



Rewarding Learning

ADVANCED
General Certificate of Education
2022 Reserve Series

Biology

Assessment Unit A2 1

assessing

Physiology, Coordination and Control,
and Ecosystems

[ABY11]

TUESDAY 21 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.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

/ 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 | Dendrites; all or nothing (law); refractory (period); | [3] | 3 |
| 2 | (a) (i) Respiration; | [1] | |
| | (ii) Light energy missing chloroplasts; | [1] | |
| | (iii) 4.4; 4.4/1000 × 100 = 0.44%; | [2] | |
| | (b) Any two from: <ul style="list-style-type: none">not all leaf eaten (e.g. leaf stalk)cellulose cannot be digestedother appropriate response (e.g. losses to decomposers) | [2] | |
| | (c) Three correctly labelled bars with width of bars decreasing from the base up; bars symmetrical with even height; | [2] | 8 |
| 3 | (a) (i) X added in correct position (outer segment); | [1] | |
| | (ii) Regeneration of rhodopsin; | [1] | |
| | (b) (i) Any two from: <ul style="list-style-type: none">a number of rod cells are connected to a bipolar cella number of bipolar cells are connected to a ganglion cellretinal convergence | [2] | |
| | (ii) Any two from: <ul style="list-style-type: none">enabling summation of (sub-threshold) light stimuli/generator potentialsproducing action potential in bipolar neurones/ganglion cellsenabling vision with high sensitivity/maximise vision in low light intensities | [2] | |
| | (c) (i) The radial muscles of the iris contract (and the circular muscles relax); allowing sufficient light to enter the retina; | [2] | |
| | (ii) Name – dark adaptation; Explanation – rhodopsin broken down in bright light so no sensitivity when initially in darkness; over time rhodopsin is reformed so sensitivity increases; cones unable to operate in reduced light so cones unable to function; | [4] | 12 |

| | | | AVAILABLE MARKS | |
|---|---------|---|-----------------|---|
| 4 | (a) | Maintenance of optimal water potential of body fluids; | [1] | 9 |
| | (b) (i) | Podocyte; | [1] | |
| | (ii) | Any two from: <ul style="list-style-type: none"> • pores in the capillary endothelium • efferent arterioles are narrower than the afferent arterioles • the coiling of the glomerular vessels • proximity to the heart | [2] | |
| | (c) (i) | Any three from: <ul style="list-style-type: none"> • all the glucose, amino acids and urea is filtered into the Bowman's capsule • as these are very small molecules • large proteins are not filtered • as too large to pass through the basement membrane • a small number of small proteins are able to pass through | [3] | |
| | (ii) | Any two from: <ul style="list-style-type: none"> • the F/P ratio would not change for amino acids, glucose and urea • the F/P ratio for the small proteins would be higher • the F/P ratio for the large proteins would be higher | [2] | |
| 5 | (a) | The maximum number of individuals/population size able to be supported (by an ecosystem/in the conditions); | [1] | |
| | (b) | Stomata on the upper surface/presence of aerenchyma (large air spaces within leaves); | [1] | |
| | (c) (i) | Nutrient assimilation/adjusting to the temperature/water a slightly different pH/other appropriate response (e.g. have not grown enough to divide); | [1] | |
| | (ii) | (More light so) more photosynthesis; more organic content build up so more division/plants reach dividing stage quicker; | [2] | |
| | (iii) | Nutrient supply becomes limiting/waste accumulation; shortage of space on the water surface; | [2] | |
| | (d) | Any two from: <ul style="list-style-type: none"> • higher temperature in the laboratory • nutrients not limiting in the laboratory • no grazing in the laboratory • water less disturbed in the laboratory • no disruption to light regime, e.g. no clouds/higher light intensity in laboratory • other appropriate response (e.g. no interspecific competition in laboratory) (converse for pond) | [2] | 9 |

| | | | AVAILABLE MARKS | |
|--------------------------------------|------------|---|---|--|
| 6 | (a) | (i) X – nucleus of Schwann cell; Y – axon; [2] | | |
| | | (ii) Saltatory conduction; depolarisation takes place at nodes of Ranvier only/no depolarisation under myelin sheath; local circuits pass from node which is depolarised causing depolarisation at the next node/impulses jump from node to node; [3] | | |
| | | (iii) The impulse travels at a faster rate; [1] | | |
| | (b) | (i) Any three from: <ul style="list-style-type: none"> • the vesicles travel to the pre-synaptic membrane and fuse with the membrane • and release the transmitter by exocytosis into the synaptic cleft • neurotransmitter combines with receptors on (post-synaptic) muscle cell • causing depolarisation of membrane [3] | | |
| | | (ii) Increases surface area across which synaptic transmission can occur; ensuring that a greater proportion of the muscle is stimulated/ensuring that the muscle contracts in unison/other appropriate response; [2] | | |
| | (c) | (i) Time for membrane to become depolarised/for stimulation to pass along T- tubules/for calcium ions to diffuse through muscle/time for myosin heads to attach/binding sites to become free; [1] | | |
| | | (ii) H-zone will become shorter; as the actin filaments are pulled between the myosin filaments/pulled closer to the M-line; as the H-zone is the region of myosin only/region of no overlap; [3] | 15 | |
| | 7 | (a) | (i) Photosynthesis; [1] | |
| | | | (ii) Respiration by decomposers/fungi/bacteria/microbes/detritivores; releases carbon dioxide (into the atmosphere); [2] | |
| | | (b) | (i) Nitrite; [1] | |
| (ii) Nitrifying bacteria; [1] | | | | |
| (c) | | (i) 1; [1] | | |
| | | (ii) Reduces biodiversity (compared to normal/typical soil nitrate levels); leads to greater growth of taller plants/nettles/plants requiring soils with high nitrate levels; thus preventing the growth of ground-level/other plants; due to competition for water/nutrients/light; [4] | 10 | |

- 8 (a) (i) Increases cell elongation; [1]
- (ii) Cytokinin increases the rate of cell division;
therefore more cells for auxin to act on/cause elongation; [2]
- (b) (i) Between 14–15 hours; [1]
- (ii) Light period converts P_{660} to P_{730} and dark period not sufficient to
remove P_{730} ;
 P_{730} sufficiently high to initiate flowering; [2]
- (c) (i) The mean number of seedlings (per square metre) remained very low
for a period of 2 years;
then increased significantly in the weeks/soon after ploughing, before
decreasing; [2]
- (ii) 16.5 and 10;
 $6.5 \div 10 \times 100 = 65\%$; [2]
- (iii) Ploughing resulted in seeds being on/near the soil surface;
light causes P_{730} to reach critical level (for germination)/to reach high
enough concentration; [2]
- (iv) Seedlings will only germinate if on/close to the soil surface/in a position
to receive light;
limited food stores mean this is important for seedling survival/
can photosynthesise early; [2]
- (d) Any **two** from:
- short lived (as seen by decrease in number in graph)
 - population density very variable
 - inhabit unstable/short-lived habitats
 - other appropriate response (e.g. rapid reproduction rate/grow rapidly)
- [2]

16

Section A

82

Section B

AVAILABLE
MARKS

9 (a) Indicative content

- antibodies are (globular proteins which are) specific and complementary to particular antigens
- (produced as a consequence of) B-lymphocytes stimulated by exposure to antigens
- which produce plasma cells
- plasma cells produce antibodies
- they lock on to the antigens forming antigen-antibody complexes;
- causing agglutination
- for subsequent destruction by phagocytes
- active immunity involves the individual's immune system producing antibodies
- as a consequence of infection/vaccination
- passive immunity involves donation of antibodies from another source
- such as serum from an individual recovering from disease/placental or colostral transfer/monoclonal antibodies
- memory cells provide long term immunity
- as memory cells can produce antibodies rapidly/higher levels of antibody than a primary response on its own
- helper T-cells help stimulate antibody production/activity
- suppressor (regulatory) T-cells deactivate/regulate B-cell activity

| Band | Response | Mark |
|------|--|----------|
| 3 | Candidates use the most appropriate specialist terms to clearly describe and explain the role of antibodies in protection against disease 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 and explain the role of antibodies in protection against disease 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 and explain the role of antibodies in protection against disease using a minimum of one point of indicative content. Spelling, punctuation and grammar, and the form and style are of a basic standard. | [1]–[4] |
| 0 | Response not worthy of credit. | [0] |

[12]

(b) Indicative content

- rejection by immune response as transplanted tissue contains ‘foreign’/ non-self antigens
- initial rejection takes longer due to time for plasma cells/antibodies to be produced/as it is a primary response
- (if from the original source) second graft is rejected more quickly due to the presence of memory cells/is a secondary response
- (if from a different source) second graft is rejected more slowly as no memory cells/time for primary response to take effect
- probability of rejection can be decreased using tissue typing (or by explanation)
- use of immunosuppression techniques such as X-rays or drugs
- which inhibit lymphocyte replication

| Band | Response | Mark |
|------|--|---------|
| 3 | Candidates use the most appropriate specialist terms to clearly explain the conclusions concerning transplant rejection and outline how rejection of transplants can be avoided 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) explain the conclusions concerning transplant rejection and outline how rejection of transplants can be avoided 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 explain one or more of the conclusions concerning transplant rejection and/or outline how rejection of transplants can be avoided using a minimum of one point of indicative content. Spelling, punctuation and grammar, and the form and style are of a basic standard. | [1]–[2] |
| 0 | Response not worthy of credit. | [0] |

[6]

Section B

Total

**AVAILABLE
MARKS**

18

18

100