Rewarding Learning

ADVANCED
General Certificate of Education
2019

Biology

Assessment Unit A2 1

assessing

Physiology, Coordination and Control, and Ecosystems

[ABY11]

THURSDAY 6 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.

Types of mark schemes
Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response
In deciding which level of response to award, examiners should look for the 'best fit' bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement.

The following guidance is provided to assist examiners.

- ***Threshold performance:*** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- ***Intermediate performance:*** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- ***High performance:*** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Quality of written communication
Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is basic.
Level 2: Quality of written communication is good.
Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level 1 (Basic): The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

Level 2 (Good): The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Level 3 (Excellent): The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

/ 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	**(a)**	1 Photosynthesis 2 Feeding 3 Respiration 4 Combustion;; 3/*4 for [2], 2 for [1]*		[2]	
	(b)	Fossilisation;		[1]	
	(c)	**(i)**	More effect/other appropriate response;	[1]	
		(ii)	Would increase biodiversity/other appropriate response;	[1]	5
2	**(a)**	**(i)**	Freshwater snails;	[1]	
		(ii)	13 122;	[1]	
		(iii)	256 ÷ 1529 = 0.167; 0.167 × 100 = 16.74%/16.7%	[2]	
	(b)	Any **three** from: • more loss to decomposers • not all of bird would be eaten • not all parts digested • greater loss to respiration • due to high metabolic rate • energy required to maintain constant body temperature/flight (or converse in relation to stickleback feeding on leech)		[3]	7
3	**(a)**	**A** Cornea; **B** Ciliary body/muscle; **C** Optic nerve;		[3]	
	(b)	**(i)**	**X** Rods **Y** Cones; *both required for mark*	[1]	
		(ii)	Z represents the blind spot; point at which optic nerve (and blood vessels) leaves/enters the retina (eye)/point at which neurones leave the retina;	[2]	
		(iii)	Light from object falls on rods/periphery of retina; rods have (high visual) sensitivity; since rhodopsin is broken down at low light intensity/rods show retinal convergence (*accept converse*);	[3]	9

4 **(a)** **(i)** Secondary; [1]

(ii) Any **two** from:
- they can grow in the habitat when there are relatively low concentrations of nitrate
- can obtain source of amino acids/ammonia/nitrogen-containing compounds (without reliance on soil nitrate)
- plants are better competitors [2]

(iii) Any **two** from:
- dead plant/animal material/nitrogenous waste
- decomposition and release of ammonia/ammonium compounds;
- action of nitrifying bacteria (on ammonium compounds) producing nitrates; [2]

(b) In the early stages of succession there is little plant cover/a lot of bare soil/ bare soil decreases as vegetation increases;
small annuals increase dramatically in early stages of succession due to availability of resources/link to bare ground/lack of competition;
small annuals decline as other larger/better adapted plants (grasses/shrubs/ trees) become established/out-competed;
shrubs and trees increase (past year 5) due to, e.g. greater soil nitrate/better soil quality/slower growing; [4]

(c) Sheep are grazers/feed on the plants;
therefore, the growth of larger species is prevented/prevent progression of sere;
climatic climax community does not develop/biotic climax will be maintained; [3]

AVAILABLE MARKS

12

5 **(a)** **(i)** A species that causes economic damage/*OAR*; [1]

(ii) Any **two** from:
- the introduction of a single/few organisms to an island
- do not require interaction of male/female organisms for reproduction/any two can reproduce
- all can produce offspring [2]

(iii) 'Crawler' stage allows distribution of young insects;
this reduces competition for food/prevents accumulation of predators; [2]

(iv) Attract predators/increase predation;
so reducing the population of the insect; [2]

(v) Increases time taken for ladybird larvae to become adults;
therefore, reduced number of predators/delay in feeding on prey; [2]

(b) Any **four** from:
- ensure they can survive/thrive/self-sufficient in the environment
- reproduce in sufficient numbers to be effective/ensure there isn't a predator that would remove the ladybird
- there is not a predator that would remove the ladybird/can survive at low prey density
- ensure they do not prey on other native organisms/disrupt existing food chain/carry disease into new environment
- may outcompete native organisms
- controlled environment prevents accidental release of species which may become invasive
- most effective species for biological control [4]

(c) **(i)** This is the threshold below which crop loss is acceptable; [1]

(ii) Ladybirds must acclimatise to new environment/lag due to alkaloids;
time lag as consequence of period required reproduce in large enough number to impact on prey population; [2]

(iii) Introduction of pesticides in 1947 reduced ladybird population;
this reduces (predator) pressure on prey; [2]

AVAILABLE MARKS

18

					AVAILABLE MARKS
6	**(a)**	**(i)**	1; [1]		
		(ii)	Creatine/creatinine/water/salt; [1]		
	(b)	**(i)**	**A** Selective reabsorption; **B** Osmoregulation/carry urine to pelvis; **C** Creation of salt gradient (in medulla); [3]		
		(ii)	Filtration due to increased pressure/the separation of substances based on size as they pass into the Bowman's capsule; [1]		
		(iii)	Any **two** from: • afferent arteriole wider than efferent arteriole • branching/knotting of glomerular capillaries • network relatively close to the heart • pores in glomerulus [2]		
		(iv)	(Large plasma) proteins; too large to cross the basement membrane; [2]		
	(c)	**(i)**	As the toxicity of the compound increases a greater volume of water is required for its removal; having a dilution effect; [2]		
		(ii)	Less water is required for its removal; so more water conserved/aids survival in drought; [2]		
	(d)	**(i)**	Increased urea in the blood will decrease the water potential/make the water potential more negative; (*accept decrease the solute potential/ make the solute potential more negative*) [1]		
		(ii)	Water moves into the blood; this increases the volume of water in the blood/ammonia requires a large volume of water for removal; [2]		17

				AVAILABLE MARKS
7	(a)	(i)	Dead or weakened (attenuated) pathogen/modified toxin/isolated antigens; that results in a (specific) immune response; [2]	
		(ii)	Lower treatment cost; fewer work days lost (so increased productivity); [2]	
	(b)		Percentage of vaccine uptake is high from 1990–2010 and the incidence of measles is low; when the percentage uptake drops (2004–2005) the incidence of measles remains low; [2]	
	(c)	(i)	Active (artificial) immunity; through the production of (their own antibodies and) B-memory cells/ (T-killer cells and) T-memory cells; [2]	
		(ii)	The head of the haemagglutinin protein is highly variable; so vaccinated individual's memory cells do not result in complementary antibody production; [2]	
		(iii)	Has the same primary structure/amino acid sequence across many different strains of the virus; [1]	
		(iv)	Design a vaccine against the stalk region of the H coat protein/with range of head region proteins/antigens; antibody/memory cells are effective against several/all strains of the flu; changes to the head region will not reduce effectiveness of the vaccine; [3]	14
			Section A	**82**

Section B

AVAILABLE MARKS

8 (a) Indicative content

- arrival of impulse at the end of the pre-synaptic neurone results in calcium ion channels opening and influx of calcium ions
- calcium ions cause (synaptic) vesicles to move towards the presynaptic membrane
- these vesicles fuse with the pre-synaptic membrane releasing neurotransmitter/acetylcholine by exocytosis
- (acetylcholine) diffuses across the synaptic cleft and binds to receptors in the postsynaptic membrane
- this results in the opening of ion channels in the post-synaptic membrane
- resulting in influx of positive ions through the post-synaptic membrane
- (if enough positive ions enter this) will result in the formation of an excitatory post-synaptic potential (EPSP)
- this crosses the threshold intensity an action potential is generated in the post-synaptic neurone
- cholinesterase removes the acetylcholine from the receptor and breakdown products diffuse back across the synaptic cleft
- they are subsequently re-synthesised into acetylcholine and stored in synaptic vesicles
- ATP required is provided by mitochondria
- inhibitory synapses make it more difficult for transmission to take place
- neurotransmitters, e.g. GABA are released from the inhibitory neurone and bind to receptors on the post-synaptic membrane
- causing an influx of negative ions, making the inside of the membrane more negative/hyperpolarisation
- creating an inhibitory post-synaptic potential (IPSP)
- consequently, the membrane resting potential becomes more negative/ hyperpolarisation makes it more difficult for the EPSP to reach threshold
- suitable example of response coordinated by inhibitory synapse

Band	Response	Mark
3	Candidates use appropriate specialist terms to fully describe synaptic transmission and clearly describe the action of an inhibitory synapse using a minimum of **ten** points of indicative content. Punctuation, grammar and form and style are of a very good or better standard.	[9]–[12]
2	Candidates sometimes use appropriate specialist terms to fully describe synaptic transmission and clearly describe the action of an inhibitory synapse using a minimum of **six** points of indicative content. Punctuation, grammar and form and style are of a good standard.	[5]–[8]
1	Candidates partially describe synaptic transmission and/or clearly describe the action of an inhibitory synapse using a minimum of **one** point of indicative content. Punctuation, grammar and form and style are of a basic standard.	[1]–[4]
0	Response not worthy of credit.	[0]

[12]

(b) Indicative content

- (*myelination*) the myelin sheath
- acts as an electrical insulator
- it is interrupted at the Nodes of Ranvier/breaks between adjacent Schwann cells
- action potentials pass by jumping or saltatory conduction
- (*axon diameter*) the thicker the axon the faster the action potential may travel
- because there is proportionally less leakage of ions from a neurone with a large diameter
- this is due to the surface area:volume of the neurone
- leakage makes it difficult to maintain potential gradient that forms the resting or action potentials
- a high number of ion channels at the Nodes of Ranvier overcome the problem of small diameter neurones

Band	Response	Mark
3	Candidates use appropriate specialist terms to fully describe and explain the adaptations of a neurone to maximise transmission speed using a minimum of **five** points of indicative content. Punctuation, grammar and form and style are of a very good or better standard.	[5]–[6]
2	Candidates sometimes use appropriate specialist terms to fully describe and explain the adaptations of a neurone to maximise transmission speed using a minimum of **three** points of indicative content. Punctuation, grammar and form and style are of a good standard.	[3]–[4]
1	Candidates partially describe and explain the adaptations of a neurone to maximise transmission speed using a minimum of **one** point of indicative content. Punctuation, grammar and form and style are of a basic standard.	[1]–[2]
0	Response not worthy of credit.	[0]

[6] 18

Section B **18**

Total **100**

AVAILABLE MARKS