



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**2013**

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**Biology**

Assessment Unit A2 1

*assessing*

Physiology and Ecosystems

**[AB211]**

**TUESDAY 21 MAY, AFTERNOON**

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

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### Section A

1	B-lymphocyte; plasma; memory;	[3]	3
2	(a) (i) Decomposers;	[1]	
	(ii) Light energy reflected from leaves/used in evaporating water on leaf surface/missing chloroplasts/wavelengths that cannot be used/inefficiency of photosynthetic (biochemical) process;	[1]	
	(iii) <b>Any two from</b>		
	• difficulty of digesting plant material/cellulose		
	• large amount of egestion		
	• not all plant material (e.g. roots) eaten	[2]	
	(b) <b>Any two from</b>		
	• rice is at a lower trophic level/wheat is at a higher trophic level		
	• shorter food chains are more efficient than longer food chains/have fewer steps of energy loss/using meat involves more steps		
	• birds/mammals providing meat are subject to high respiratory losses (as are endotherms)	[2]	6
3	(a) (i) D – distal/second convoluted tubule; E – collecting duct;	[2]	
	(ii) B and E;	[1]	
	(b) (i) <b>Any two from</b>		
	• microvilli/infoldings increase surface area for reabsorption		
	• mitochondria provide ATP/energy for active transport		
	• capillary in close contact with cells providing short diffusion distances		
	• membrane possesses carrier molecules for glucose/amino acids/active transport/facilitated diffusion	[2]	
	(ii) Proteins are too large to pass through the basement membrane; all the glucose is actively/selectively reabsorbed (in the proximal tubule); urea more concentrated as water is reabsorbed;	[3]	
	(c) <b>Any two from</b>		
	• the loop of Henlé creates a negative water potential/osmotic gradient/high salt concentration in medulla;		
	• the longer the loop of Henlé the better the species is at concentrating urine/the more water is reabsorbed (from the collecting duct);		
	• necessary to conserve water/prevents dehydration;	[2]	10

- 4 (a) (i) A – mitochondrion;  
B – synaptic vesicle; [2]
- (ii) Consequence of the angle of sectioning/axons in different plane/section only through synapse [*do not allow axons in TS*]; [1]
- (b)  $20 \times 10^{-9}$  m (appropriate conversion factor);  
 $0.02 \text{ ms}^{-1} / 2 \times 10^{-2} \text{ ms}^{-1} / \div 1 \times 10^{-6}$ ; [2]
- (c) (i) **Any two from**
- neurotransmitters from inhibitory synapse combine with receptors on post-synaptic membrane
  - hinder the development of an excitatory post-synaptic potential/prevents threshold being reached
  - prevent/reduce depolarisation of post-synaptic membrane/increase levels of polarisation in post-synaptic membrane [2]
- (ii) **Any two from**
- Prozac increases release of serotonin/prevents breakdown of serotonin in synaptic cleft/mimics shape of serotonin
  - attaches to (serotonin) receptor sites
  - restores functioning of inhibitory synapse to normal levels
  - other appropriate response [2]
- 5 (a) The maximum population size that the ecosystem/environment can support; [1]
- (b) (i) During egg incubation/before eggs are hatched/March/March to April; [1]
- (ii) Food shortage/predation/eaten by sibling/infection/poisoning/other appropriate suggestion; [1]
- (c) **Any four from**
- large number of owls captured
  - permanency of marking technique described (e.g. bird ring/leg tag/paint)
  - non-toxic nature of marking/marking must not make owls more obvious to predators/retain one in captivity to ensure non-toxicity
  - formula – number in first sample  $\times$  number in second sample divided by the number of marked owls in the second sample
  - allow time for owls to redistribute before second sample
  - repeat count after a few months/different time of year for reliability [4]
- (d) (i) K-selected; [1]
- (ii) Appropriate example of density-dependent factor, e.g. competition for food/nesting sites;  
explanation of how density-dependent factor leads to increased mortality when population numbers high (e.g. shortage of food leads to increased death rates);  
explanation as to how density-dependent factor leads to reduced mortality when population numbers low (e.g. shortage of food less likely to affect death rates/more food available so less likely to die of starvation); [3]

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6	<p>(a) The cell wall becomes more flexible/is able to stretch; water enters the cell by osmosis to provide turgor pressure which causes the cell to elongate; [2]</p> <p>(b) (i) Prevents (differential) movement of auxin due to light; [1]</p> <p>(ii) As concentration of auxin in the block increases the angle of curvature increases up to a maximum and then decreases [<i>not inhibits growth at high concentrations</i>]; the more auxin the greater degree of cell elongation/greater number of cells elongating (on the side of the stem under the agar block); at high levels the auxin starts to become toxic/inhibits cell's physiology/ other appropriate response; [3]</p> <p>(c) (i) Growth in the stem is stimulated (relative to control); Growth in root is inhibited (relative to control) [<i>not root decreases in length</i>]; [2]</p> <p>(ii) The (optimum) value for growth in stems is higher than for roots; consistent with gradient from apical meristem down through the plant; [2]</p>	10
7	<p>(a) (i) The use of reed beds/explanation of more efficient soakaway system (e.g. create terraces by ploughing across land/herringbone drainage) other appropriate response; [1]</p> <p>(ii) Nitrate/phosphate leaches into waterways leading to algal blooms; decomposition of dead algae/increased bacterial population/aerobic respiration by bacteria; aquatic life dies due to shortage of oxygen (in context of decomposition); [3]</p> <p>(iii) <b>Any two from</b></p> <ul style="list-style-type: none"> <li>• calculation of application levels to match crop needs/so supply does not exceed demand</li> <li>• only apply fertiliser immediately prior/or during periods of vigorous growth</li> <li>• do not spray when rain is forecast</li> <li>• do not spray near waterways</li> <li>• use more organic fertiliser/use less artificial fertilisers</li> <li>• other appropriate response [2]</li> </ul> <p>(b) <i>Anabaena</i> produces its own ammonia (nitrate)/amino acids; nitrate less likely to be limiting (than phosphate)/does not require nitrate from the environment; [2]</p>	8

- 8 (a) (i) A parasite lives in or on another organism (host) causing harm/causes harm (to host) over a period of time; [1]
- (ii) Fewer red blood cells/red blood cells destroyed; less oxygen transported for respiration; [2]
- (iii) More likely to target individuals with malaria; increases the number of mosquitoes carrying the parasite; [2]
- (b) (i) Saves human lives at expense of other species/priority of human life; [1]
- (ii) **Any two from**
- broad spectrum insecticide/kills other (beneficial) insects/decreases biodiversity
  - kills predators of pests/target pest resurgence
  - bioaccumulation in food chains/passes through trophic levels
  - may lead to increase in resistant species [2]
- (c) (i) Nets are more effective than not using nets in preventing mosquito attack/malaria; nets sprayed with insecticide are more effective than unsprayed nets; [2]
- (ii) **Any two from**
- variability in age
  - diet
  - health/already have malaria (increasing body temperature)
  - density of mosquitoes/proximity of home to waterways (mosquito breeding grounds)
  - nets not being closed properly/not properly positioned/different mesh size
  - unevenness of insecticide spraying/different insecticides used
  - other appropriate suggestion [2]
- (iii) Another child or children in family/child of same age/gender/health/same village/not have malaria; same house (environment)/genetically similar/same proximity to mosquito breeding grounds/any other appropriate response [**second point must be linked to first point**]; [2]
- (iv) (In rural Africa) difficulty in testing for presence of malaria/malaria takes long time to develop/some people resistant to malaria/may already have been infected/not all biting mosquitoes may carry malaria; [1]

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## Section B

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## 9 (a) Any ten from

- the cornea and the lens are both involved in the convergence of light/combine to focus light onto the retina
- the lens is responsible for accommodation/fine control of light rays
- for a close up object the ciliary muscles contract reducing tension in the suspensory ligaments
- allowing the lens to become thicker
- causing the greater convergence/refraction/shorter focal length required
- in high light intensities the circular muscles in the iris contract (radial muscles relax) to reduce the diameter of the pupil
- reducing the amount of light entering the eye
- protecting the retina from damage
- the choroid layer prevents internal reflection (which would distort vision)
- cones contain the photosensitive pigments that function in high light intensities
- each cone synapses with individual bipolar neurones/cones show no convergence
- giving greater visual acuity/greater resolution
- there are three types of cone thereby providing colour vision
- each type has a different type of iodopsin sensitive to red, green or blue light
- colour vision depends on the degree of stimulation of each type of cone
- the presence of two eyes provides binocular vision/gives stereoscopic vision/good depth perception [10]

## (b) Any six from

- rods contain the photosensitive pigment rhodopsin which is broken down/bleached in low light intensities
- several rods synapse with one bipolar neurone/rods exhibit retinal convergence
- allowing summation of (generator) potentials (transmitter substances) to produce an impulse in the bipolar neurone/allows threshold to be reached
- providing greater sensitivity
- pupil is dilated/large to allow as much light as possible to stimulate the retina (enter eye)
- pupil dilation is due to contraction of radial muscle in the iris
- large eyes/pupils
- to maximise the amount of light reaching the retina/photosensitive cells
- mainly rods present/no cones
- other appropriate response (e.g. layer at back of eye to reflect light back through retina) [6]

## Quality of written communication

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]

**Section B****Total****AVAILABLE  
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**18****90**