



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**2024**

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## **Biology**

**Assessment Unit A2 1**

*assessing*

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

**[ABY11]**

**TUESDAY 4 JUNE, MORNING**

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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*

AVAILABLE  
MARKS

### Section A

- |          |            |   |     |   |
|----------|------------|---|-----|---|
| <b>1</b> | <b>(a)</b> | <b>(i)</b> More rapid production/slower decline of antibodies;  | [1] |   |
|          |            | <b>(ii)</b> B-lymphocyte;<br>plasma;  | [2] |   |
|          | <b>(b)</b> | Phagocytes/polymorphs engulf the clumps of bacteria;<br>leading to intracellular digestion by lysosomal/hydrolytic enzymes;   | [2] | 5 |
| <b>2</b> | <b>(a)</b> | <b>(i)</b> P <sub>660</sub> ;<br>far-red;   | [2] |   |
|          |            | <b>(ii)</b> A plant which flowers when the day length is shorter than a critical<br>value/the night length exceeds a minimum value;   | [1] |   |
|          |            | <b>(iii)</b> Concentration of P <sub>730</sub> reaches a critically low level;  | [1] |   |
|          |            | <b>(iv)</b> Reduced light levels (as leaves form);  | [1] |   |
|          | <b>(b)</b> | <b>(i)</b> Promotes elongation in cells;  | [1] |   |
|          |            | <b>(ii)</b> Gibberellin;  | [1] | 7 |
| <b>3</b> | <b>(a)</b> | <b>(i)</b> (Myosin heads which) attach to the binding sites in actin;<br>rotate/reorientate pulling the actin over the myosin;  | [2] |   |
|          |            | <b>(ii)</b> ATP enables the myosin heads to detach from the actin binding<br>sites;   | [1] |   |
|          |            | <b>(iii)</b> Each myosin filament is attached to several actin filaments;   | [1] |   |
|          | <b>(b)</b> | <b>(i)</b> Actin filaments are pulled over the myosin filaments;<br>thus reducing the diameter of the contraction ring;<br>further/sufficient contraction causes cytokinesis; | [3] |   |
|          |            | <b>(ii)</b> Amino acids;  | [1] | 8 |

4	(a) (i) Y and Z;	[1]
	(ii) Nitrification involves oxidation reactions/oxygen content in products increases;	[1]
	(iii) X;	[1]
	(iv) W;	[1]
(b)	(i) Difficulty in digesting plant material/cellulose;	[1]
	(ii) Energy used in catching prey/other appropriate response;	[1]
(c)	(i) The composition of the organic content changes over time; different fungal species are specialised to decompose different organic content;	[2]
	(ii) Initially the dung was dense/compact with low oxygen; over time the dung becomes fragmented/broken up allowing oxygen to enter;	[2]
	(iii) Any <b>two</b> from: <ul style="list-style-type: none"> <li>• shorter time scale</li> <li>• smaller number of species involved</li> <li>• no climax community</li> <li>• other appropriate response</li> </ul>	[2]
5	(a) (i) Reduction in light intensity/it became darker;	[1]
	(ii) The pupil increases in size; radial muscles in the iris contract (and circular muscles relax);	[2]
	(iii) Allows more light to enter the eye in order that the photoreceptors can be stimulated;	[1]
(b)	(i) Eagle fovea $1000 \div 2 = 500$ human fovea $1000 \div 3 = 333.3$ ; $= 166.7/167$ ;	[2]
	(ii) (Due to each cone synapsing with a bipolar neurone/each cone provides a discrete impulse; therefore the eagle has more discrete impulses per unit area than humans/image has a greater resolution;	[2]
(c)	(i) 17.5 minutes;	[1]
	(ii) From 0 – 10 minutes/in bright light the rhodopsin is broken down/rods are bleached; once in darkness the rhodopsin begins being resynthesised (leading to the increase in rod sensitivity); eventually all the rods are functional/all the rhodopsin is resynthesised;	[3]

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6 (a) (i)

Blood group of recipient	Blood group of donor			
	A	B	AB	O
A		X	X	
B		✓	X	
AB		✓	✓	
O		X;	X;	

(one mark for each correct column)

[2]

(ii) The A antigens (of blood group A) will react/combine with the antibodies in blood group B;

[1]

(iii) Blood group O can be given as transfusions to any of the four groups; as it does not have any (A or B) antigens on its red blood cells;

[2]

(b) (i) Rh<sup>+</sup> antigens (antigen D) from the foetus can enter the mother's blood (late in the pregnancy); this will cause the mother to produce anti-D antibodies; anti-D memory cells are produced;

[3]

(ii) Already anti-D antibodies present from first pregnancy; these anti-D antibodies can cross the placenta; and cause agglutination of foetal red blood cells;

[3]

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- 7 (a) (i) A pest species is a species which causes economic damage/harm to health; [1]
- (ii) Protection from predators/other appropriate response; [1]
- (iii) 1960;  
1960 – 0 = 1960; [2]
- (iv) Any **four** from:
- (in those years where infestation occurred) the estimated number of larvae varied
  - infestations never occurred in successive years
  - due to adult moths avoiding laying eggs in sections of hedge already infested
  - after the pesticide was applied the infestation involved a higher numbers of larvae
  - (possibly) due to the natural predators of the moth being killed/reduced in number [4]
- (v) Any **two** from:
- (the photograph shows that) some of the leaves survive the infestation
  - the moths avoid infesting the same section of hawthorn the year(s) following previous infestation (allowing recovery time)
  - other appropriate response (e.g. food reserves stored in roots) [2]
- (b) (i) The higher the level of grazing the higher the relative number of trichomes; (*or converse*) [1]
- (ii) The production of trichomes is a protective response to deter grazing; high levels of trichomes give competitive advantage in heavily grazed areas; [2]

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8 (a) Antidiuretic hormone/ADH;	[1]	<b>AVAILABLE MARKS</b>
(b) (i) Descending limb;	[1]	
(ii) Y placed inside base of the loop;	[1]	
(iii) Creates a more negative water potential; in the medulla (relative to that in the filtrate); leading to water being osmotically removed from the collecting ducts/ distal convoluted tubule/descending limb; ions enter the descending limb (thus providing the ions for the continuous removal of ions from the ascending limb);	[4]	
(c) • As aridity increases the length of the loop of Henlé increases • mammals in dry habitats must conserve water • a longer loop of Henlé creates a lower water potential over a larger distance/part of the medulla • causing more water to be reabsorbed/the production of a more concentrated urine	[4]	
(d) The corrective response is the action taken once the blood solute potential varies from the set point; negative feedback is the switching off of the corrective response once the set point has been regained/prevents overcorrection;	[2]	14
(e) Excretion is the removal of toxic products of metabolism;	[1]	
<b>Section A</b>		<b>82</b>

Section B

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9 (a) Indicative content

- (when not conducting impulses) neurones have a resting potential/are polarised
- (in the resting potential) the outside of the membrane is +70 mV relative to the inside
- depolarisation involves positive ions diffusing into the membrane
- this involves the reversal of polarity (at the point of the action potential)
- when depolarised an action potential is formed
- nerve impulse is the propagation of an action potential along the neurone
- local circuits
- refractory period is the period immediately after the action potential when a further impulse cannot occur/is more difficult/prevents overstimulation
- neurones/axons are long therefore reducing the number of synapses (which maximises speed of nervous conduction)
- axons with large diameters conduct impulses faster
- as there is proportionally less leakage of ions
- myelination also speeds up conduction
- myelin acts as an electrical insulator
- with impulses passing directly between nodes of Ranvier/saltatory conduction
- impulses travel faster at higher temperatures/body temperatures

Band	Response	Mark
3	Candidates use the most appropriate specialist terms to clearly describe and explain how impulses pass along neurones and how neurones are adapted to speed up nervous communication using a minimum of <b>seven points</b> of indicative content. Spelling, punctuation and grammar are excellent, and the form and style are of a high standard.	[7]–[9]
2	Candidates use appropriate specialist terms to clearly describe and explain how impulses pass along neurones and how neurones are adapted to speed up nervous communication using a minimum of <b>four points</b> of indicative content. Spelling, punctuation and grammar are excellent and the form and style are of a high standard.	[4]–[6]
1	Candidates partially describe and explain how impulses pass along neurones and/or how neurones are adapted to speed up nervous communication using a minimum of <b>one point</b> of indicative content.	[1]–[3]
0	Response not worthy of credit.	[0]

[9]



**(b) Indicative content**

- (arrival of impulse at the end of the pre-synaptic neurone leads to) calcium ion channels opening/influx of calcium ions
- which cause synaptic vesicles to move to the pre-synaptic membrane
- these vesicles fuse with the pre-synaptic membrane and release transmitter by exocytosis
- (acetylcholine/transmitter) diffuses across the synaptic cleft and binds with receptors in the post-synaptic membrane
- results in influx of positive ions (in the post-synaptic membrane)
- this can result in the development of an excitatory post-synaptic potential (EPSP)
- if this reaches the threshold potential an action potential is generated in the post-synaptic neurone
- cholinesterase breaks down the acetylcholine/transmitter
- breakdown products diffuse across the synaptic cleft and are resynthesised into acetylcholine/transmitter
- synapses allow impulses to pass from neurone to neurone
- (while synapses slow the rate of nervous communication) they allow flexibility/integration
- explanation of flexibility/integration (e.g. each neurone may have synapses with many other neurones/role of inhibitory synapses)
- they ensure unidirectionality
- explanation of how unidirectionality achieved
- they prevent overstimulation/filter out low level stimuli

**AVAILABLE MARKS**

<b>Band</b>	<b>Response</b>	<b>Mark</b>
3	Candidates use the most appropriate specialist terms to clearly describe and explain the process of synaptic transmission and explain the functions of synapses in nervous communication using a minimum of <b>seven points</b> of indicative content. Spelling, punctuation and grammar are excellent, and the form and style are of a high standard.	[7]–[9]
2	Candidates use appropriate specialist terms to clearly describe and explain the process of synaptic transmission and explain the functions of synapses in nervous communication using a minimum of <b>four points</b> of indicative content. Spelling, punctuation and grammar are excellent, and the form and style are of a high standard.	[4]–[6]
1	Candidates partially describe and explain the process of synaptic transmission and/or the functions of synapses in nervous communication using a minimum of <b>one point</b> of indicative content.	[1]–[3]
0	Response not worthy of credit.	[0]

[9]

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**Section B**

**18**

**Total**

**100**