



Rewarding Learning

ADVANCED
General Certificate of Education
2014

Centre Number

71	
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Candidate Number

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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.

For Examiner's use only

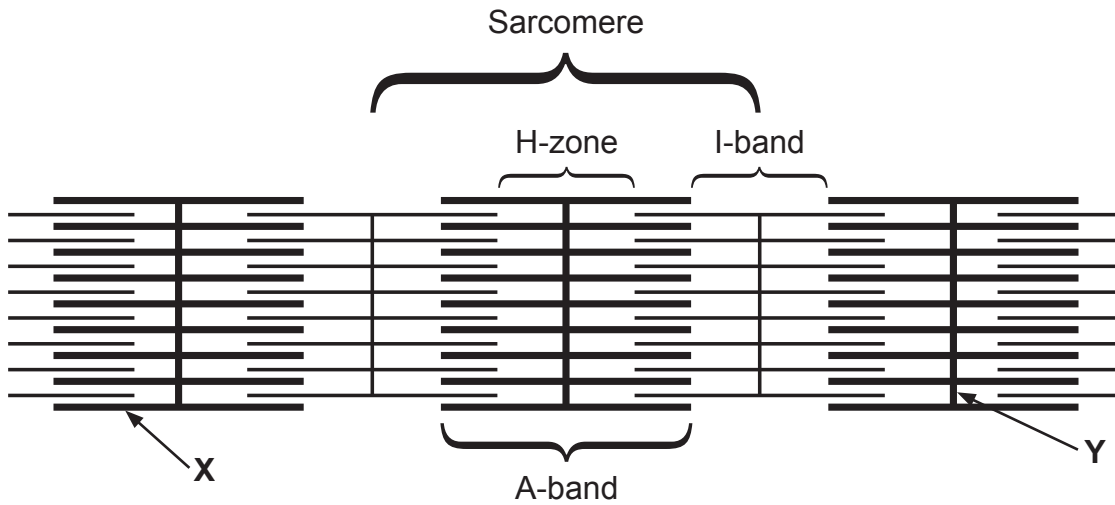
Question Number	Marks
1	
2	
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8	
9	

Total Marks	
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Section A

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



- (a) Identify the structures labelled X and Y.

X _____

Y _____

[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]

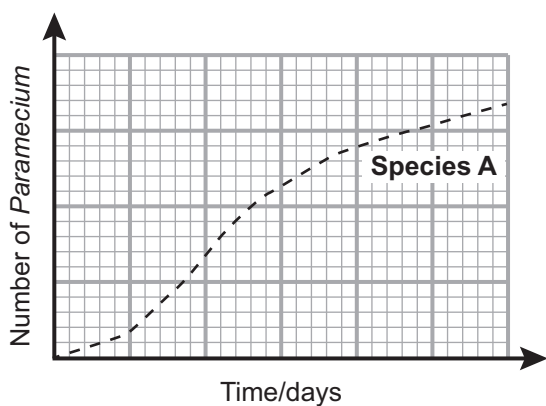
Examiner Only	
Marks	Remark

2 (a) In relation to the study of population growth, explain what is meant by the term 'biotic potential'.

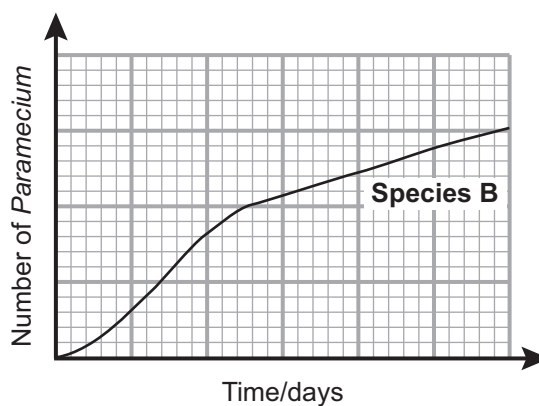
[1]

(b) *Paramecium* are mobile prototists. 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.

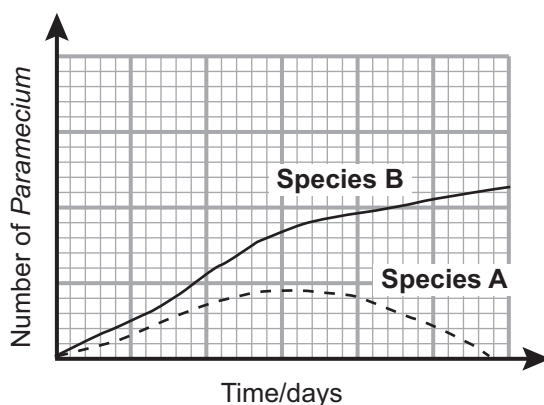
Graph 1



Graph 2

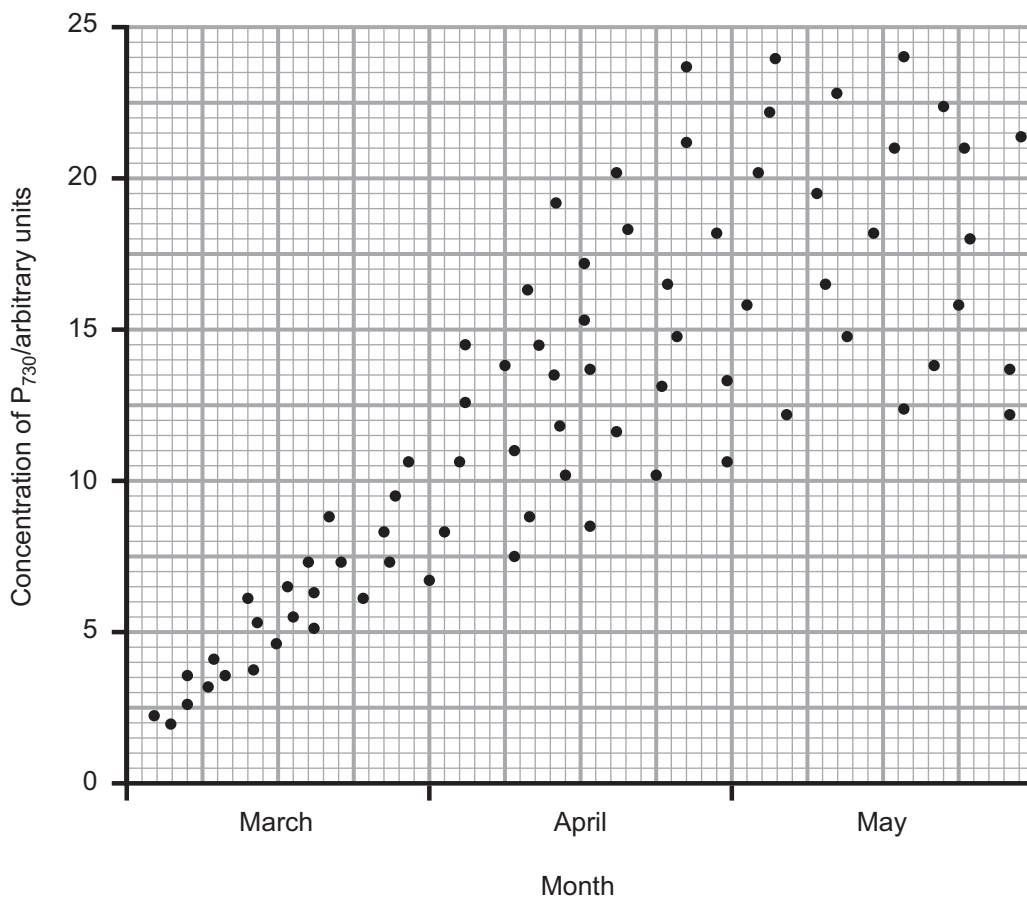


Graph 3



Examiner Only	
Marks	Remark

- 3 (a) In an investigation into flowering in plants, the concentration of phytochrome P_{730} in the leaves of one species of flowering plant was measured between March and May. The results are shown in the graph below.



- (i) Describe and explain fully the results shown.

[3]

Examiner Only	
Marks	Remark

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

(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

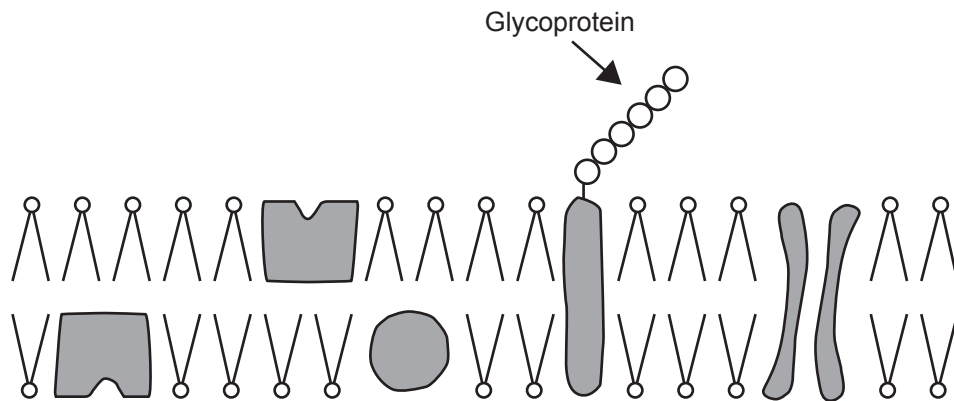
Examiner Only

Marks Remark

(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.

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.



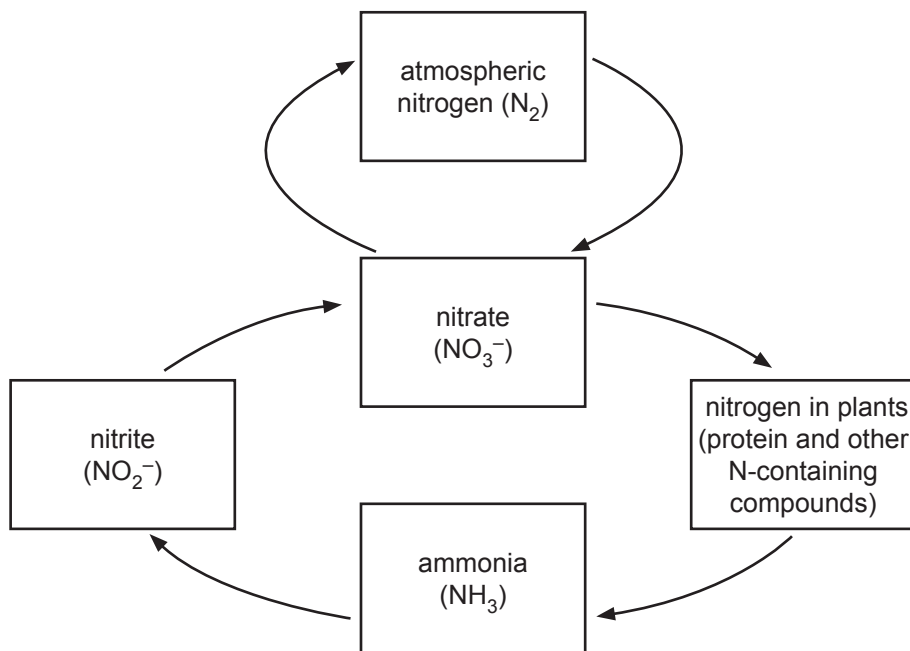
(i) Label on the diagram above:

- with **A**, the location of an ADH receptor molecule
- with **B**, a channel protein (aquaporin).

[2]

Examiner Only	
Marks	Remark

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



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

_____ [1]

(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'.

_____ [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

Examiner Only	
Marks	Remark

(iii) State **two** factors (variables) that should have been considered in the investigation design to ensure that valid results were obtained.

1. _____

2. _____

_____ [2]

Examiner Only	
Marks	Remark

(ii) Killer T-cells are produced as a consequence of cell-mediated immunity.

- Name the type of cell which produces them.

_____ [1]

- Describe how killer T-cells combat pathogenic microorganisms.

_____ [2]

(d) Rejection of transplants is also a consequence of cell-mediated immunity. However, a range of techniques is used to suppress the immune response to prevent rejection.

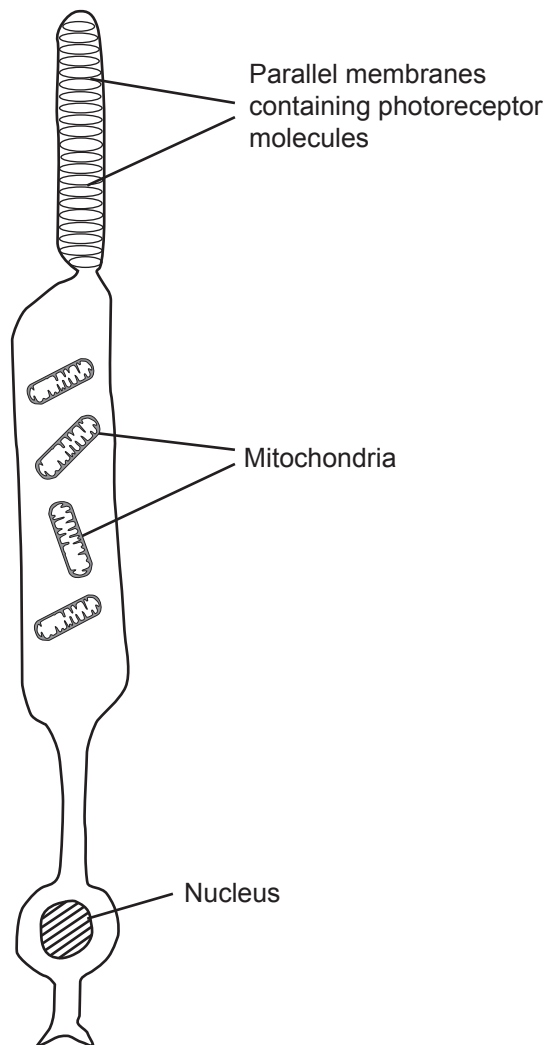
(i) Explain **two** ways in which cell-mediated immunity can be suppressed.

1. _____

2. _____
_____ [2]

Examiner Only	
Marks	Remark

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



(i) Add an arrow beside the diagram to show the direction of light entering the retina. [1]

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

_____ [1]

Examiner Only	
Marks	Remark

- (b) Transduction is the process of changing energy from one form to another. Phototransduction is a term that describes the general function of rod cells.

Suggest a definition for phototransduction in the context of rod cells.

[1]

- (c) In the retina, rod cells synapse with an adjacent bipolar cell. When a rod is not stimulated, the transmitter substance, glutamate, diffuses across to the bipolar neurone reducing the possibility of it becoming depolarised.

When the rod cell is stimulated, it stops releasing glutamate. The reduction in glutamate crossing the synaptic gap promotes depolarisation in the bipolar cell.

- (i) Using the information provided, give **one** similarity and **one** difference between the synaptic transmission described above and that in typical neurone to neurone synapses.

Similarity

Difference

[2]

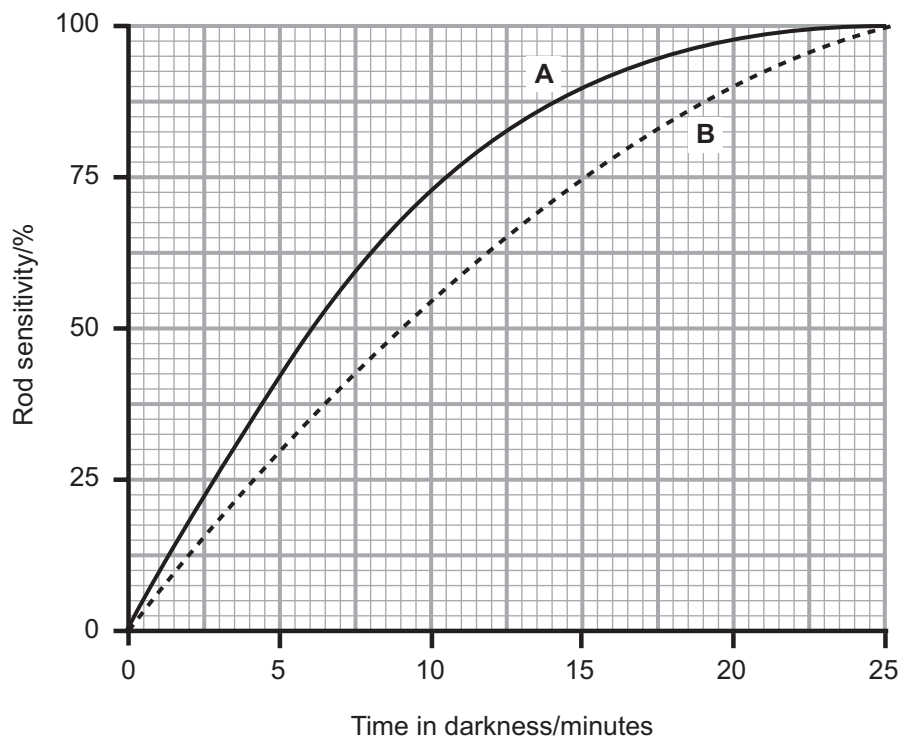
- (ii) Give **one** advantage of the presence of synapses in nervous communication.

[1]

Examiner Only

Marks Remark

- (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]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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will be happy to rectify any omissions of acknowledgement in future if notified.

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



Source: Chief Examiner

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



Source: Chief Examiner