

# ADVANCED General Certificate of Education 2014

Ce	ntre Number
71	
Cano	didate Number

### **Biology**

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

**WEDNESDAY 21 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 **Photographs 1.4A** and **1.4B** 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.

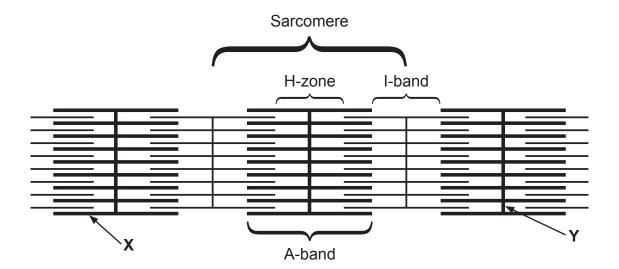
**Quality of written communication** will be assessed in Section B, and awarded a maximum of 2 marks.

1	miner's only
Question Number	Marks
1	
2	
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7	
8	
9	

Total	
Marks	

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**1** The diagram below represents a section through a myofibril in a skeletal muscle.



(a) Identify the structures labelled X and Y.

X	
Υ	 [2]

(b) The diagram above shows the myofibril in its relaxed state. Complete the table below by adding a tick (✓) in the appropriate box to describe what happens to each feature when the muscle contracts.

Feature	Increases in length	Decreases in length	No change in length
A-band			
I-band			
H-zone (H-band)			
Sarcomere			

[2]

[1]

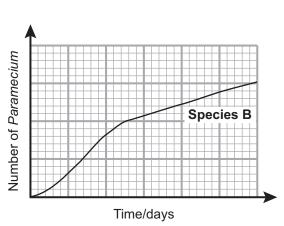
(b) Paramecium are mobile protoctistans. The graphs below show the population growth curves of two species (A and B) of Paramecium when cultured in separate beakers (Graphs 1 and 2) and when cultured together in the same beaker (Graph 3). Each beaker contained a rich supply of bacteria, the preferred food source of both species.

Graph 1

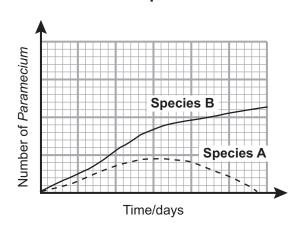
2

Numper of Paramecium
Species A
Time/days

Graph 2



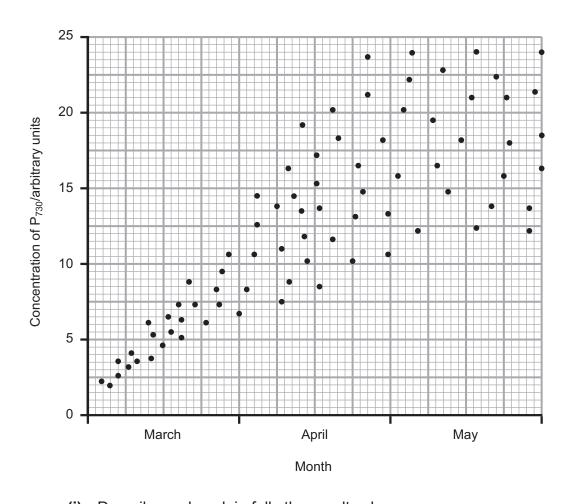
Graph 3



	(1)	Describe and give a possible explanation for the population	Examin Marks	er Only Remark
		growth curves of the two species when cultured together	IVIATKS	Remark
		(Graph 3).		
		[3]		
	(11)	Protoctistan numbers can be estimated using a haemocytometer.		
		Suggest <b>one</b> reason why it might be difficult to estimate Paramecium numbers accurately using this technique.		
		Paramecium numbers accurately using this technique.		
		[1]		
(c)		ner species of protoctistans can photosynthesise. They live in the		
		face layers of seas and lakes. Numbers of individuals of these		
		ecies often increase rapidly in spring and fall very sharply in mid to		
	iate	summer, producing J-shaped growth curves.		
	Suc	ggest reasons for the J-shaped growth curves of these species.		
	Oug	ggoot readend for the ordinaped growth our vee or those openios.		
		[3]		

3 (a) In an investigation into flowering in plants, the concentration of phytochrome P<sub>730</sub> in the leaves of one species of flowering plant was measured between March and May. The results are shown in the graph below.





(ii)	In May, the concer units. Suggest <b>one</b>	ntration of P <sub>730</sub> ranges from 12–24 arbitrary reason for this high degree of variability.
		[1]
sub	stance was applied	ion into plant growth, a particular plant growth to the tip of a stem and left for a period of time. ows the results of this investigation.
		leaves
, ,		
	Control	Growth substance added
(i)	Name the plant gro	owth substance involved.
		[1]
(ii)	increased elongati	ubstance causes its effect mainly through the on of cells. Suggest why it produces the nen cytokinin levels are not limiting.

(b)

Examiner Only

Marks Remark

(a)	Pho	otograph 1.4A shows part of a softwood forest in midsummer.	Examiner Marks F			
	(i)	Give <b>one</b> piece of evidence which suggests that this forest has been planted by man rather than developing naturally.				
		[1]				
	The low.	photograph suggests that the biodiversity in the softwood forest is				
	(ii)	Suggest <b>two</b> reasons for the low biodiversity of the forest in <b>photograph 1.4A</b> .				
		1				
		2				
		[2]				
	(iii)	(iii) Apart from the conservation of native forests, give <b>one</b> advantage of softwood plantations.				
		[1]				
(b)		otograph 1.4B shows part of the same forest after being damaged ire. The photograph was taken in March, nearly two years after the				
	(i)	Give <b>one</b> piece of evidence which suggests that succession is already taking place.				
		[1]				
	(ii)	Name the type of succession taking place.				
		[1]				

[4]	describe and explain the sequence of plant succession that will becur in the following years.	l	Marks	R
	occur in the following years.			
[4]				
[4]				
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		[4]		

5	Excretion in the kidney involves both ultrafiltration and selective
	reabsorption.

Examiner Only		
Marks	Remark	

(a) Name the effective filter during ultrafiltration.

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

**(b)** The relative concentrations of a range of substances found in the glomerular (renal) filtrate and the plasma can be compared.

The relative concentration is expressed as the filtrate/plasma (**F/P**) ratio which is calculated by dividing the concentration of the substance in the filtrate by its concentration in the plasma. Some **F/P** ratios are shown in the table below.

Substance	F/P ratio
Glucose	1
Amino acids	1
Small proteins	0.002
Medium-sized proteins	0.0003
Urea	1

(i)	Explain the ratios shown in the table.	Examir Marks	ner Only Remark
		- Walks	Remark
		-	
		-	
		-	
		-	
	rol		
	[3]		
<i>(</i> )			
(11)	Normally, all of the glucose which is in the proximal tubule returns to the blood. Explain how this is brought about.		
		-	
		-	
	[2]		

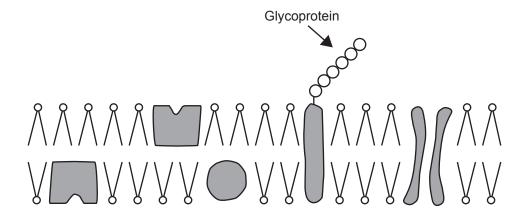
(c) Another function of the kidney is osmoregulation and involves antidiuretic hormone (ADH). ADH exerts its greatest effect in the collecting ducts of the kidney.

Examiner Only

Marks Remark

ADH binds to protein receptor molecules in the cell surface membrane of the cells lining the collecting ducts. This subsequently leads to an increased number of protein channel molecules (aquaporins) in the cells.

The diagram below represents a section through the cell surface membrane of a cell lining a collecting duct.

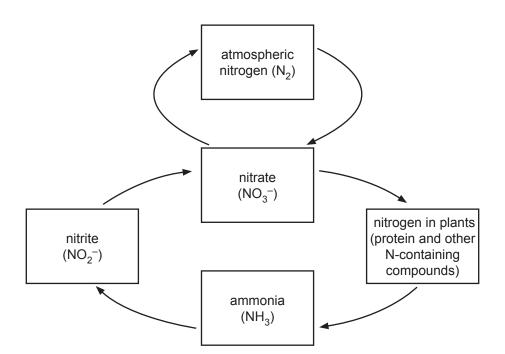


- (i) Label on the diagram above:
  - with A, the location of an ADH receptor molecule
  - with B, a channel protein (aquaporin).

[2]

osmoregulation in	· <b>,</b>			
			[3]	

**6** A simplified nitrogen cycle is represented by the diagram below.



Examiner Only

(a)	How does the diagram	show that	t the process	of nitrification	involves
	oxidation?				

		r.

- **(b)** Pea plants are able to fix nitrogen using nitrogen-fixing bacteria. These bacteria are found in nodules, which are small oval swellings in the roots. The bacteria have a mutualistic association with the pea plant.
  - (i) Explain what is meant by 'mutualistic association'.

۲۰	1

To determine if a relationship exists between soil nitrogen concentration and root nodule size in peas, the following investigation was carried out.

- The nitrogen content of the soil at the base of the stem of 10 pea plants was determined
- The pea plants were carefully excavated and the length of 10 randomly selected root nodules from each plant was measured
- A mean value for nodule length in each plant was calculated

Plant	Soil nitrogen content/%	Mean nodule length/mm
1	0.17	3.2
2	0.36	0.8
3	0.24	2.4
4	0.29	1.6
5	0.14	3.8
6	0.20	2.8
7	0.37	1.0
8	0.09	4.1
9	0.11	3.6
10	0.33	1.2

(ii)	Using the results, state the relationship between soil nitrogen content and mean nodule length. Suggest a possible explanation for the relationship.
	[3]

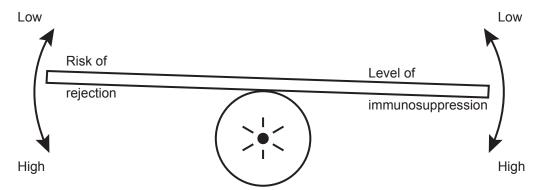
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	[2]	
	[2]	

lepr	ae.	The bacterium has an optimum temperature for growth of arour a few degrees below core body temperature.		ner Only Remark
able incl	e to ude vous	ae is unusual as an infectious bacterial pathogen in that it is only live within body cells. Parts of the body most affected by leprosy the lining of the nasal cavity, ear lobes, fingers and feet. Here, the stissue is affected by bacteria entering and damaging the Schw	the	
(a)		ng the information provided, suggest why leprosy mainly affects external parts of the body.	3	
			_ [1]	
(b)		plain how damage to Schwann cells could affect nervous nsmission.		
			_ [3]	
(c)	(i)	Using the information provided, explain why the immune responsible to <i>M. leprae</i> is likely to be cell-mediated.	onse	
			_ [1]	

	(ii)		er T-cells are produced as a consequence of cell-mediated nunity.		Examine Marks	r Only Remark
		•	Name the type of cell which produces them.	[4]		
		•	Describe how killer T-cells combat pathogenic microorganisms.	_ [1]		
				 _ [2]		
(d)	imr	nunit	on of transplants is also a consequence of cell-mediated cy. However, a range of techniques is used to suppress the e response to prevent rejection.			
	(i)	sup	plain <b>two</b> ways in which cell-mediated immunity can be pressed.			
		2		[2]		

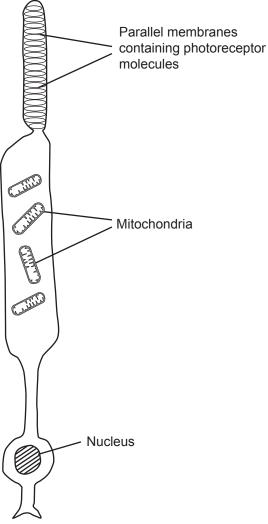
Immunosuppression is a delicate balancing act as shown in the diagram below.

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mark

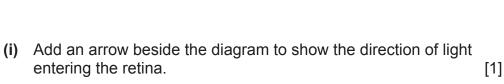


(ii)	Using the information provided and your understanding, explain why the level of immunosuppression must be carefully balanced.				
	[2]				

8 (a) The diagram below represents a rod cell.



**Examiner Only** 



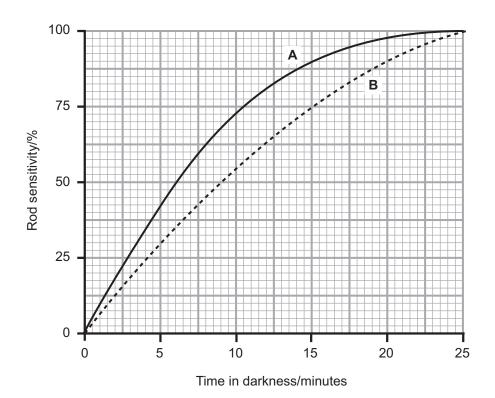
(ii) State the precise function of the mitochondria found in rod cells.

\_\_\_\_\_[

(b)	and	nsduction is the process of changing energy from one form to other. Phototransduction is a term that describes the general ction of rod cells.		Examine Marks	r Only Remark
	Sug	ggest a definition for phototransduction in the context of rod cell	S.		
			_ [1]		
(c)	rod acre	ne retina, rod cells synapse with an adjacent bipolar cell. When is not stimulated, the transmitter substance, glutamate, diffuses oss to the bipolar neurone reducing the possibility of it becoming tolarised.	3		
	red	en the rod cell is stimulated, it stops releasing glutamate. The uction in glutamate crossing the synaptic gap promotes polarisation in the bipolar cell.			
	(i)	Using the information provided, give <b>one</b> similarity and <b>one</b> difference between the synaptic transmission described above and that in typical neurone to neurone synapses.			
		Similarity			
		Difference			
			[2]		
	(ii)	Give <b>one</b> advantage of the presence of synapses in nervous communication.			
			_ [1]		

(d) In an investigation concerning dark adaptation in rods, two individuals (A and B) were subjected to a period of time in very bright light. This was immediately followed by a period of time in darkness. Rod sensitivity was measured throughout the time in darkness. The results are shown in the graph below.





(i) Calculate the percentage change in rod sensitivity for individual A between 5 minutes and 15 minutes after entering dark conditions.

(Show your working.)

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

	(ii)	Explain the results shown in the graph for individual <b>A</b> .		Examin	
				Marks	Remark
			_ [2]		
	(iii)	Suggest <b>one</b> reason for the difference in response between individuals <b>A</b> and <b>B</b> .			
			 [1]		
(e)	thei	en viewing objects in the night sky, people tend to view them ver eyes at a slight angle rather than focusing directly on the objecter. Suggest a reason for this.	vith ect		
			_ [2]		
			— [ <del>-</del> ]		

#### **Section B**

tion B Examiner Only
Marks Remark

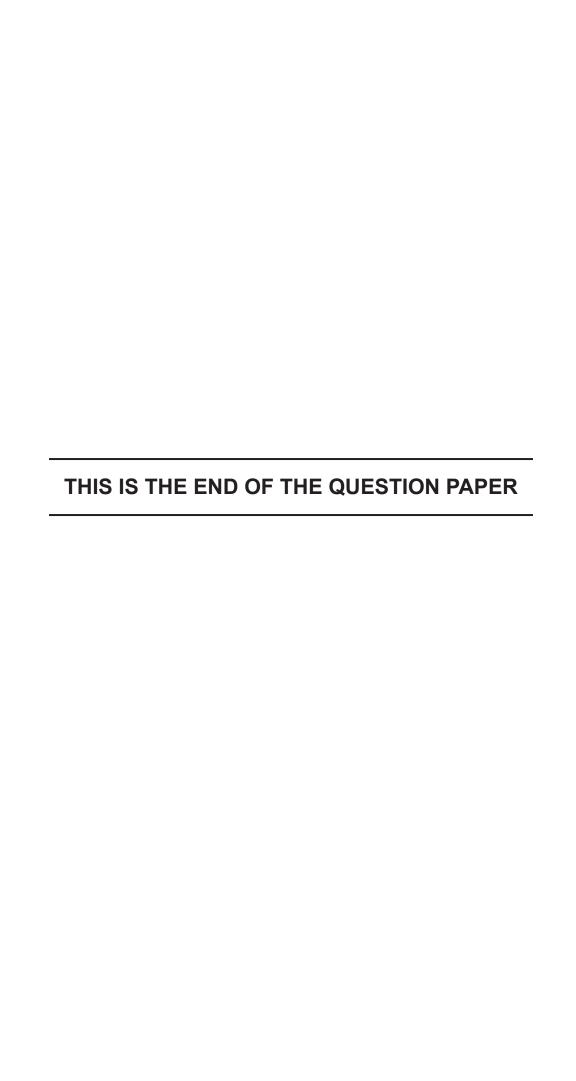
Quality of written communication is awarded a maximum of two marks in this section. 9 Sustainable farming practices promote both the conservation and fertility of soils and also biodiversity in terrestrial (land-based) habitats. (a) Describe and explain how sustainable farming practices help promote the conservation and fertility of soils. (b) Describe and explain how sustainable farming practices help promote biodiversity in terrestrial (land-based) habitats. [8] Quality of written communication [2] (a) Describe and explain how sustainable farming practices help promote the conservation and fertility of soils.

	E: Ma	kaminer Irks F	Only Remark
	·	THO I	tomani

			Examin Marks	er Only Remark
		-	Marks	Remark
		-		
		-		
		-		
		-		
(b)	Describe and explain how sustainable farming practices help promote biodiversity in terrestrial (land-based) habitats.			
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GCE Biology Advanced (A2) Assessment Unit A2 1 Physiology and Ecosystems Summer 2014

# Photograph 1.4A (for use with question 4(a))



Source: Chief Examiner

## Photograph 1.4B (for use with question 4(b))



Source: Chief Examiner