



*Rewarding Learning*

**ADVANCED  
General Certificate of Education  
2025**

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## **Biology**

**Assessment Unit A2 1**

*assessing*

**Physiology, Coordination and Control,  
and Ecosystems**

**[ABY11]**

**MONDAY 2 JUNE, AFTERNOON**

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**MARK  
SCHEME**

## General Marking Instructions

### **Introduction**

The main purpose of the mark scheme is to ensure that examinations are marked accurately, consistently and fairly. The mark scheme provides examiners with an indication of the nature and range of candidates' responses likely to be worthy of credit. It also sets out the criteria which they should apply in allocating marks to candidates' responses.

### **Assessment objectives**

Below are the assessment objectives for Biology.

Candidates should be able to demonstrate:

- AO1** Knowledge and understanding of scientific ideas, processes, techniques and procedures.
- AO2** Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:
- in a theoretical context
  - in a practical context
  - when handling qualitative data
  - when handling quantitative data.
- AO3** Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to:
- make judgements and reach conclusions
  - develop and refine practical design and procedures.

### **Quality of candidates' responses**

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17 or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

### **Flexibility in marking**

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

### **Positive marking**

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 17 or 18-year-old GCE candidate.

### **Awarding zero marks**

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

### **Marking calculations**

In marking answers involving calculations, examiners should apply the 'own figure rule' so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

/ denotes alternative points  
 ; denotes separate points  
**comments on mark values are given in bold**  
*comments on marking points are given in italics*

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**Where one response is required to gain a mark, candidates will not gain credit if a correct response is given alongside one or more incorrect responses. This is referred to as listing.**

### Section A

- |          |                |  |     |   |
|----------|----------------|--|-----|---|
| <b>1</b> | <b>(a)</b>     | (Promote) elongation in internodal regions;<br>(promote) cell division;  | [2] |   |
|          | <b>(b) (i)</b> | $P_{660}$ and $P_{730}/P_R$ and $P_{FR}$ ;   | [1] |   |
|          | <b>(ii)</b>    | No flowering occurs as $P_{730}$ levels will be too high;<br>(the interruption means that) the dark periods are too short to allow $P_{730}$ to fall (below critical value);                               | [2] | 5 |
| <b>2</b> | <b>(a) (i)</b> | Both are protein molecules/made of amino acids;  | [1] |   |
|          | <b>(ii)</b>    | I-band/isotropic band;   | [1] |   |
|          | <b>(b) (i)</b> | Completion of relaxation phase on graph accurate and returns to its original length;   | [1] |   |
|          | <b>(ii)</b>    | The myosin heads attach to the binding sites on the actin filaments;<br>the myosin heads rotate/'rock back';<br>pulling the actin (filaments) over the myosin (thus shortening sarcomere length);          | [3] |   |
|          | <b>(iii)</b>   | There are many sarcomeres lined end to end (contracting together);   | [1] | 7 |
| <b>3</b> | <b>(a) (i)</b> | <b>X</b> – choroid and <b>Y</b> – sclera;  | [1] |   |
|          | <b>(ii)</b>    | Prevents internal reflection of light/vascular layer;  | [1] |   |
|          | <b>(b) (i)</b> | The cones are concentrated at the fovea/there are a large number of cones in one place;<br>each cone synapses with a single bipolar neurone;<br>therefore each cone sends a discrete impulse to the brain; | [3] |   |
|          | <b>(ii)</b>    | Cones absent;<br>the position where the neurones of the retina leave/enter the eye;  | [2] |   |
|          | <b>(c)</b>     | (Depth perception is) the ability to judge distance/how far away an object is;<br>two eyes (at front of head) can focus on an object simultaneously/OAR (e.g. binocular/stereoscopic vision);              | [2] | 9 |

			AVAILABLE MARKS	
4	(a) (i)	Fast to measure/can be recorded in the field/OAR;	[1]	8
	(ii)	September–November: leaf fall from trees (leads to an increase in the depth of leaf litter); March–June: decomposition occurs; the higher temperature increases decomposer population;	[3]	
	(b)	Any <b>four</b> from:		
		<ul style="list-style-type: none"> <li>• millipedes have a larger consumption than centipedes</li> <li>• less energy available to centipedes in reference to trophic level/position in food chain</li> <li>• millipedes egest a larger amount than centipedes</li> <li>• as most leaf litter is indigestible/contain high levels of cellulose</li> <li>• respiratory losses are higher in the millipede</li> <li>• millipedes more active/OAR</li> </ul>		
		(accept converse)	[4]	
5	(a) (i)	4.8 ms;	[1]	13
	(ii)	Increased number of ion channels open/influx of positive ions/gated channels open;	[1]	
	(iii)	The membrane potential decreases/becomes more negative; due to positive ions leaving the (axon); membrane becomes repolarised/hyperpolarisation/reference to refractory period;	[3]	
	(b) (i)	Ensure unidirectionality (of impulse travel)/provides integration (control)/prevents overstimulation;	[1]	
	(ii)	$40 \times 10^{-9} \div 0.50$ ; $8 \times 10^{-8} \text{ s}$ ;	[2]	
	(iii)	Removal of acetylcholine (ACh); allows repolarisation (of post-synaptic membrane);	[2]	
	(c)	Atropine reduces synaptic transmission in ciliary muscle neurones; leading to reduced contraction in ciliary muscle leads to suspensory ligaments remaining taut; resulting in lens being pulled into its thinner shape (and having reduced refractive power);	[3]	

- 6 (a) (i) 1 – respiration  
2 – combustion; [1]
- (ii) The moss continues to photosynthesise thus absorbing carbon dioxide from the air;  
dead moss/peat doesn't decompose reducing the rate of carbon dioxide build up in the atmosphere; [2]
- (iii) Drainage causes the peatlands to dry out/they do not remain waterlogged;  
(increased) carbon (dioxide) released (by decomposers as decomposition can take place); [2]
- (b) (i) Protein/amino acids/nucleic acids/nucleotides; [1]
- (ii) Rates of nitrification are decreased and denitrification increased;  
(nitrification decreased) as aerobic conditions/oxygen is required for nitrification/nitrifying bacteria;  
(denitrification increased) as anaerobic conditions/lack of oxygen required for denitrification/denitrifying bacteria; [3]
- (c) (i) The insects provide a source of nitrogen/amino acids (from digested protein);  
enabling the production of proteins; [2]
- (ii) Any **two** from:
- leaves have low/small surface area therefore less light absorbed
  - sticky liquid/hair like structures therefore less light absorbed
  - sundews are low-growing plants so don't receive as much light
  - contain less chlorophyll/chloroplasts therefore less light absorbed
  - less oxygen so less active uptake of minerals (as they become a limiting factor) [2]
- (iii) Sundews are both producers and consumers/can be placed in two trophic levels; [1]

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- 7 (a) Killer T-cells destroy (infected) cells by enzyme action; helper T-cells stimulate B-cells to divide/produce plasma cells/antibody production/phagocytosis; [2]
- (b) (i) Non-self antigens (in transplanted tissue) sensitises T-lymphocytes; the T-lymphocytes produce killer T-cells which destroy transplanted cells (containing the non-self antigens); [2]
- (ii) Prevent the cloning of T-cells; therefore T-killer cells cannot be produced to attack the transplanted tissue; [2]
- (iii) Tissue typing/irradiation by X-ray; [1]
- (c) (i) The A antigens and B antigens in blood group AB will react with a and b antibodies in blood group O; causing agglutination; [2]
- (ii) Organs can be donated regardless of blood type/antigens on transplanted organ will not be recognised as foreign; therefore increasing the number of transplants available/rejection is less likely; [2]

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- 8 (a) Maximum reproductive potential of a population (under optimum environmental conditions with unlimited resources); [1]
- (b) Any **four** from:
- (very) rapid growth rate so outcompetes slower growing species
  - explosive seed dispersal allows the species to spread (widely) across habitats
  - seeds are able to float thus able to spread via waterways (and colonise riverside habitats)
  - produce many seeds so more plants will develop
  - taller plants outcompete shorter species [4]
- (c) (i)  $0.3 \times 20 \times 24$ ;  
144; [2]
- (ii) As ground coverage of Himalayan Balsam increases pollination rates in species A and/or B are reduced;  
due to pollinating insects visiting Himalayan Balsam flowers;  
as ground coverage of Himalayan Balsam increases species C is unaffected/species C initially decreases and then increases;  
species C is not pollinated by insects involved in the pollination of Himalayan Balsam; [4]
- (d) Himalayan Balsam produces high levels of nectar for a wide range of insect species;  
at a time when most other nectar-producing plant species are not in flower; [2]
- (e) Features of both K and r-selected species;  
K-selected large size, high competitive ability/OAR (*allow converse*); [2]

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**Section A**

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Section B

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9 (a) Indicative content

- waste products include urea and/or creatine
- ultrafiltration occurs at the glomerulus
- under high pressure
- due to afferent/efferent arteriole narrowing/coiling of glomerulus/close to the heart/branch off the aorta
- basement membrane is the effective filter
- podocytes aid filtration
- capillary system is in close proximity to PCT
- selective reabsorption occurs at PCT
- glucose, amino acids, small proteins and mineral ions (at least two named) are reabsorbed
- by facilitated diffusion and active transport
- cuboidal epithelial cells have microvilli to increase surface area available/basal invaginations increase surface area for transport to blood capillaries
- many protein carriers in the membrane aids transport
- many mitochondria provide ATP for active transport
- some urea also returns to the blood by diffusion
- waste products pass into the collecting duct/ureter

Band	Response	Mark
3	Candidates use the most appropriate specialist terms to clearly describe and explain the process of excretion using a minimum of <b>nine points</b> of indicative content. Spelling, punctuation and grammar are excellent and the form and style are of a high standard.	[9]–[12]
2	Candidates use appropriate specialist terms to clearly describe and explain the process of excretion using a minimum of <b>five points</b> of indicative content. Spelling, punctuation and grammar are excellent and the form and style are of a high standard.	[5]–[8]
1	Candidates partially describe and explain the process of excretion using a minimum of <b>one point</b> of indicative content.	[1]–[4]
0	Response not worthy of credit.	[0]

[12]

**(b) Indicative content**

- the descending limb is permeable to water and ions/the ascending limb is impermeable to water
- ascending limb actively transports/pumps sodium and chloride ions into medulla/interstitial fluid
- (producing) a solution with a negative solute/water potential
- this enables osmotic extraction of water from the descending limb
- this enables a hypertonic urine to be produced
- ADH released from the pituitary gland
- so increasing the permeability of the (cells lining DCT and) collecting ducts
- reference to aquaporins
- increasing the reabsorption of water from the urinary filtrate

Band	Response	Mark
3	Candidates use the most appropriate specialist terms to describe and explain the roles of the loop of Henlé and the collecting duct in osmoregulation, using a minimum of <b>five points</b> of indicative content. Spelling, punctuation and grammar are excellent and the form and style are of a high standard.	[5]–[6]
2	Candidates use appropriate specialist terms to describe and explain the roles of the loop of Henlé and the collecting duct in osmoregulation, using a minimum of <b>three points</b> of indicative content. Spelling, punctuation and grammar are excellent and the form and style are of a high standard.	[3]–[4]
1	Candidates partially describe and explain the roles of the loop of Henlé and the collecting duct in osmoregulation, using a minimum of <b>one point</b> of indicative content.	[1]–[2]
0	Response not worthy of credit.	[0]

[6]

**Section B**

**Total**

**AVAILABLE MARKS**

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18

100