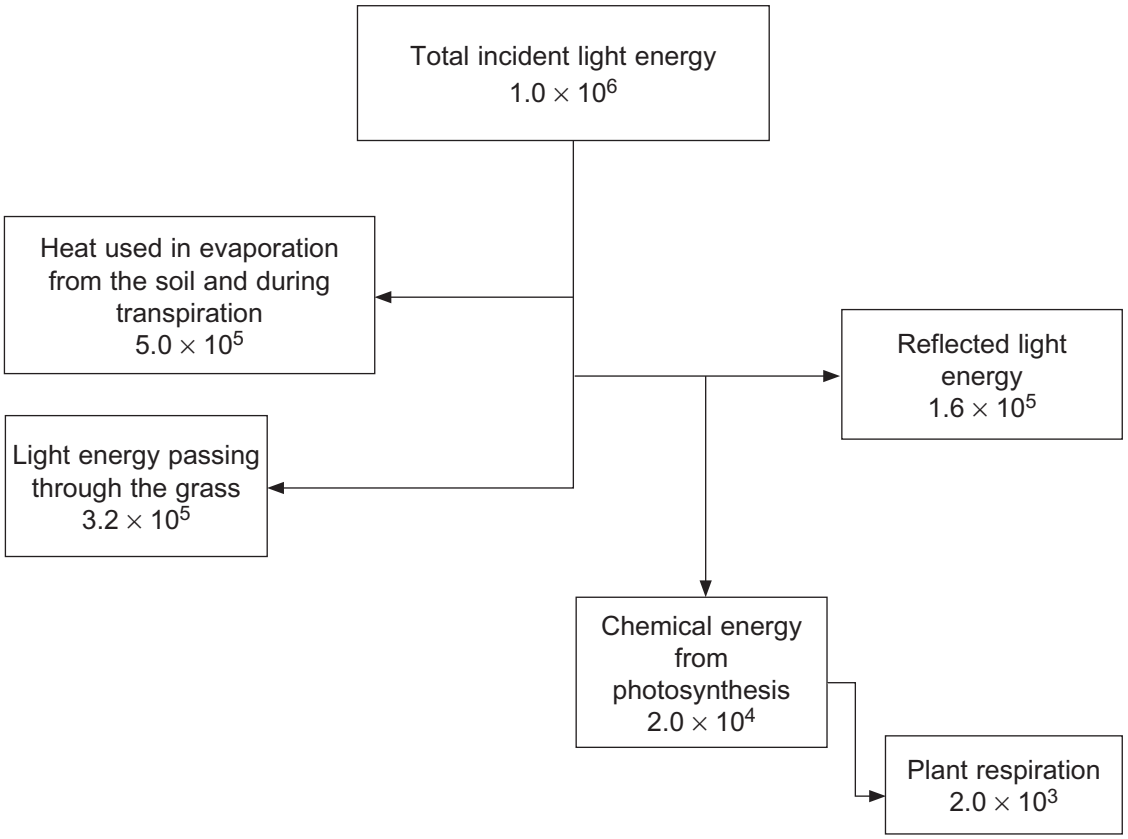
_____

_____ [1]

Examiner Only	
Marks	Remark

4 During photosynthesis by green plants, light energy is converted into chemical energy, some of which is subsequently used in respiration.

(a) The diagram below shows the fate of incident light energy on 1 m^2 of grass. (Units $kJ\,m^{-2}y^{-1}$.)



(i) Calculate the percentage of the total incident light energy which is converted into chemical energy. Show your working.

Answer _____ [2]

(ii) Define the term Net Primary Production (NPP).

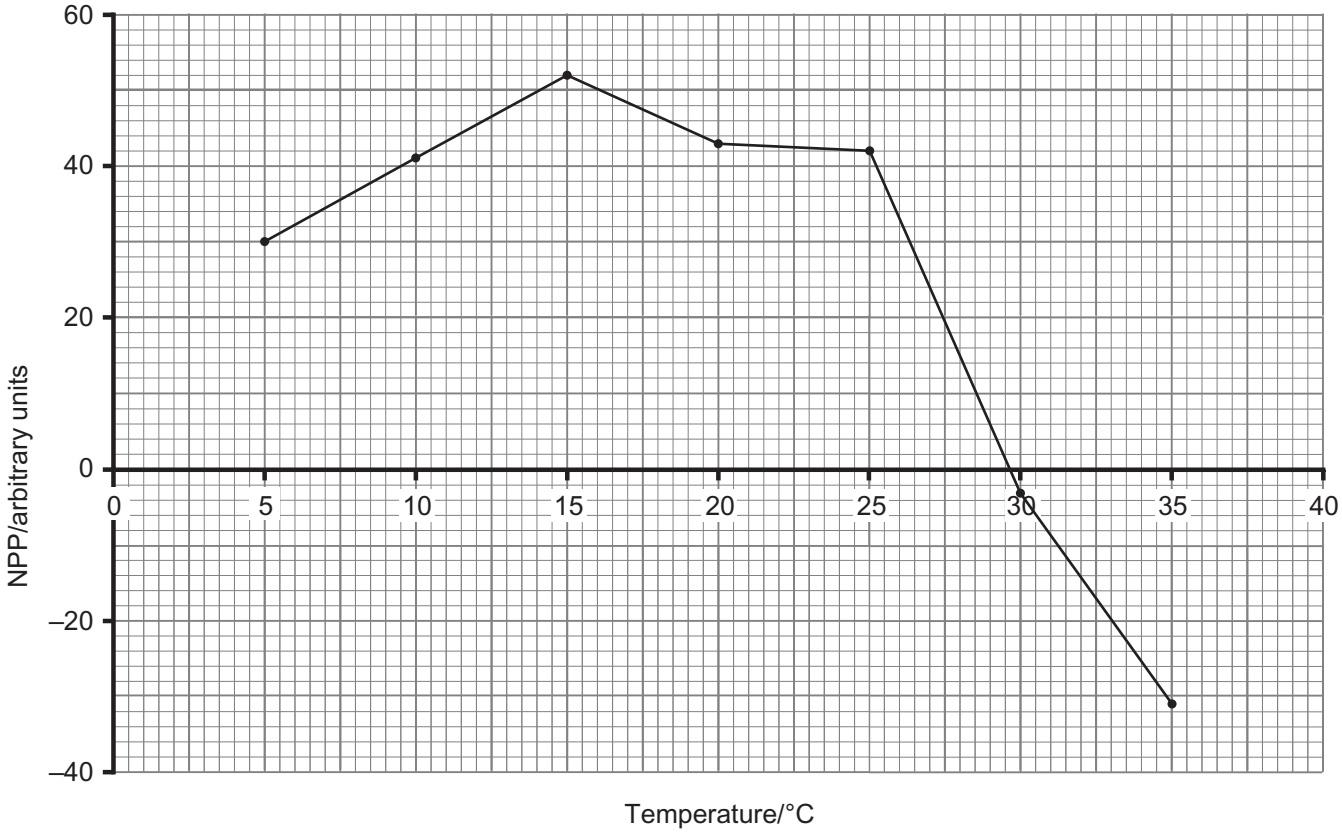
_____

_____ [1]

(iii) Calculate NPP for the grass.

Answer _____ [1]

(b) The processes of photosynthesis and respiration are both influenced by temperature. The graph below shows NPP of grass at different temperatures.



(i) Explain the negative NPP values above 30 °C.

_____

_____

_____

_____ [2]

(ii) Early summer temperatures are in the range 5 to 20 °C. Explain why grass is a suitable species for cropping as silage in early summer.

_____

_____ [1]

(c) Explain **two** advantages of using silage to feed cattle over allowing the cattle to graze the field.

1. _____

_____

2. _____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 The growth of maize in Ireland has been improved by the introduction of photodegradable plastic. The **photographs 4.5 X** and **Y** show photodegradable plastic strips with maize seedlings growing through perforations in the plastic.

(a) Suggest **one** advantage of the plastic being photodegradable.

_____

_____ [1]

(b) The plastic strip influences the temperature of the soil underneath. The table below shows the average soil temperatures for May and June underneath a plastic strip (at the centre and at its edge) and in soil lacking plastic cover.

Month	Soil temperature/°C		
	Under plastic cover		No plastic cover
	Centre	Edge	
May	14.9	13.0	11.4
June	19.9	17.7	16.0

(i) Using the information in the table, explain why the use of plastic strips improves the growth of maize.

_____

_____

_____ [1]

(ii) Examine **photographs 4.5 X** and **Y** and suggest **two** additional advantages of growing maize under plastic.

1. _____

_____

2. _____

_____ [2]

(c) The growth of maize under plastic was investigated at two sites in Ireland: Carrick-on-Suir, Co. Tipperary (in the South-East) and Dromore, Co Down (in the North-East). Five varieties of maize were tested. The table below shows the relative performance of the varieties at the two sites. (100 represents the overall average for the five varieties at both sites.)

	Carrick-on-Suir	**Dromore**
Variety	**Grain yield**	**Grain yield**
Nancis	102	125
Loft	104	123
Hudson	117	102
Rival	111	58
Janna	108	50

Comment on the influence of the site on the relative performance of the varieties in the investigation.

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_____ [3]

Examiner Only

Marks	Remark

Examiner Only

Marks	Remark

(d) In recent years, maize silage has become a significant component of the feed on many dairy and beef farms in Ireland.

In an investigation into the benefits of feeding cattle with a grass-maize silage mixture compared to grass-only silage, the weight of the finished beef cattle was found to be greater when maize was included in their diet.

The table below shows other comparisons made during the investigation.

	Grass silage	**Grass plus maize silage**
Mean amount eaten /kg dry matter day^{-1}	8.38	9.08
Energy absorbed/MJ day^{-1}	104	111
Energy stored in the carcass/MJ day^{-1}	5.0	5.9

(i) Using the information in the table, explain the increased weight of cattle fed on the grass-maize silage.

_____

_____

_____

_____ [2]

(ii) Suggest **two** reasons why so little of the absorbed energy is stored in the carcass.

1. _____

_____

2. _____

_____ [2]

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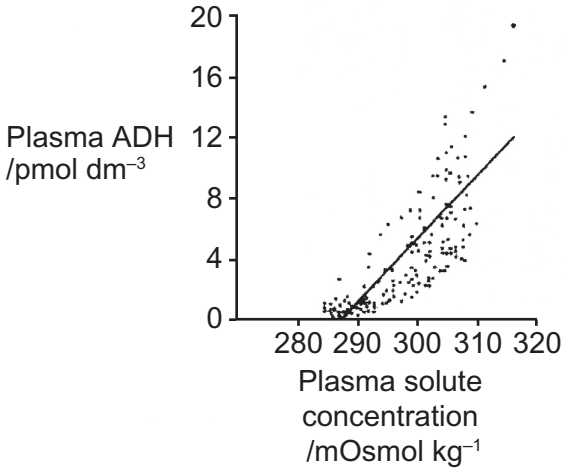
(Questions continue overleaf)

6 In humans, the process of osmoregulation is an example of homeostasis and involves

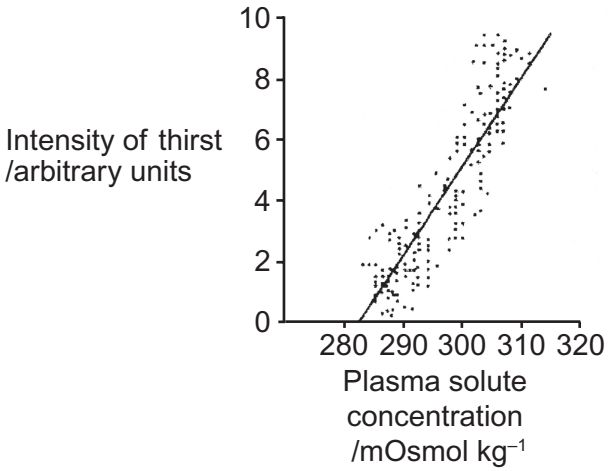
- the release of antidiuretic hormone (ADH) which controls water loss
- a thirst response which controls water uptake through drinking

The graphs below show how ADH levels and the intensity of a person's thirst are affected by changing plasma solute concentration.

Graph A



Graph B



(a) Using the information in **Graph A** and your understanding of how ADH is released into the plasma, explain the effect of changing plasma solute concentration on plasma ADH levels.

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_____ [4]

Examiner Only	
Marks	Remark

(b) Describe and explain the effect of increasing ADH levels on urine production.

Examiner Only

Marks	Remark

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_____

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_____ [3]

(c) With reference to **Graph B**, describe and explain the relationship between a person's thirst and the plasma solute concentration.

_____

_____

_____

_____ [2]

(d) Plan an investigation which tests the following hypothesis.

"Drinking isotonic solutions instead of water reduces urine production"

(There is no need to include a plan for statistical analysis.)

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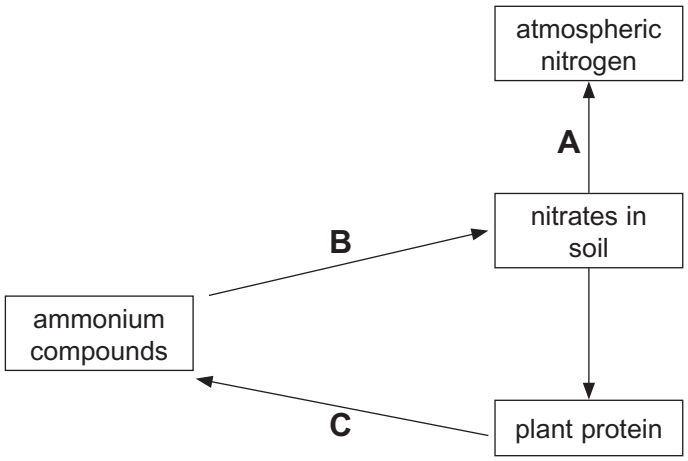
_____ [4]

Examiner Only	
Marks	Remark

7 **(a)** The diagram below summarises part of the nitrogen cycle.



Identify the processes labelled **A** to **C**.

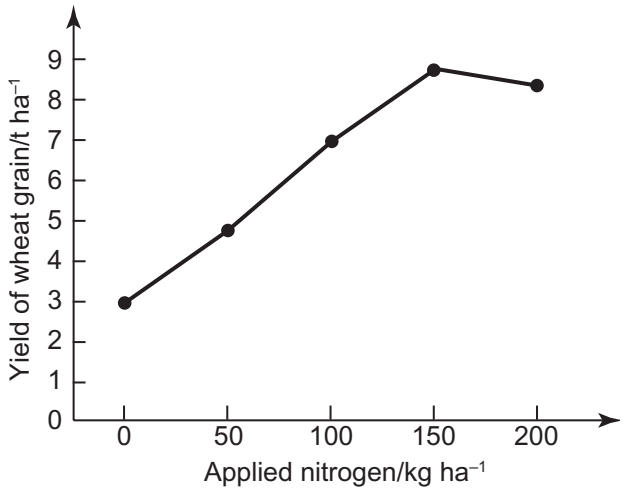
A _____

B _____

C _____ [3]

(b) Nitrogen-containing compounds can be added to soil by the use of artificial fertilisers. There are both economic and environmental reasons for determining the amount of artificial fertiliser to add to cereal crops, such as wheat.

An investigation was carried out to determine the effect of adding different levels of artificial fertiliser on the amount of wheat grain harvested. The results are shown in the graph below.



Source: Plant science in action. Caroline Barnes and Nick Poore. Hodder and Stoughton ISBN 0-340-60099-3

Describe and explain the results of the investigation.

Examiner Only

Marks	Remark

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_____ [4]

(c) Nitrates are very soluble and are easily leached from soil, causing eutrophication in local rivers. Explain how eutrophication causes a high Biological Oxygen Demand (BOD) in a river.

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_____ [3]

Examiner Only	
Marks	Remark

8 Reindeer (*Rangifer tarandus*) have been introduced to remote oceanic islands to provide a source of meat for sailors on whaling ships.

(a) On South Georgia, in the South Atlantic Ocean, reindeer were first introduced in 1909. The reindeer graze the lowland grass community of plants when this is not covered by winter snow. In the winter months the deer graze the lichen-rich banks, where less snow accumulates.

The table shows the plant species present in the lichen-rich banks for an area where there are no reindeer (ungrazed) and where reindeer are present (grazed).

Plant species	Mean percentage cover/%	
	Area ungrazed by reindeer	Area grazed by reindeer
Vascular plants		
Acaena decumbens	9	5
Acaena tenera	4	–
Festuca erecta	17	–
Phleum alpinum	7.5	–
Rostkovia magellanica	5	40
Lichens		
Cetraria islandica	10	–
Cladonia balfourii	4	–
Cladonia carneola	–	2
Cladonia furcata	6	1
Cladonia rangiferina	10	–
Ochrolechia frigida	5	2
Pseudocyphellaria freycinetii	23	5
Psoroma hypnorum	5	3
Stereocaulon glabrum	5	–
Mosses		
Chorisodontium aciphyllum	21.5	40
Polytrichum alpinum	20.5	40
Tortula robusta	4	–

(i) Comment on the effect of grazing on the diversity of the plant species.

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_____ [3]

(ii) It has been suggested that the reindeer population should be totally removed from the island. The killing of reindeer on South Georgia is controversial. Suggest the arguments that biologists might present to justify the killing of the reindeer population.

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_____ [3]

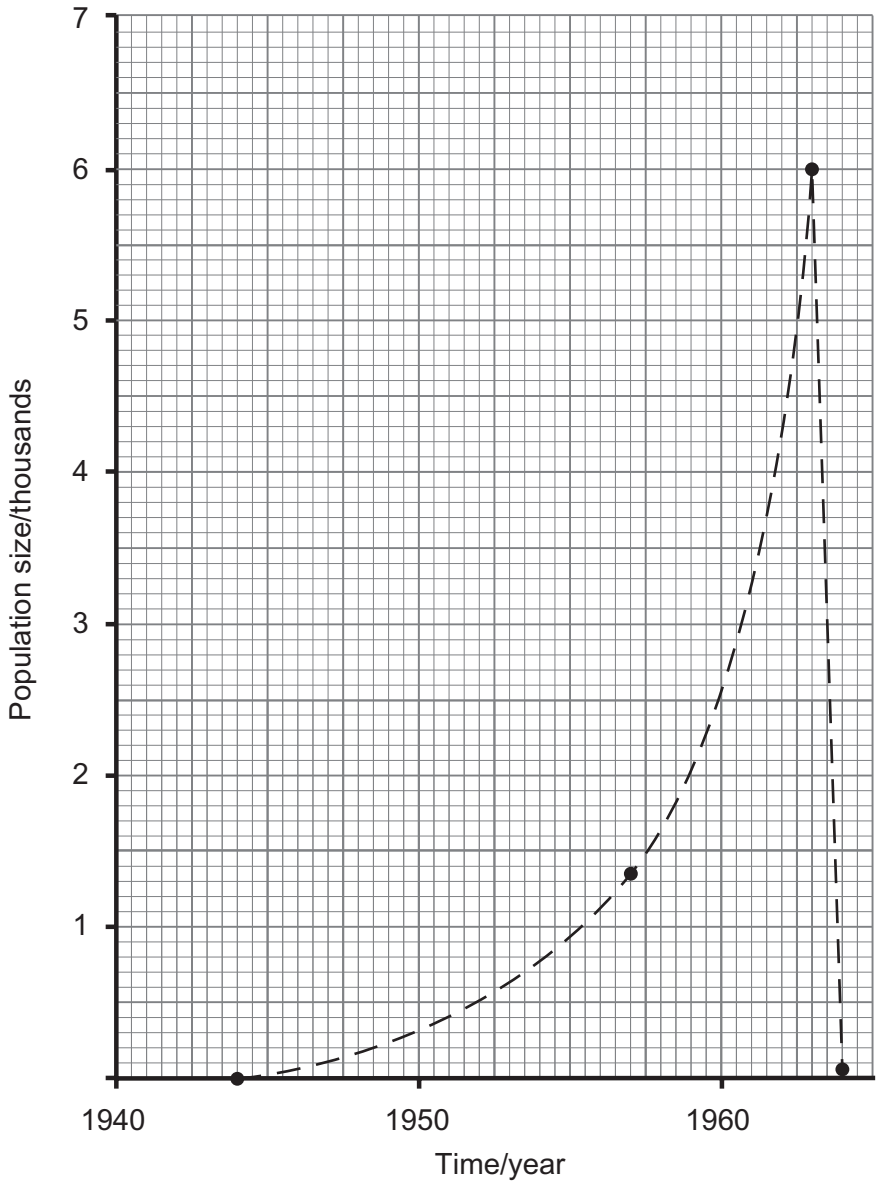
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(b) A reindeer population was introduced to St Matthew Island in the North Pacific. The climate, with heavy winter snow falls, and the vegetation cover on St Matthew is very similar to that of South Georgia.

A biologist undertook censuses of the reindeer population on the island in certain years. These showed a huge increase followed by a rapid decline: 29 deer in 1944; 1 350 in 1957; 6 000 in 1963; and finally only 42 in 1964.

These population numbers are shown in the graph below. The dotted line is the biologist's assumption of the growth curve overall.



Source: David R Klein 'The introduction, increase, and crash of reindeer on St Matthew Island' Alaska Cooperative Wildlife Research Unit, University of Alaska

(i) Suggest why the biologist chose an exponential curve to represent the growth of the reindeer population up to 1963.

_____

_____

_____

_____ [2]

(ii) During the winter of 1963–64 exceptionally high levels of snow occurred. Suggest how the study in South Georgia, described in part **(a)**, may explain the huge decline in the St Matthew population from 1963 to 1964.

_____

_____

_____

_____ [2]

(iii) Suggest why these "boom and bust" population changes do not occur in reindeer populations on the mainland.

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_____ [2]

Examiner Only	
Marks	Remark

Section B

Examiner Only	
Marks	Remark

9 *Quality of written communication is awarded a maximum of 2 marks in this section.* [2]

Give an account of the various immune responses following the entry of bacteria and viruses into the blood at the site of a wound. [16]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

Photographs 4.5 X and Y
(for use with question 5)

Metre wide sheets of photodegradable plastic with maize plants emerging through the perforated plastic

Source: Chief Examiner