

# ADVANCED General Certificate of Education January 2013

## **Biology**

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

FRIDAY 11 JANUARY, AFTERNOON



**Centre Number** 

**Candidate Number** 

71

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 answer 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.

Total Marks

For Examiner's

use only

**Marks** 

Question

Number

1 2

3

4

5

6

7

8

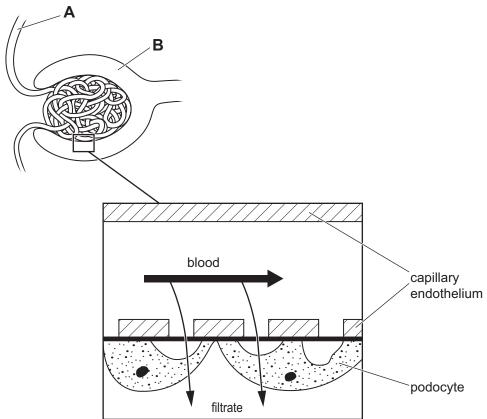
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	•	Section A		Examiner Only  Marks Remark
1		oout the control of flowering in pla d(s) in the blank spaces to comp		
	The pigment	is found in the leaves of flow	ering plants	
	and occurs in two interchanges	able forms. In daylight, the	form	
	is rapidly changed to the	form. Short day plants will	flower	
	when the period of	reaches or exceeds a	minimum	
	length.		[3]	

The diagram below shows the site of ultrafiltration in a kidney. 2

Examiner Only Marks Remark



(a)	(i)	Identify	structures	<b>A</b> an	d <b>B</b>	shown	on i	the	diagram
(a)	(1)	IUCIIIII	311 UCLUI C3	A all	u D	SHOWII	OH	นเธ	ulaulaili.

[2] (ii) On the diagram, label and name the structure which is the effective filter in ultrafiltration. [1]

(b) The table below shows the value of water potential components in both the blood plasma and the renal filtrate (in the nephron) at the site of ultrafiltration. The pressure potential,  $\psi_{\rm p}$ , is a measure of hydrostatic pressure. All units are in kPa.

Examin	er Only
Marks	Remark

Blood plasma	Renal filtrate
$\psi_{s} = -3.5$ $\psi_{p} = 6.5$	$\psi_{s} = -0.5$ $\psi_{p} = -1.2$
$\psi_{\sf plasma} =$	$\psi_{filtrate} =$

Using the information provided, calculate the net filtration force. (Show your working out.)

Net filtration force	kPa	[2]

(c) In healthy individuals, protein does not normally appear in the urine. One indicator of high blood pressure is the presence of protein in the urine. Explain the presence of protein in the urine in someone with high blood pressure.

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

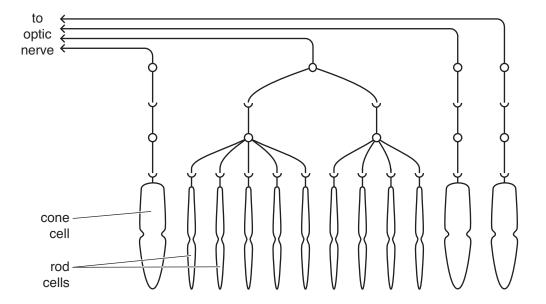
awa env	ny human activities harm the environment. However, there is increasareness of the harm we cause. Legislation and the promotion of vironmentally-friendly activities are approaches taken by governmentally protect the environment.	Marks Remark
(a)	The European Nitrates Directive aims to reduce nitrate enrichmen our waterways. One aspect of the Directive is to restrict the applic of some forms of fertiliser on agricultural land during the winter months.	
	Suggest how this reduces nitrate enrichment of waterways.	
		[2]
(b)	Many governments promote the use of managed reed bed system Reed beds of the common reed ( <i>Phragmites australis</i> ) can help reduce organic waste in waterways by breaking down organic compounds and then utilising the breakdown products for growth.	
	An important adaptation in <i>Phragmites</i> is that oxygen can be transferred from the leaves, through the stem and into the roots. Diffusion of oxygen out of the roots creates an oxygen-rich environment in the area immediately surrounding the roots. Consequentially oxygen gradients are created over very short distances resulting in localised aerobic and anaerobic conditions conditions that favour highly diverse microbial populations.	-
	Investigations have shown that constructed reed bed systems are effective small-scale biofilters (filters of biological materials), particularly in reducing nitrate levels.	very
	(i) With reference to the nitrogen cycle, explain why localised gradients in oxygen levels are important in the breakdown and removal of organic waste.	t
		[3]

	(ii)	Explain the significance of the reeds "utilising the breakdown products for growth" in their role as a biofilter.	Examin Marks	er Only Remark
		[1]		
	(iii)	Suggest <b>two</b> reasons why many governments promote the use of managed reed bed systems as a means of reducing organic waste in rural areas.		
		1		
		2		
		[2]		
(c)	atm aga	islation is also in place to reduce ozone depletion of the osphere. Ozone gas forms a layer in the stratosphere that protects inst the harmful effects of ultraviolet radiation.  lain one way in which ozone depletion can harm humans.		
		[1]		

4	(a)		<b>otograph 1.4</b> shows a section through part of the wall of a mmalian eye.		Examine Marks	r Only Remark
		(i)	Identify layer ${\bf X}$ that lies immediately below the photoreceptor cells.			
				[1]		
		(ii)	Identify the dark circular structures in the layers labelled Y.	F.43		
				[1]		
		(iii)	The mammalian retina is described as being 'inverted'. Using <b>photograph 1.4</b> , suggest why the mammalian retina is describ as being inverted and suggest a possible disadvantage of this.			
				[2]		

(b)	Mammalian photoreceptor cells (rods and cones) and their associated
	neurones are represented in the diagram below.

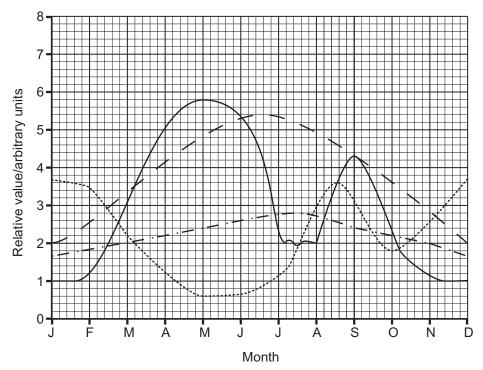
Examiner Only				
Marks	Remark			



The diagram shows that the rods and cones differ in the structural
arrangement with their associated neurones. Describe and explain the
significance of this to human vision.

[4]		

**5 (a)** Phytoplankton is the general name given to the microscopic protoctists that photosynthesise in the upper, light-rich layers of lakes. The graph below shows the relationships between light, temperature, nutrients and the growth of phytoplankton in an Irish lake throughout a year.



Key:	
	Phytoplankton
	Nutrients
	Light
	Temperature

(i) Using the information in the graph, explain why the population of phytoplankton increases in early spring (February–April).

phytopiankton increases in early spring (rebruary—April).		
	[2]	

Examiner Only

Marks Remark

(ii) Suggest why there is a second peak of phytoplankton numbers in late summer (August–September).

late sammer (Magast Coptember).			
			[2 <sup>-</sup>
			[2.

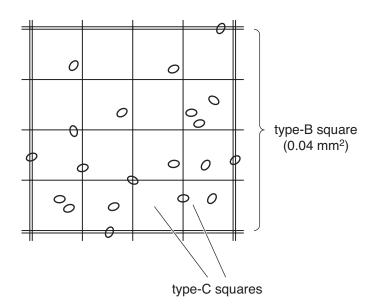
(iii)	Phytoplankton are consumed by zooplankton (microscopic heterotrophic protoctists). Suggest how the numbers of zooplankton in this lake would change throughout the year. Explain your answer.		Examin Marks	er Only Remark
(iv)	Phytoplankton could be described as being r-selected. Identify one piece of evidence in the graph for this statement.	[3]		
		[1]		

**(b)** Phytoplankton numbers can be estimated using a haemocytometer.

Examiner Only

Marks Remark

The diagram below represents a type-B square from a haemocytometer slide. The distance between the surface of the type-B square and the overlying coverslip is 0.1 mm.



(i)	Suggest why type-B squares, rather than type-C squares, are
	used to estimate the number of phytoplankton in the sample used.

[1]

(ii) Count the number of phytoplankton in the type-B square shown.

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

(iii) Using your answer from (ii) above, calculate the number of phytoplankton per mm³. (Show your working.)

Answer \_\_\_\_\_ cells mm<sup>-3</sup> [2]

(c)	are	ensure validity, it is important that appropriate sampling procedures in place during sampling of the phytoplankton in the lake and also en adding the phytoplankton to the haemocytometer.	Examine Marks	er Only Remark
	(i)	Suggest <b>one</b> variable that should be controlled when sampling the phytoplankton in the lake.		
		[1]		
	(ii)	Suggest <b>one</b> precaution that should be undertaken when adding the phytoplankton to the haemocytometer.		
		[1]		

6 Hedgerows in Northern Ireland show considerable regional diversity.

In Fermanagh, hedges are commonly associated with water-filled ditches and frequently border semi-natural vegetation such as rough pasture or meadow. In intensively-farmed East Down, hedgerows less frequently have ditches and they often border large fields commonly used for silage, crop or livestock farming. In addition, East Down hedges tend to be much more frequently trimmed than Fermanagh hedges.

Examiner Only

Marks Remark

In an investigation of the biodiversity of hedgerows, 25 Fermanagh and 25 East Down hedgerows were sampled at the same time of year. The number of plant species in 30 metre lengths of hedge was determined for each hedgerow. Flowering plants, and the moisture-requiring ferns and mosses, were only recorded as far out from the hedgerow as the extent of the lateral growth of the woody species.

The table below shows the average number of species recorded in Fermanagh and East Down hedgerows.

	Average number in 30 n	of plant species n of hedge
Plant species	Fermanagh	East Down
Woody species	8	3
Flowering plants	15	5
Ferns and mosses	8	4

(a)	Suggest an explanation for the increased species-richness in Fermanagh hedges.		
	[4		

(b)	cou	e species diversity of the Fermanagh and East Down hedgerows ald have been compared using Simpson's Index which would give gle statistical indicator for each of the two areas.	Examiner Only Marks Remark
	(i)	Suggest <b>one</b> reason why Simpson's Index was not used to compare the two areas.	_
			1]
	(ii)	Suggest <b>one</b> way in which Simpson's index would be a more effective measure of diversity than the data that was gathered to compare diversity in the East Down and Fermanagh hedgerows.	
		[	1]
(c)	Hed	dgerows are not climatic climax communities. Give <b>one</b> reason /.	
		[	 1]
(d)	use	moving hedgerows to create larger fields for intensive agricultural can contribute to soil erosion. Suggest <b>two</b> reasons for this.	
			_
	2		_
			2]

mic	roor	nune system has evolved to protect against disease-causing ganisms. However, there is a fine balance between defending foreign pathogens and causing harm to the body's own cells.	Examiner Only  Marks Remark
(a)	imn pan	e 1 diabetes is an autoimmune condition, caused by the body's nune system, which damages its own insulin-producing cells in the creas. The consequence is that insulin can no longer be produced ufficient quantity to control blood sugar levels.	
	pred sign	set of diabetes in patients appears to involve both genetic disposition and environmental factors. Research suggests that a nificant environmental trigger is infection with a virus such as skenpox or rubella in the months before the onset of diabetes.	
	(i)	Suggest how infection with a virus can act as an environmental trigger.	
		[	1]
	(ii)	Explain why Type 1 diabetes is a cell-mediated response and not an antibody-mediated immune response.	
			_
		[2	2]
	(iii)	Describe the process of cell-mediated immunity.	_
			_
			_
			_
		[4	- 1]

**(b)** Another adverse immune response is caused by rhesus incompatibility between mother and foetus during pregnancy. Sarah is rhesus negative and is married to Paul. The table below shows the rhesus status of their four children.

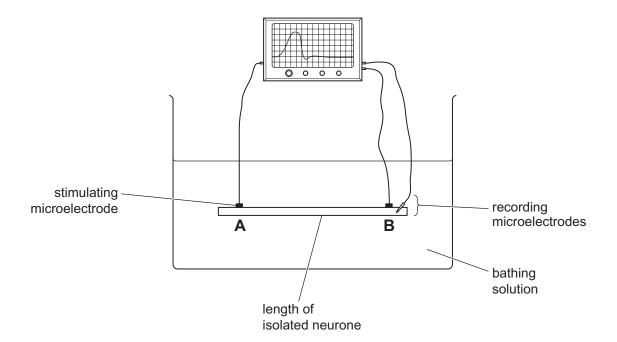
Examiner Only	
Marks	Remark

Child	Age	Rhesus status
Mary	6	negative
Sean	4	positive
Bill	3	negative
Aoife	1	positive

In terms of rhesus incompatibility, explain why Sarah's pregnand required careful monitoring. Your answer should explain which or children, were at particular risk and state one thing that would been done to reduce the risk.			
ΝΊ			

**8 (a)** An investigation was carried out to investigate the effect of electrical stimulation on isolated neurones. This type of investigation uses neurones obtained from freshly killed animals. The experimental set-up is shown in the diagram below.

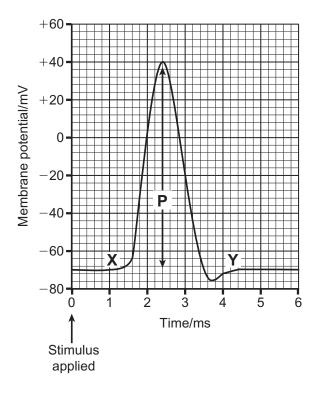




In the investigation the neurone was stimulated via a microelectrode at **A**, where depolarisation of the neurone was initiated. At **B**, a pair of microelectrodes, one external and one internal, record the potential difference as an impulse passes.

The graph below shows the potential difference detected by the microelectrodes at  ${\bf B}$ , following stimulation by the microelectrode at  ${\bf A}$ .





(i) State the name of the change in the potential difference shown as **P** on the graph.

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

(ii) Describe and explain the sequence of events between  ${\bf X}$  and  ${\bf Y}$  following stimulation.

[4]

(b)	The set-up in the investigation described in part (a) could also be used to investigate the speed of nervous conduction along a neurone.	Examiner Only  Marks Remark
	Using the set-up described, devise a plan for an investigation to compare the speed of nervous conduction between myelinated and non-myelinated neurones.	
	Your answer should indicate the variable(s) that you will need to control to ensure that valid results are obtained. You do not need to describe how the neurones are obtained.	
	[41]	
(c)	Experiments of the type described in this question can raise ethical concerns. Suggest <b>one</b> ethical concern which may be expressed. Justify the use of such experiments.	
	[3]	

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(Questions continue overleaf)

## **Section B**

Examiner Only

Marks Remark

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

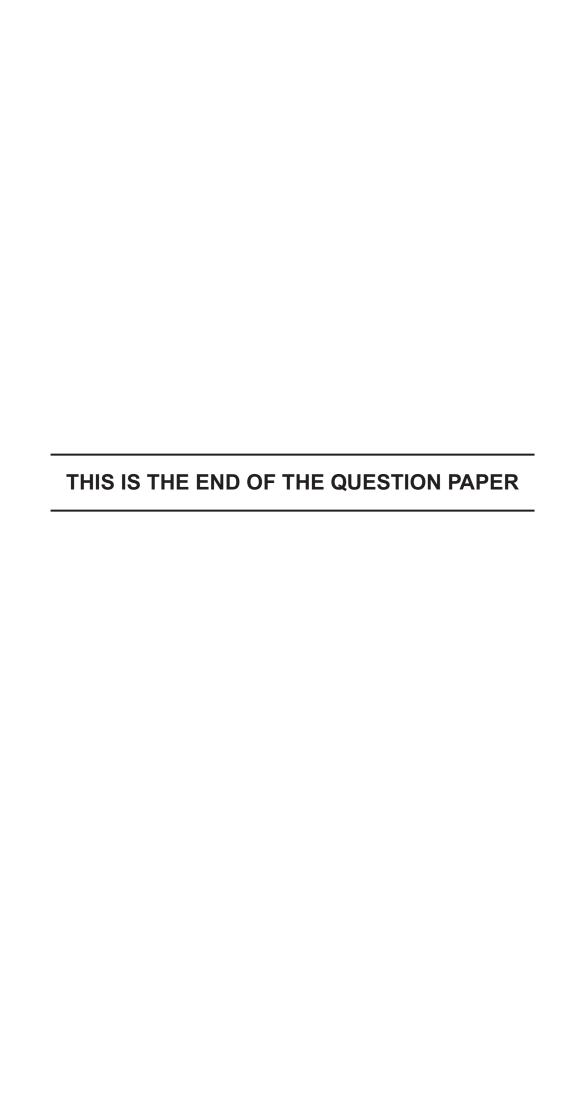
000		
9	(a)	Give an account of the efficiency of light absorption by plants and the subsequent transfer of energy within food chains. [10]
	(b)	Discuss how farmers are able to maximise the productivity of plants and animals. [6]
	Qua	ality of written communication [2]
	(a)	Give an account of the efficiency of light absorption by plants and the subsequent transfer of energy within food chains.

 Exam	iner Only
Marks	Remark

		Examin	er Only
		Marks	Remark
(b)	Discuss how farmers are able to maximise the productivity of plants		
(,	and animals.		
	and animals.		

 Exam	iner Only
Marks	Remark
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	Marks	Remark



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× (for use with Question 4) Assessment Unit A2 1: Physiology and Ecosystems Photograph 1.4 GCE Biology Advanced (A2) January 2013 Bipolar cells Photoreceptor cells © Ralph Eagle / Science Photo Library