Rewarding Learning

ADVANCED
General Certificate of Education
January 2014

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

FRIDAY 10 JANUARY, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

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

AVAILABLE MARKS

Section A

1 Suspensory ligaments;
choroid;
(retinal) convergence;
stereoscopic; [4] 4

2 **(a)** **(i)** 390 kJ m^{-2} $year^{-1}$;
9.75%; **[consequential to figure above]** [2]

(ii) Respiration – cows/mammals are endotherms/high levels of respiration needed to maintain body temperature above surroundings;
Faeces – cellulose in grass difficult to digest; [2]

(b) **(i)** **Any two from**
- respiratory/energy losses reduced as less used in movement
- large number of animals in close proximity increase ambient temperature thus reducing heat loss/warmer temperature indoors than outdoors
- more efficient grazing of confined area/allows grass in other areas to recover (become more nutritious) [2]

(ii) Disease spread more readily/animals more likely to develop bone or joint injury/grass too heavily grazed causing damage/other appropriate response (e.g. crowding causes stress so reducing meat quality); [1] 7

				AVAILABLE MARKS
3	(a)	Minimum due to increased photosynthesis/less fossil fuel combustion (in summer) explained (e.g. lower domestic heating requirements); maximum due to reduced photosynthesis/decomposition of deciduous leaves/increased fossil fuel combustion explained (e.g. increased domestic heating requirements); [2]		
	(b)	(i) **Any three from** • carbon dioxide levels increasing/high • due to increased combustion of fossil fuels/deforestation • carbon dioxide (and other gases) is a 'greenhouse gas'/acts as barrier (blanket) • trapping heat/infrared/long wave radiation escaping from atmosphere [3]		
		(ii) The increase in carbon dioxide may not be the cause of the global warming/there are other greenhouse gases, e.g. methane/other appropriate suggestion; [1]		
	(c)	(i) Sulfur dioxide/nitrogen dioxide (from power station); combines with water vapour to form sulfuric acid/nitric acid; [2]		
		(ii) **Any two from** • trees defoliated/cuticle damage • trees unable to photosynthesise/produce starch/glucose • minerals (calcium, magnesium and nitrate) less available/soluble • aluminium in soil damages roots • reduced decomposition (due to acidic soil) [2]		10
4	(a)	(i) **A** – muscle fibre; **B** – nucleus; [2]		
		(ii) (Not cardiac muscle) as not branched/no intercalated discs/is multinucleate/peripheral nuclei; (not smooth muscle) as multinucleate/striated/not spindle shaped/ peripheral nuclei; [2]		
	(b)	(i) **Any three from** • action potential causes calcium ions to (leave the sarcoplasmic reticulum and) enter the sarcoplasm/released • causes myosin binding sites on actin to be exposed/allowing myosin heads to attach/actinomyosin complexes (cross bridges) form • myosin heads rotate/rock back pulling actin over myosin • reduction in calcium ions allows sarcomere to relax/lengthen [3]		
		(ii) Muscle (fibre) contains many sarcomeres arranged end to end; muscle contraction involves all sarcomeres (in row) contracting simultaneously/contraction is sum total of all sarcomeres; [2]		9

			AVAILABLE MARKS
5	**(a)**	A–B (lag phase) due to time taken to grow/reach size necessary to form buds/time taken for buds to grow before separating; nutrient assimilation/activating genes/producing enzymes; D–E (decline phase) due to death rate > rate of cell production; due to running out of nutrients/build-up of waste; [4]	
	(b) **(i)**	8200 cells mm^{-3}; [1]	
	(ii)	Adding more glucose/using a larger flask (to dilute waste or allow more oxygen to diffuse into the solution)/other appropriate answer; [1]	
	(c) **(i)**	Volume = (0.04 × 0.1) = 0.004 mm^3; 16 ÷ 0.004/16 × 250 = 4000 cells mm^{-3} [2]	
	(ii)	**Any two from** • flask not mixed before sampling • samples not obtained from the same depth • clumping of cells • haemocytometer grid not totally filled/overfilled [2]	
	(iii)	Dead yeast cells were counted/other appropriate suggestion; [1]	
	(d)	(Serial) dilution (or explained); when calculating numbers need to multiply by dilution factor; [2]	13
6	**(a)** **(i)**	**A** – myelin sheath/Schwann cell; **B** – axon; [2]	
	(ii)	Vertical line on myelin sheath avoiding nucleus (not across node of Ranvier); [1]	
	(b)	Action potential jumps from node to node/saltatory conduction; depolarisation/inside of axon becomes positive relative to the outside at nodes of Ranvier only; [2]	
	(c)	Giant axons have faster conduction; allows faster escape/withdrawal; [2]	7

			AVAILABLE MARKS
7	**(a)**	Antibodies are (globular) proteins/have tertiary/quarternary structure; provides a specific shape/have a (specific) receptor site; complementary to microorganisms/antigens of different disease-causing microorganisms; [3]	
	(b)	**Any two from** • previous infection • a microbe may possess different antigens • different vaccines used previously • other appropriate response [2]	
	(c) **(i)**	One type of antigen used in immunisation/sensitised (cloned) B-lymphocytes specific to antigen; [1]	
	(ii)	Give long life qualities/rapid division to hybridoma cells; [1]	
	(iii)	Antibodies produced in large quantities/faster production/meet medical needs/less risk of infection from animals/other appropriate suggestion; [1]	
	(iv)	Horses have 'closer relationships' with humans than mice/mouse needs only one injection/antibody does not have to be continuously removed from animals/other appropriate response; [1]	9

				AVAILABLE MARKS
8	(a)	(i)	Sand is unable to retain moisture/exposed to high winds/other appropriate response; [1]	
		(ii)	Long roots/curved leaves/reduced surface area of leaves/fewer stomata/sunken stomata/leaf hairs/thick waxy cuticle/other appropriate response; [1]	
	(b)	(i)	Low biodiversity in young dunes/near sea, increases to maximum in dune slack and falls further inland; **Any four from** • in young dunes soil moisture/humus levels too low to support most plants (will only support specialist plants, e.g. marram) • in dune slack high light levels and rising soil moisture/humus levels will support greater variety on plant species • in dune slacks little marram grass to provide shade/most plants are ground-hugging • some plants may be nitrogen-fixing (in nutrient-poor soil) • the older more stable dunes allows the establishment of shrubs (plants with longer life cycles/K-strategists) • (due to) high humus/high moisture levels • the shrubs/species in older dunes (heather, bracken, gorse) reduce light levels reaching the ground • reducing biodiversity in ground layer/only allowing mosses to grow in ground layer • other appropriate response [5]	
		(ii)	**Any two from** • angle of sun will change (affecting amount of light reaching ground layer)/light levels change during the day • rain may increase soil moisture levels/sun may reduce soil moisture • other appropriate response, e.g. grazing effects [2]	
	(c)		Fixing nitrogen can compensate for poor soil development; allows the development of N-containing compounds (protein, nucleic acids, ATP); [2]	
	(d)	(i)	Both develop on bare rock/land that has not been colonised before; [1]	
		(ii)	All stages of sand dune succession are evident at one time/is spatial (quarry succession is temporal/at any one time only one stage/sere is evident)/quarry succession is faster/less gradation of environmental factors in a quarry/other appropriate response; [1]	13
			Section A	**72**

Section B

AVAILABLE MARKS

9 (a) Ultrafiltration (up to any six from)

- the blood entering the glomerulus is at high (hydrostatic) pressure
- due to the short distance from the heart/the afferent arteriole being thicker than the efferent arteriole/the coiling of the capillaries in the glomerulus
- smaller components of the blood (e.g. glucose, amino acids, salts, water, urea) are filtered out of glomerulus into the Bowman's capsule
- larger components (e.g. blood cells and plasma proteins) are retained
- ultrafiltration aided by pores in capillary walls
- the basement membrane is the effective filter
- between the podocytes in wall of Bowman's capsule
- filtration is opposed by the more negative solute potential of the plasma protein

Reabsorption (up to any six from)

- useful products (e.g. glucose, amino acids) are selectively reabsorbed in the proximal tubule
- by facilitated diffusion/active transport
- proximal tubule cells adapted by presence of microvilli to increase surface area/ abundant mitochondria to provide ATP/release energy for active transport
- urea is not reabsorbed (but some diffuses back into the blood)
- water is reabsorbed by osmosis
- allowing concentration of urea to increase down the proximal convoluted tubule
- small proteins are reabsorbed by pinocytosis
- additional water is reabsorbed from the collecting ducts (descending limb of loop of Henlé/distal convoluted tubule) [11]

(b) Homeostasis is the maintenance of constant (steady state) conditions in the body/maintains the blood water potential at a constant level;

Any four from

- osmoreceptors (sensors) in the hypothalamus allow blood water/solute potential to be monitored
- if deviation from the set point/normal water (solute) potential a corrective mechanism takes place to return water/solute potential to normal value
- if water/solute potential decreases more ADH is released (if water/solute potential increases less ADH is released)
- increased ADH will lead to more water being reabsorbed in the collecting ducts (decreased ADH will lead to less water being reabsorbed in the collecting ducts)
- homeostatic mechanisms have a negative feedback system
- as water/solute potential returns to normal/set point the effect of the corrective measure is reduced – explained in a water/solute potential context (as water/solute potential rises towards normal the level of ADH released decreases or converse) [5]

Quality of written communication:

		AVAILABLE MARKS
2 marks:	The candidate expresses ideas clearly and fluently through well-linked sentences, which present relationships and not merely list features. Points are generally relevant and well-structured. There are few errors of grammar, punctuation and spelling.	
1 mark:	The candidate expresses ideas clearly, if not always fluently. The account may stray from the point or may not indicate relationships. There are some errors of grammar, punctuation and spelling.	
0 marks:	The candidate produces an account that is of doubtful relevance or obscurely presented with little evidence of linking ideas. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the account. [2]	18
	Section B	**18**
	Total	**90**