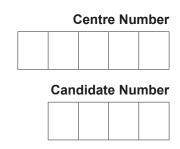


Rewarding Learning

#### **ADVANCED**

**General Certificate of Education** 

2015



### **Biology**

Assessment Unit A2 1

assessing

Physiology and Ecosystems



# [AB211] THURSDAY 21 MAY, 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.

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	
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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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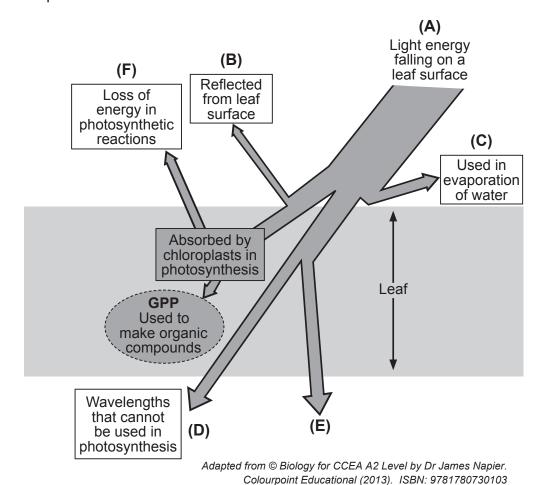
#### **Section A**

ty ık	Examin Marks	er Only Remark	
iere.			
[2]			
 _ [2]			

1 (a) The following account is about the adverse impact of human activity on the environment. Write the most appropriate word(s) in the blank spaces to complete the account.

	The	depletion of the ozone layer has resulted in increased	
	pen	etration of UV light, causing an increased risk of skin cancer	
	and	Acid rain also harms the atmosphe	re.
	It re	sults from the combustion of fossil fuels as a consequence of	
		reacting with water.	[2]
(b)	Stat	e <b>one</b> strategy used to reduce ozone depletion and acid rain:  Ozone depletion	
		Acid rain	_
	•	Acid rain	

**2** (a) The diagram below summarises the fate of light energy falling on a crop leaf.



(i) Suggest what is represented by the arrow **E**.

\_\_\_\_\_[1]

(ii) Using the letters given, devise a formula to show the amount of light energy falling on the leaf surface that represents Gross Primary Production (GPP).

(iii) Suggest **one** way that farmers can maximise the amount of light energy falling on the leaves of a crop in a field.

[1]

) Ma	ny crops are grown as a monoculture.	Examiner O
(i)	Explain precisely what is meant by the term monoculture.	_
		[1]
(ii)	Explain how monocultures can harm:	
	• soil quality	
	animal biodiversity	
		_ [2]

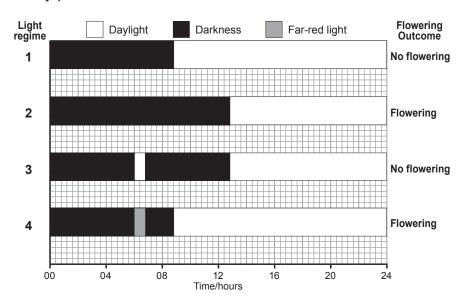
3 (a) An investigation was carried out in a laboratory to determine the photoperiod necessary to promote flowering in a species of plant. The results are shown in the table below.

Examiner Only		
Marks	Remark	

Length of continuous dark period/hours	Length of continuous light period/hours	Flowering outcome
16	8	no flowering
14	10	no flowering
12	12	no flowering
10	14	flowering
8	16	flowering
(i) What is the evidence	ce that this species is a	long-day plant?

(i)	What is the evidence that this species is a long-day plant?
	[1
(ii)	Suggest why the investigation was carried out in a laboratory rather than field (outdoor) conditions.
	[1
(iii)	Describe how this investigation could be extended to give a more precise value for the photoperiod required to promote flowering.
	F.A.

**(b)** The following diagram shows the effect of different light regimes on a short-day plant.



(i) In terms of phytochrome conversions, explain why the plant does **not** flower in light regime 3.

(ii) Explain why flowering does occur in light regime 4, yet not in light

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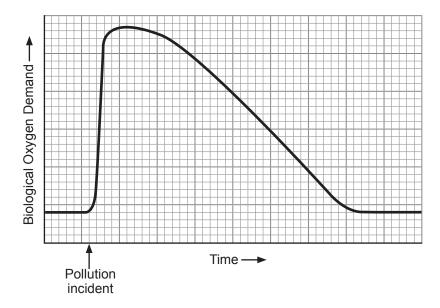
[2]

regime 1.

(c)	The human eye is normally able to distinguish different colours. However, in one form of red-green colour blindness, individuals are unable to distinguish between red and green colours.	Examine Marks	r Only Remark
	With regard to the function of the retina, suggest the biological basis of this type of colour blindness.		
	[1]		

(a)		otograph 1.4 is an electron micrograph of a section through the ll of a proximal convoluted tubule in the kidney.		Examiner Iarks I	r Only Remarl
	(i)	Identify the structures labelled <b>A</b> and <b>B</b> .			
		A			
		B[2	2]		
	(ii)	Explain precisely the role of the structures labelled <b>A</b> in the proximal convoluted tubule.			
		[2	2]		
(b)	(i)	Name the type of epithelial cells shown in the electron micrograph			
	(ii)	Give <b>two</b> differences in structure between the endothelium lining the glomerular capillaries and the epithelium in <b>Photograph 1.4</b> .			
		1	-		
		2			
		[2	2]		

(a) The graph below shows how an incident of slurry pollution in a small lake affected the Biological Oxygen Demand (BOD) over a period of time.



explain the immediate effect of the slurry pollution on BOD in ne lake.
[3

9447

(i)

	fertiliser and slurry on BOD in waterways.	
	Similarity	
	Differences	
An	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms stoneflies) can be used for this purpose.	
A not and Sugar	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms	
A not and Sugar	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In the aquatic food web, as indicator species, rather than	
Sugtrop	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of the species of using invertebrates, which occupy lower that the section of the species of the species of using invertebrates, which occupy lower that the species in the aquatic food web, as indicator species, rather than predator fish such as pike.	
Sugtrop	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In the aquatic food web, as indicator species, rather than	
Sugtrop	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.	
Sugtrop	icator species can be used to monitor pollution levels in waterways. umber of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.  In section of different species of aquatic invertebrates (e.g. bloodworms distoneflies) can be used for this purpose.	

(c) It is also important to monitor and conserve woodland. The photograph below shows a section of woodland that has been coppiced.



Source: Chief Examiner

Using your knowledge and the information provided:

(i) Describe the process of coppicing and its effect on trees.

[2]

(ii) Describe and explain one way in which coppicing can promote biodiversity.

(a) The main proteins involved in skeletal muscle contraction are represented in the diagram below. Adapted from  $\circledcirc$  Biology for CCEA A2 Level by Dr James Napier. Colourpoint Educational (2013). ISBN: 9781780730103 Identify protein A. [1] (ii) Explain the process of muscle contraction in a myofibril following nervous stimulation.

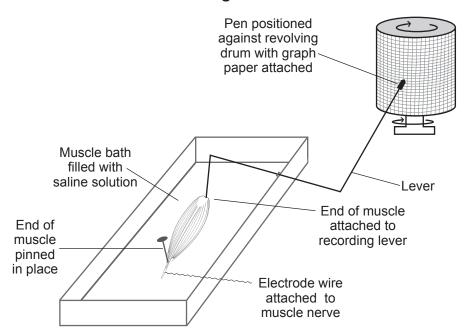
\_\_\_\_\_ [4]

**(b)** An experiment was carried out to investigate muscle contraction in skeletal muscle. This type of investigation uses muscles obtained from freshly killed animals. The experimental set-up is shown in diagram **A**.

Examiner Only

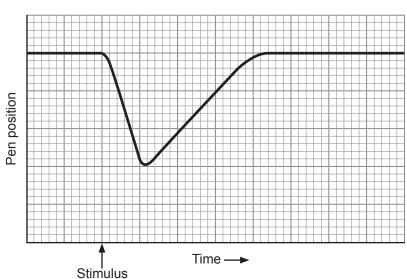
Marks Remark

#### Diagram A



If a single electrical stimulus is applied to the muscle (by the electrode wire), the following trace (graph line) is produced on the graph paper on the revolving drum.



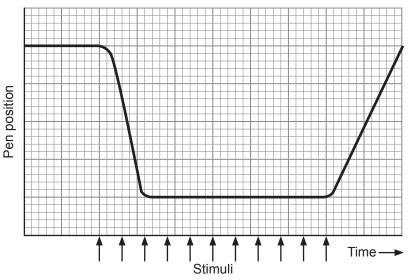


(i) On diagram **B** above, mark with an **X**, a part of the trace that represents muscle contraction.

[1]

The diagram below represents the trace from a muscle that was stimulated repeatedly over a period of time, with very short intervals between successive stimuli.





(ii) Identify **two** differences between the muscle response to repeated stimuli and a single stimulus.

1. \_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_\_[2]

(iii) Suggest **one** example of human activity that would involve this type of contraction.

[1]

(c) When using the experimental set-up shown in diagram A to compare different types of contraction in muscle, it is important to ensure that variables are controlled as far as possible. Describe **two** variables that need to be controlled in this investigation to ensure valid results.

1. \_\_\_\_\_\_

2. \_\_\_\_\_

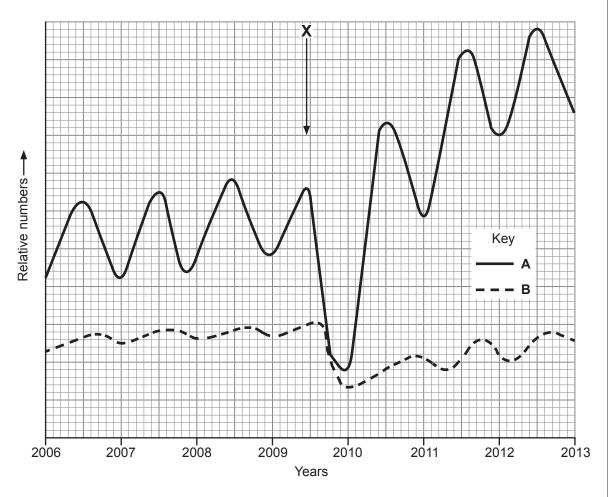
\_\_\_\_\_\_[2

•	peo	ngles is a medical condition that is most common in older people, or ple with weakened immune systems (e.g. transplant patients and ents undergoing chemotherapy).	-	Examine Marks	er Only Remark
	cau vari may con nerv	e varicella zoster virus that causes shingles is the same virus that ses chickenpox. Following an initial chickenpox infection, most of the cella zoster viruses are destroyed by the immune system, but some y remain dormant within nervous tissue for many years. Shingles is sequence of the reactivation of the virus, which then migrates out of yous tissue into body fluids to cause the characteristic 'shingles rash ne surrounding skin.	e a f		
		September 2013, people who were 70 years old became eligible for ngles vaccination as part of NHS policy.			
	(a)	Explain precisely why transplant patients have an increased risk of suffering from shingles.			
			[1]		
	(b)	While the vaccination programme for shingles costs the NHS many millions of pounds to implement, it is suggested that a similar amou of money will be saved once the vaccination programme is fully in place. Suggest <b>one</b> way in which the vaccination programme outlin above helps save NHS spending.	unt		
			<u> </u>		

(c)	viru soc	e vaccine contains 'live' attenuated (weakened) varicella zoster is. In many people there is a significant immune response very in after immunisation, with both antibody-mediated and -mediated responses taking place.		Examin Marks	er Only Remark
	(i)	Suggest why the immune response to the shingles vaccine mabe more rapid than for most other vaccinations with 'live' virus.			
			— [2]		
	(ii)	Using the information provided, explain fully why the immune response following activation involves both cell-mediated and antibody-mediated responses.			
			_		
			_		

8 (a) Relative changes over time in the numbers of a crop pest species (A) and its main predator species (B) in a field are shown in the graph below. Both species are very small insects. X shows the time at which a broad-spectrum insecticide (pesticide) was applied to the crop in this field.





(i)	Give one piece of evidence from the graph which indicates that A
	is the pest (prey) and <b>B</b> is the predator.

		[1]

(ii)	Describe and explain the effect that the insecticide has on	Examin	
	species A.	Marks	Rema
	[4]		
ver with inse Nur cap qua (ca sub a s	e to their small size, individual insects of species <b>A</b> usually only travelly short distances and spend most of their time on leaf surfaces, often a many insects feeding on the same leaf. The habitat of individual ects is usually restricted to a small number of adjacent crop plants.  The habitat of individual ects is usually restricted to a small number of adjacent crop plants.  The habitat of individual ects is usually restricted to a small number of adjacent crop plants.  The habitat of individual ects is usually restricted to a small number of adjacent crop plants.  The habitat of individual ects is usually only travel adjacent crop plants.  The habitat of individual ects is usually only travel adjacent crop plants.  The habitat of individual ects is usually only travel adjacent crop plants.  The habitat of individual ects is usually only travel adjacent crop plants.  The habitat of individual ects is usually only travel adjacent crop plants.  The habitat of individual ects is usually only travel adjacent crop plants.  The habitat of individual ects is usually entities of individual ects is usually entities of individual ects is usually entities of individual ects is usually entities.  The habitat of individual ects is usually entities of individual ects is usually entities.  The habitat of individual ects is usually entities of individual ects is usually entities of individual ects is usually entities.  The habitat of individual ects is usually expressed and individual ects is usually entities.  The habitat of individual ects is usually expressed and individual ects is usually expressed and individual ects is usually entities.  The habitat of individual ects is usually expressed and i		
	[1]		
(ii)	Using the information provided, suggest <b>one</b> reason why sampling was restricted to individual quadrats (rather than on a whole field basis).		
	[1]		

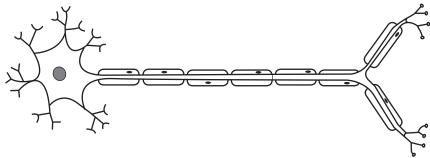
	<ul> <li>(iii) During the sampling of one square metre at a particular time number of species A initially captured and marked was 242. repeated several days later, 166 were captured, of which 84 been marked.</li> <li>Calculate the estimated population size of species A (in m<sup>-2</sup>) quadrat at this particular time. (Show your working.)</li> </ul>	When had Remark
(c)	Using the information provided, draw and label a possible pyram numbers for the organisms described in parts (a) and (b).	. m <sup>-2</sup> [2]

s	sects can also harm humans. African trypanosomiasis (sleeping ckness) is caused by a protoctistan parasite that is transmitted by emale tsetse flies.	Examine Marks	er Only Remar
(i	) Describe the characteristic features of protoctistans.		
	[1]		
u n o re	or ecological and other reasons, governments discourage the sole se of pesticides and promote other strategies for reducing pest umbers. One such strategy is the use of sterile males. In many areas f Africa, sleeping sickness has been virtually eradicated due to the elease into the wild of large numbers of male tsetse flies that have een sterilised by radiation.		
(i	i) Describe how the use of sterile male tsetse flies helps reduce the incidence of sleeping sickness.		
	[2]		
(i	ii) Evaluation of the use of sterile male flies shows that it is more effective than using chemical pesticides in reducing the incidence of sleeping sickness.		
	Suggest <b>two</b> reasons why it is more effective than chemical pesticides.		
	1		
	2		
	[2]		

[4]

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

**9** Neurones are specialised cells, highly adapted for rapid nervous communication throughout the body. The diagram below represents a motor neurone.



Adapted from © Biology for CCEA A2 Level by Dr James Napier. Colourpoint Educational (2013). ISBN: 9781780730103

- (a) Using the diagram and your knowledge, describe and explain how neurones are adapted for their function. Your answer should refer to how nerve impulses are initiated, propagated and passed on. [12]
- **(b)** Nervous communication involves synaptic transmission. While they may limit the speed of nervous transmission, synapses have a necessary role in coordination and control. Outline why synapses are important.

Quality of written communication [2]

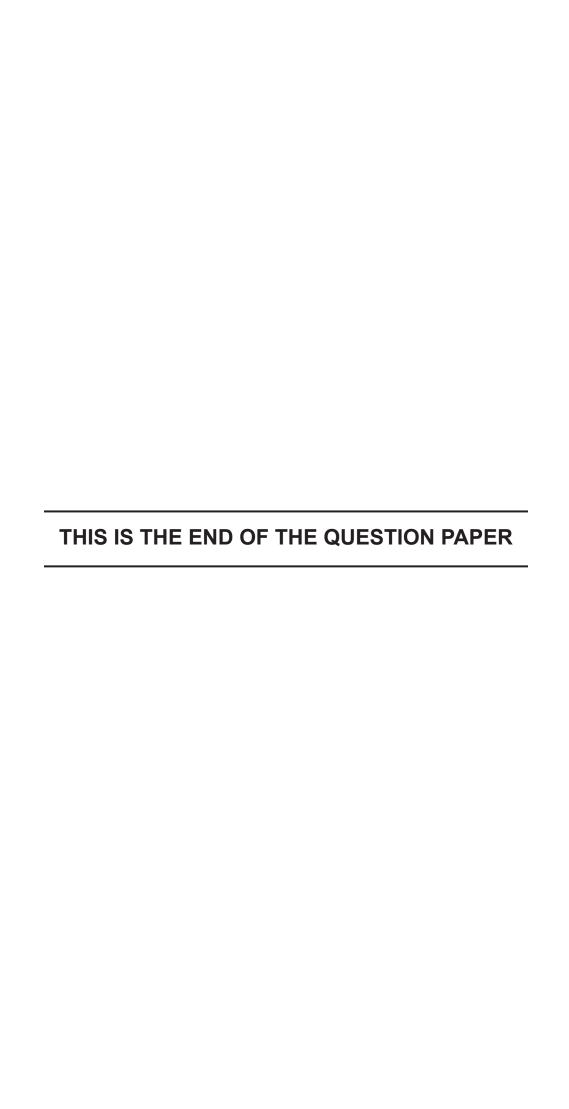
(a)	Using the diagram and your knowledge, describe and explain how neurones are adapted for their function. Your answer should refer to how nerve impulses are initiated, propagated and passed on.

	Examin	
	Marks	Remark
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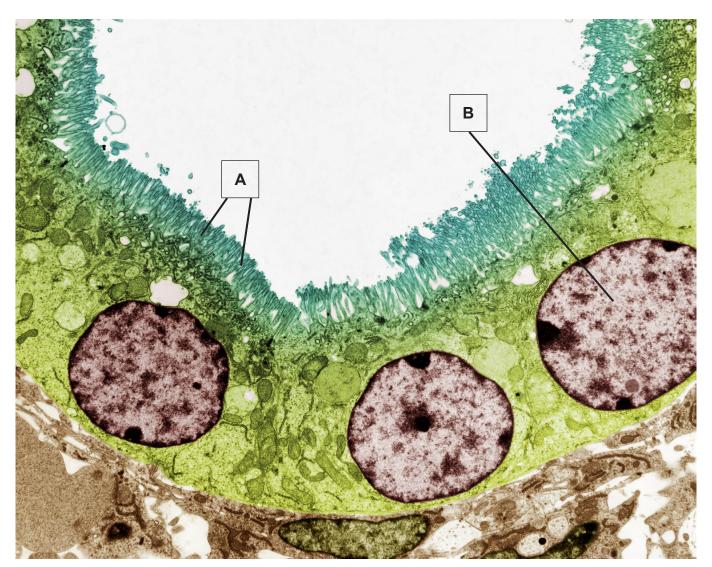
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 	Marks	Remark
•		

(b)	Nervous communication involves synaptic transmission. While they may limit the speed of nervous transmission, synapses have a necessary role in coordination and control. Outline why synapses are important.		Examiner Only  Marks Remark
		-	
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Extra lined page	Exar Mark	niner Only s Remark



## Photograph 1.4 (for use with Question 4)



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