



Rewarding Learning

ADVANCED
General Certificate of Education

Centre Number

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Candidate Number

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Biology

Assessment Unit A2 1

assessing

Physiology, Coordination and
Control, and Ecosystems



[ABY11]

ABY11

Assessment

Assessment Level of Control:

Tick the relevant box (✓)

TIME

2 hours 15 minutes.

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Section A carries 82 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.

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32ABY1101

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32ABY1102

Section A

- 1 The four blood groups of the ABO system are shown in the table below. The antigens present on the surface of red blood cells and the antibodies present in the plasma are shown for a group A individual.

(a) Complete the table for the other three blood groups.

Blood group	Antigens on red blood cells	Antibodies in plasma
A	A	anti-b
B		
AB		
O		

[3]

- (b) Explain precisely why an individual with group A blood should not receive a transfusion of group B blood.

[2]

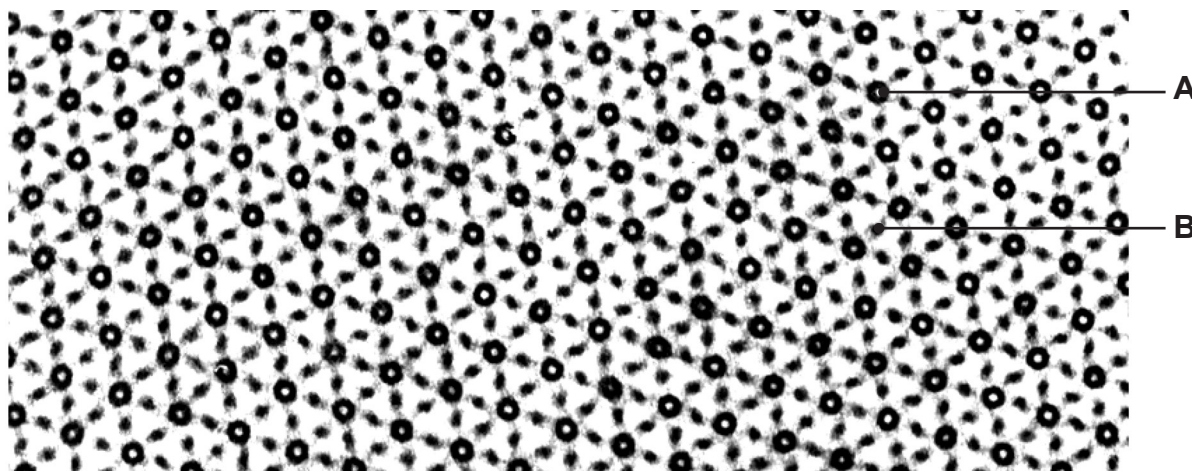
- (c) Antibodies present in the recipient's blood, rather than in the donated blood, cause transfusions to fail. Suggest an explanation for this.

[1]

[Turn over]



- 2 An electron micrograph of a transverse section of a muscle fibre from the flight muscle of an insect is shown below. The magnification is $\times 170\,000$.



© Don W. Fawcett / Science Source / Science Photo Library

- (a) (i) Identify the protein filaments labelled A and B.

A _____

B _____

[2]

- (ii) Identify the band of the sarcomere through which this section was taken. Explain your answer.

[2]

- (b) In the micrograph above, the distance between the two types of filaments averages 3 μm . Use this information to calculate the actual distance, in **nanometres**, between the filaments. $1\mu\text{m} = 1000$ nanometres. (Show your working.)

_____ nm [2]



[illegible]

[4]

[4]

[1]

[Turn over

12625



32ABY1105

- 3 (a) Explain how tears and mucus act as natural barriers to infection.

Tears _____

Mucus _____

_____ [2]

- (b) In the 19th century, Ignaz Semmelweis compared the death rate from infectious disease of women in two maternity wards (**Ward A** and **Ward B**) in a hospital.

Some of his results are shown in the table below.

Year	Percentage of women who died	
	Ward A	Ward B
1834	7.7	7.4
1836	7.5	7.8
1844	8.4	2.1
1846	11.3	2.8
1848	2.7	2.8
1849	2.0	1.9

Before 1840, all doctors and nurses worked in both maternity wards. Additionally, doctors and nurses often worked in other wards.

After 1840, Semmelweis insisted that **only** doctors would work on Ward A and **only** nurses would work on Ward B. He also insisted that these nurses would **not** work on any other wards.



- (i) Describe and explain the effect on death rate of having **only** nurses working on Ward B after 1840.

[3]

Before 1846, many doctors did not wash their hands between treating patients. In 1847, Semmelweis instructed the doctors to wash their hands before they began to work in Ward A.

- (ii) Calculate the decrease in the percentage of women who died from infectious diseases on Ward A between 1846 and 1849.

_____ [1]

[Turn over



(iii) Using the data in the table, suggest why Semmelweis was correct to insist on hand washing.

[2]

(iv) Currently in the UK, less than 0.1% of women die from infectious diseases following birth. Other than washing hands, suggest **two** reasons for this low death rate from infectious diseases in maternity wards.

1.

2.

[2]





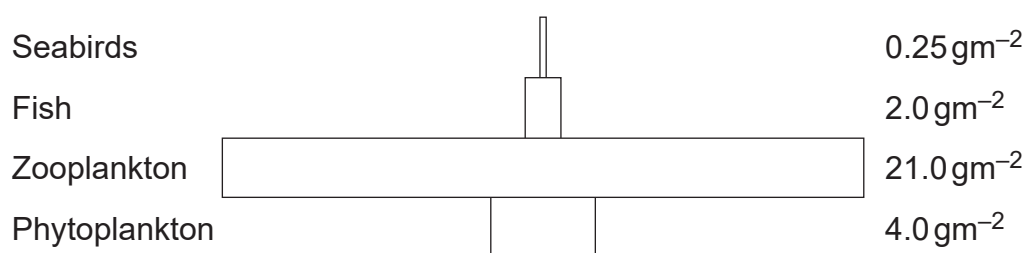
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(Questions continue overleaf)



- 4 (a) A pyramid of biomass for trophic levels in a marine food chain is shown below.



(Diagram not drawn to scale.)

- (i) State **one** disadvantage of collecting data for a pyramid of biomass.

_____ [1]

- (ii) In the pyramid shown, the zooplankton biomass is greater than phytoplankton biomass.

Explain how this might occur.

_____ [2]

- (iii) State **two** reasons why light energy reaching the phytoplankton may not be used to make organic molecules (food).

1. _____

2. _____
_____ [2]



(b) There has been a huge decline in the number of seabirds around the world in the last 60 years. In one area surveyed, scientists have estimated that population numbers may have dropped by 1.21×10^9 birds, or 70%.

- (i) Use this data to estimate the size of the remaining seabird population in the area surveyed. Give your answer in standard form.
(Show your working.)

_____ [3]

- (ii) Suggest **two** reasons for the decline in the number of seabirds.

1. _____

2. _____

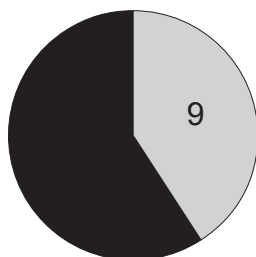
_____ [2]

[Turn over

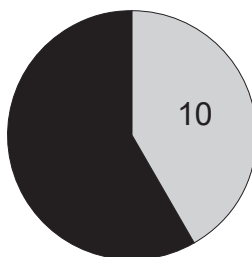


- 5 In some species of plants, flowering is controlled by photoperiod. Two types of plants, chrysanthemum and petunia, were exposed to different lighting regimes as shown in the diagram below. The numbers show the hours of light. The flowering outcome for each regime is given.

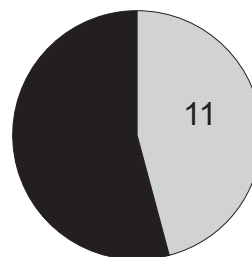
Chrysanthemum



Flowering

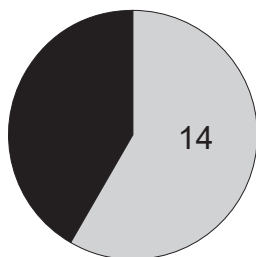


Flowering

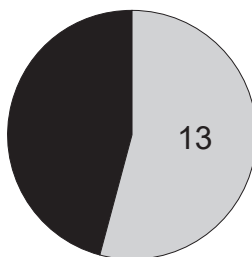


No Flowering

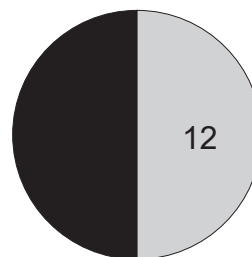
Petunia



Flowering



Flowering



No Flowering

- (a) State the active form of the pigment that controls flowering.

[1]

- (b) (i) Describe the evidence supporting the conclusion that petunia is a 'long-day plant'.

[2]



- (ii) Explain why a plant such as petunia could be more accurately described as a 'short-night plant'.

[3]

- (iii) Many 'long-day plants' are induced to flower around Christmas, so they can be sold in flower at this time. One method of achieving this is to expose the plants to long light periods in the weeks beforehand, but this is relatively costly.

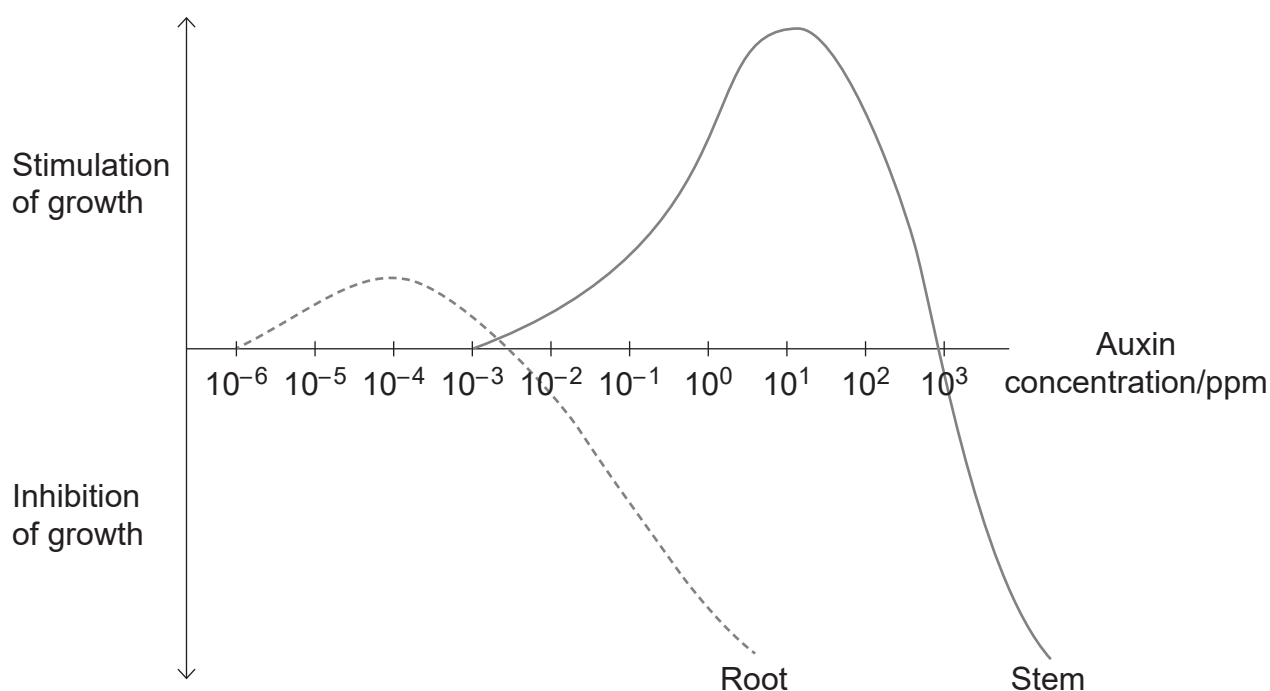
Suggest and explain a more cost-effective method of bringing the long-day plants into flower out-of-season.

[3]

[Turn over



- (c) Other chemical substances in plants can control the growth of cells. Auxin can stimulate growth by promoting cell elongation, but in certain concentrations it can inhibit growth. The effect of auxin on the growth of roots and stems of plants is shown in the graph below.



- (i) State why a log scale is used for the auxin concentration on the graph.

[1]



- (ii) Describe fully the relationship between auxin concentration and growth of both roots and stems.

Roots _____

Stems _____

[4]

- (d) Name another plant growth substance and describe how it stimulates growth in a plant.

[2]

[Turn over



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32ABY1116

- 6** Sand dunes undergo a process of succession. Murlough Nature Reserve is a sand dune system which has been developing over the last 6000 years.

The different stages of succession can be seen as distinct zones in the sand dune system, starting with pioneer species in the new dunes and a climax community in the older, more established regions.

- (a) (i)** Identify the type of succession represented by the sand dune system in Murlough Nature Reserve.

[1]

- (ii)** Pioneer species in this succession possess xerophytic adaptations. Explain why.

[1]

- (iii)** Define the term 'climax community'.

[2]

- (iv)** Describe the changes in the type and biomass of plant species as succession progresses.

[2]

[Turn over]



(v) Explain the change in the type of plant species as succession progresses.

[1]

(b) In a long-term study, samples of soil from one area of the dune system were tested to measure the percentages of carbon and nitrogen. Data from the study is shown in the table below.

Age of soil/years	Percentage of soil mass	
	Carbon	Nitrogen
5	0.02	0.002
20	0.06	0.004
80	0.36	0.022
200	0.90	0.050



[4]

[3]

[Turn over

- 7 The functioning of the mammalian nervous system can be disrupted by many chemicals. One such chemical is a protein toxin produced by a bacterium, *Clostridium tetani*, which causes a disease called tetanus.

Animals such as mice are often used as models in human disease research.

- (a) Apart from ethical concerns, suggest **two** advantages and **one** disadvantage of using mice in this way.

[3]





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The protein toxin which causes tetanus consists of two polypeptide chains, an A-chain and a B-chain, as shown in the diagram below.

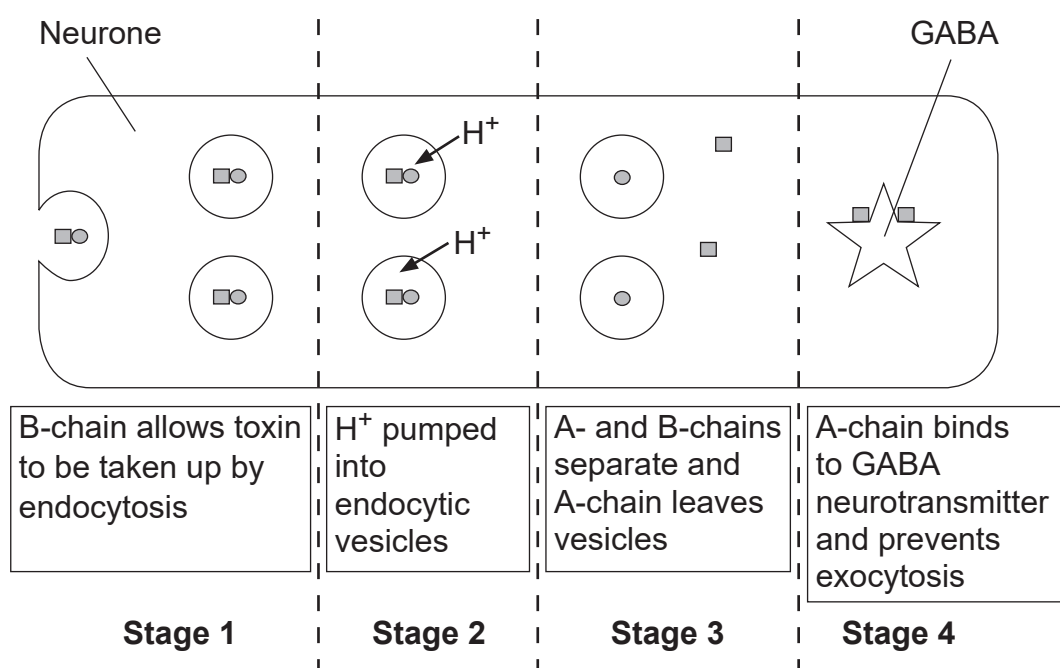


- (b) Identify the level of protein structure which involves the association of two (or more) polypeptide chains.

[1]

- (c) The toxin enters neurones by endocytosis. The B-chain assists with this, while the A-chain interferes with the release of a neurotransmitter by the cells.

The diagram below shows the four stages which occur in neurones affected by the toxin.



- (i) Explain why the A-chain alone cannot cause the disease.

[2]



In **Stage 2**, H^+ ions are pumped into vesicles containing the toxin. The result of this is to reduce the pH within the vesicle and this causes the A- and B-chains to separate (**Stage 3**).

- (ii) Suggest how the entry of H^+ ions into the vesicles would cause the A- and B-chains to separate from each other.

[2]

- (d) The disease tetanus results in prolonged muscle spasms (muscles remain contracted). Using the diagram and your knowledge, explain how the A-chain of the tetanus toxin causes muscles to remain contracted.

[4]

[Turn over]



- (e) Tetanus is a relatively rare infectious disease. Describe and explain how most people are likely to have achieved immunity to tetanus.

[3]



Section B

Quality of written communication will be assessed in this section.

- 8** The kidney is an organ that is involved in excretion and homeostasis.
- (a)** Give an account of the role of the kidney in excretion. Your account should include reference to the processes of:
- ultrafiltration
 - selective reabsorption
- [9]
- (b)** Describe and explain the process of osmoregulation in the body, including the role of the loop of Henlé.
- [9]

- (a)** Give an account of the role of the kidney in excretion. Your account should include reference to the processes of:
- ultrafiltration
 - selective reabsorption

[illegible]

[Turn over



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32ABY1126



Handwriting practice lines consisting of 18 horizontal lines, each preceded by a small blue dot.

[Turn over

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32ABY1127

(b) Describe and explain the process of osmoregulation in the body, including the role of the loop of Henlé.

[illegible]



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For Examiner's use only	
Question Number	Marks
1	
2	
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8	

Total Marks	
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Examiner Number

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