

ADVANCED General Certificate of Education January 2011

Candidate Number

Centre Number

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]





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	
IVIAI NS	



Section A

	Section A	Examin	er 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]		

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

LAGIIIII	or Only
Marks	Remark

[1]

Auxins ______

Gibberellins ______

(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.

shown in the table below.					
	I I make a da al	Treatment with an a	rtificial growth substance		
	Untreated Control	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.				
nongation produc	Jou by cuoi	i doddiiont	•	
				ı

Examiner Only				
Marks Remark				

6948.11**R** 3 [Turn over

		all drugs taken by humans, including nicotine and alcohol, afferous system, especially synapses.	ct	Examine Marks	er Only Remark
(a)	the	e drug nicotine, found in the leaves of the tobacco plant, binds acetylcholine receptor sites in synapses. After binding to these eptor 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]		

6948.11**R** 4

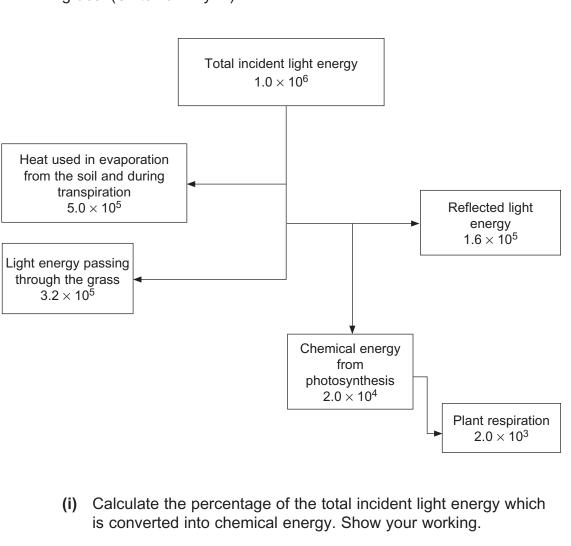
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(b)	reco	e drug alcohol, binds with gamma aminobutyric acid (GABA) eptors in synapses. After binding, alcohol acts in a similar way GABA – the inside of the neurone membrane becomes more gative, a state known as hyperpolarisation.	Examiner Only Marks 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 $1\,\text{m}^2$ of grass. (Units $kJ\,\text{m}^{-2}y^{-1}$.)



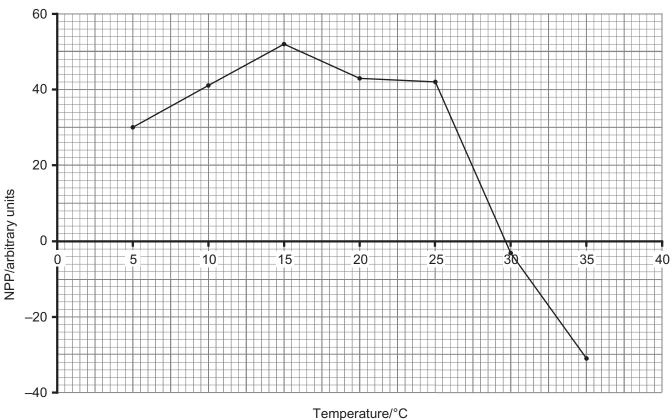
Answer _____ [2]

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

(iii) Calculate NPP for the grass.

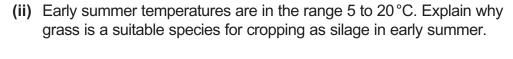
Answer _____[1]

(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							
(I) Explain the negative NFF values above 50 C	/i\	Evolain t	ho pogativo	NIDD V	ومبياه	ahovo	$30 \circ C$
	(1)	Ε λριαιτί ι	ne neganve	INE L A	aiues	abuve	30 C.

_____[2]



_____[1]

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

1. _____

2. _____

_____[2]

todegradable plastic strips with maize seedlings growing through orations in the plastic. Suggest one advantage of the plastic being photodegradable. [1] 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. Soil temperature/°C Under plastic cover No plastic cover Centre Edge May	otode	grada	ble plastic. The	e photographs	roved by the introduction a 4.5 X and Y show	Exami Marks
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. Soil temperature/°C	-		•	with maize see	dlings growing through	
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Month Under plastic cover Centre Edge			•	strip (at the ce	ntre and at its edge) and	in
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advantages of growing maize under plastic. 1	_					 _ [1]
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[2]	2.					
						_ [2]

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(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.)

•	Examiner Only				
Marks Remark	Marks Remark				

	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 he varieties in the investigation.	periormance of
	[3

6948.11**R** 9 [Turn over

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

Examiner Only

Marks Remark

In an investigation into the benefits of feeding cattle with a grassmaize 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

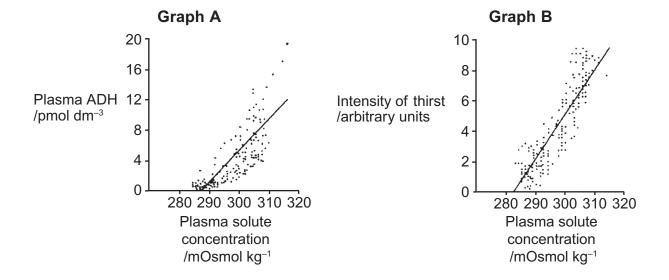
		_ [⁴
i)	Suggest two reasons why so little of the absorbed energy is stored in the carcass.	
)	Suggest two reasons why so little of the absorbed energy is	

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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.



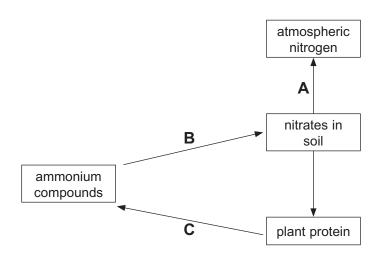
(a) Using the information in **Graph A** and your understanding of how ADH is released into the plasma, explain the effect of changing plasma solute concentration on plasma ADH levels.

Examiner Only Marks Remark

[4]

Describe and explain the effect of increasing ADH levels on urine production.	Examiner O
	_
	_ [3]
With reference to Graph B , describe and explain the relationship between a person's thirst and the plasma solute concentration.	
	_ [2]
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.)	
	_ [4]

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

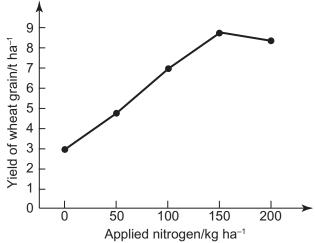


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Α					

(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

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[3]

Describe and explain the results of the investigation.		Examin Marks	er (
	[4]		
Nitrates are very soluble and are easily leached from soil, causir eutrophication in local rivers. Explain how eutrophication causes high Biological Oxygen Demand (BOD) in a river.	ng a		
	[3]		

Examiner Only

- 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).

	Mean percentage cover/%				
Plant species	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	_			

Marks Remark

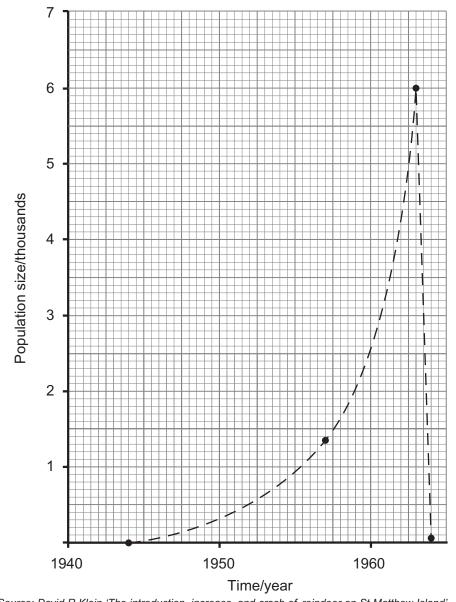
It has been suggested that the reindeer population should be totally removed from the island. The killing of reindeer on South Georgia is controversial. Suggest the arguments that biologists might present to justify the killing of the reindeer population.	Comment on the effect of grazing on the diversity of the plar species.	Examine Marks
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[3]		
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Examiner Only

(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; 1350 in 1957; 6000 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.	_	Examine Marks	r Only Remark
		[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 no occur in reindeer populations on the mainland.	t		
		[2]		

6948.11**R** 19 [Turn over

Section B

	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]			

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GCE Biology Advanced (A2) Assessment Unit A2 1: Physiology and Ecosystems January 2011

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