



Rewarding Learning

ADVANCED
General Certificate of Education
2023

Biology

Assessment Unit A2 1

assessing

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

[ABY11]

THURSDAY 1 JUNE, MORNING

**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

- | | | | |
|----------------|---|-----|----|
| 1 | Actin;
sarcomere;
A-band/dark band/anisotropic band;
Calcium/Ca ²⁺ ; | [4] | 4 |
| 2 | (a) (i) A – synaptic vesicles;
B – post-synaptic membrane/transmitter receptors; | [2] | |
| | (ii) (Produce ATP/release energy) to resynthesise neurotransmitter; | [1] | |
| | (iii) Neurotransmitter takes less time to diffuse across cleft;
faster responses/body less likely to suffer harm; | [2] | |
| (b) (i) | Between 3.2 and 3.6 arbitrary units/
any value between 3.2 and 3.6 arbitrary units; | [1] | |
| (ii) | The action potentials are the same;
same amplitude regardless of the strength of the stimulus (above
threshold); | [2] | |
| (c) | Any three from:
• –70 mV/between 2–2.5 ms is resting potential
• during which the membrane is polarised
• 2.5 ms represents start of an action potential/depolarisation begins
• due to positive ions entering neurone | [3] | 11 |

- 3 (a) Ureter – bladder – urethra; [1]
- (b) (i) Microvilli/basal invaginations;
to increase surface area (across which substances can be absorbed)/
increased number of carrier/channel proteins; [2]
- (ii) Lowers the solute potential in the epithelial cells/blood;
creating an osmotic gradient which facilitates the reabsorption of
water; [2]
- (c) (i) Ultrafiltration;
urea is a small molecule so able to pass through the filter/
urea forced through by hydrostatic pressure; [2]
- (ii) Urea diffuses back into blood from the proximal tubule (as the
concentration of urea in the tubule is greater than that in the blood); [1]
- (iii) Equilibrium between the concentration of urea in the blood and the
proximal tubule/urea doesn't get selectively reabsorbed; [1]
- (d) Any **three** from:
- hypothalamus increases the synthesis of ADH
 - increase in ADH released by the pituitary
 - increase in permeability of collecting ducts (and distal convoluted tubule)
 - increase in water reabsorbed into the blood [3]

AVAILABLE
MARKS

12

4 (a) Gibberellin;
cell division; [2]

(b) (i) **Essential mark:** the overall concentration of auxin at each distance down the stem doesn't change significantly/the concentrations at A, B and C are similar (showing that the auxin is not destroyed);

Any **two** from:

- (at each of A, B and C) there is more auxin on the shaded than the illuminated side
- auxin is moved from the illuminated side to the shaded side (at each of A, B and C)
- leading to an increasing differential in auxin concentration between the sides down the stem/from A to C [3]

(ii) (The greater concentration of auxin on the shaded side of the stem) leads to increased cell elongation; causing differential growth on the two sides (leading to the stem bending in the direction of the light source); [2]

(c) (i) 13.1 hours/13 hours 6 minutes; [1]

(ii) As the length of dark period increases the level of P_{730} decreases until a critically low level is reached/its inhibitory effect is removed; as an increasingly longer dark period enables more P_{730} to be broken down (to P_{660}); and an increasingly shorter light period leads to a reduced conversion of P_{660} to P_{730} /faster conversion of P_{660} to P_{730} during the day; [3]

AVAILABLE
MARKS

11

- 5 (a) (Biotic potential is) the maximum rate of growth of a population; [1]
- (b) (i) Avoids confusion with seeds/seedlings from other trees/other appropriate response; [1]
- (ii) $6.2 \div 7$;
 $(6.2 \div 7 \times 100 =) 88.57/88.6\%$; [2]
- (iii) Most seeds are dispersed close to the tree/within 4 m from the tree; decreasing number of seeds dispersed with distance between 4–10 metres;
(number of seeds dispersed decreases with distance away from the tree = [1]) [2]
- (iv) Any **four** from:
- no seedlings grow within 3 metres due to competition (from parent tree)
 - for water/minerals/light
 - increasing numbers survive with distance away from the tree/from 3 metres as competition is reduced
 - for water/minerals/light (allow once)
 - more seedlings survive for 2 years than for 5 years
 - as 5-year seedlings will be larger and there is greater competition between seedlings
 - (more time for) seedlings to be predated/destroyed for other reasons [4]
- (c) (i) Provided with carbohydrate/other products of photosynthesis; [1]
- (ii) The heat treatment killed the (mycorrhizal) fungi; mycorrhiza associations are necessary for normal growth and/or the survival of seedlings of that species; [2]
- (d) (i) Conifers keep their leaves for longer/throughout the year; so photosynthesise more thus absorbing more carbon dioxide from the atmosphere;
(or converse) [2]
- (ii) Greater range of habitats across the seasons/variation in light levels reaching the ground in different seasons/conifers cast too dense a shade to allow many plant species to survive at ground level/other appropriate response; [1]

AVAILABLE
MARKS

16

			AVAILABLE MARKS	
6	(a)	(i) Certain B-lymphocytes are sensitised/stimulated; to form plasma cells which produce antibodies;	[2]	11
		(ii) Faster antibody production – memory cells are able to produce antibodies without requiring being sensitised; Greater antibody production – with both memory cells and B-lymphocytes producing plasma cells/memory cells clone rapidly;	[2]	
	(b)	4096;	[1]	
	(c)	(i) For the first 3 days the percentage of bacteria which were resistant was (very) low/3 or less (or converse); (in an antibiotic-free environment) resistance has a higher metabolic cost so selected against/non-resistant bacteria are able to grow and multiply faster; from day 4 on (almost) all the bacteria were resistant (or converse); as the antibiotic had killed all the non-resistant bacteria;	[4]	
		(ii) This will increase the probability of mutation taking place; and the possibility of antibiotic-resistance developing;	[2]	

- 7 (a) A community interacting with its abiotic environment; [1]
- (b) (i) Succession will take place leading to the growth of shrubs/trees (and the subsequent loss of grassland); [1]
- (ii) $0.02 \div 3623.02 \times 100$;
 5.5×10^{-4} or 0.00055/0.0006%; [2]
- (iii)
- Tertiary consumers
 Secondary consumers
 Primary consumers
 Producers
- [one mark for pyramid correct way round with 4 bars labelled and one for symmetry] [2]
- (c) (i) Too few nutrients/water unable to be retained in the soil to enable succession to take place/allow shrubs/trees to grow; [1]
- (ii) The synthesis of organic nitrogen-containing compounds/amino acids from gaseous nitrogen;
 nitrates easily leached from sandy soil/very few nitrates available in the soil; [2]
- (d) (i) (Different species within) the same genus; [1]
- (ii) Bulbous buttercup located on crests and meadow buttercup in troughs;
 bulbous buttercups adapted for drier soils/soils with greater drainage and/or meadow buttercups adapted for moister soils;
 greater decomposer activity in troughs;
 more decomposer activity (in troughs) as debris/dead plant material accumulates there/they are more moist;
 more meadow (than bulbous) buttercups so more material to decompose/decomposer activity high when abundance of meadow buttercup high; [5]
- (e) (i) Biological control; [1]
- (ii) Viruses mutate easily (so could mutate and be able to infect other mammals)/more difficult to control/monitor than other control agents (e.g. insects)/OAR; [1]

AVAILABLE MARKS

17

Section A

82

Section B

AVAILABLE MARKS

8 (a) Indicative content

- outer segment/membranes/end closest to choroid/sclera contains rhodopsin
- inner segment/section closest to vitreous humour contains nucleus and/or mitochondria
- synapse with bipolar neurone
- thin and elongated structures (which enables large numbers to be present)
- cones have iodopsin (in the outer segment/membranes) rather than rhodopsin
- cones have a range of pigment types (which allow colour perception)
- cones are less elongated than rods/are wider (more 'cone' shaped) than rods

Band	Response	Mark
3	Candidates use the most appropriate specialist terms to clearly describe the structure of rods and outline how the structure of cones differs from that of rods using a minimum of five points 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 (partially) describe the structure of rods and outline how the structure of cones differs from that of rods using a minimum of three points of indicative content. Spelling, punctuation and grammar are good, and the form and style are of a high standard.	[3]–[4]
1	Candidates partially describe the structure of rods and/or outline how the structure of cones differs from that of rods using a minimum of one point of indicative content. Spelling, punctuation and grammar are of a basic standard as is the form and style.	[1]–[2]
0	Response not worthy of credit.	[0]

[6]

(b) Indicative content

- several rod cells synapse with a bipolar neurone
- retinal convergence
- allowing sub-threshold potentials from individual rods to combine/summate
- to reach the threshold potential required for an action potential in the bipolar neurone
- bipolar neurones also show retinal convergence (or by explanation)
- as a consequence of retinal convergence rods will not provide acuity of vision
- rods are more abundant than cones at the periphery of the retina
- and are responsible for sensitivity of vision (being able to distinguish shapes and outlines)
- concentration of cones in the fovea (where light rays are focused during precision vision)
- cones are responsible for visual acuity/accuracy of vision
- which includes colour vision
- each cone cell synapses with a single bipolar neurone
- allowing each cone cell to produce a discrete impulse
- rods are readily broken down in low light levels/cones require high light intensities to function
- no rods or cones at the blind spot

AVAILABLE
MARKS

Band	Response	Mark
3	Candidates use the most appropriate specialist terms to clearly describe how visual acuity and visual sensitivity in the eye are achieved using a minimum of nine points 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 how visual acuity and visual sensitivity in the eye are achieved using a minimum of five points of indicative content. Spelling, punctuation and grammar are good, and the form and style are of a high standard.	[5]–[8]
1	Candidates partially describe how visual acuity and/or visual sensitivity in the eye are achieved using a minimum of one point of indicative content. Spelling, punctuation and grammar are of a basic standard as is the form and style.	[1]–[4]
0	Response not worthy of credit.	[0]

[12]

18

Section B

18

Total

100