



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**January 2011**

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## **Biology**

**Assessment Unit A2 1**

*assessing*

**Physiology and Ecosystems**

**[AB211]**

**MONDAY 24 JANUARY, AFTERNOON**

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# **MARK SCHEME**

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

**Section A**

1	Pioneer; primary; climax; secondary;	[4]	4
2	(a) Shoot tip/zone of elongation internodal region <b>Both for [1]</b>	[1]	
	(b) NAA treatment resulted in more elongated cells (causing greater stem elongation); NAA has little effect on cell division (similar number of cells produced)/2,4-D treatment resulted in less cell elongation; 2,4-D's increased stem elongation as a result of greater cell division (with each new cell elongating a little);	[3]	4
3	(a) (i) Post synaptic membrane;	[1]	
	(ii) <b>Any three from</b> <ul style="list-style-type: none"> <li>• (binding with ACh receptor sites) causes depolarisation of the post synaptic membrane</li> <li>• inside the post-synaptic membrane becomes positive/influx of sodium ions through post synaptic membrane</li> <li>• an excitatory post-synaptic potential (EPSP) occurs</li> <li>• if a threshold is reached (e.g. enough sodium enter) an action potential occurs</li> </ul>	[3]	
	(iii) Post synaptic nerve cell remains in an excited state/continuous stimulation of post synaptic membrane/less summation is needed to transmit across the synapse;	[1]	
	(b) (i) Block the ACh receptor sites/blocks channels which allow movement of ions across the membrane/induce the entry of negative ions ( $\text{Cl}^-$ )/induce the removal of positive ions ( $\text{Na}^+/\text{K}^+$ )/other appropriate response;	[1]	
	(ii) <b>Any two from</b> <ul style="list-style-type: none"> <li>• depolarisation is less likely to take place</li> <li>• prevents threshold being reached</li> <li>• thus an action potential is less likely to be created/rendering the nerve less capable of carrying an impulse</li> </ul>	[2]	
	(iii) Increased reaction times/loss of motor control/may lead to dangerous behaviour/less pain felt;	[1]	9

- 4 (a) (i)  $2.0 \times 10^4 \div 1.0 \times 10^6$ ;  
 $0.02 (2 \times 10^{-2}) \times 100 = 2\%$ ; [2]
- (ii) Gross primary production (photosynthesis) less respiration/  
 GPP – R; [1]
- (iii)  $2.0 \times 10^4 - 2.0 \times 10^3 = 1.8 \times 10^4$  (accept  $18 \times 10^3$  or 18 000 or  
 equivalent); [1]
- (b) (i) **Any two from**
- temperature increases the rate of respiration
  - higher temperatures are above the optimum for photosynthesis/  
 make photosynthesis less efficient
  - thus respiration exceeds GPP (photosynthesis) [2]
- (ii) Over this range of temperatures NPP is always high/always  
 positive; [1]
- (c) **Any two from**
- silage is a high energy/high protein food
  - grass can be cut when most productive/it contains most energy
  - cutting silage prevents grazing by other herbivores
  - grass will continue to die and decay in the field passing some of its  
 energy to decomposers/silage prevents further decomposition
  - cattle spoil less of the grass by trampling
  - cattle kept indoors move about less/are kept warm (thus conserving  
 their energy)
  - grass species can be selected for silage cutting (more upright and  
 faster growing early summer species)
  - silage can be stored for winter fodder
  - other appropriate reason [2]

- 5 (a) The plastic does not remain as litter/does not interfere with harvesting/other appropriate suggestions; [1]
- (b) (i) The higher temperature under the plastic (makes more/earlier growth more likely); [1]
- (ii) **Any two from**
- (condensation on the plastic) suggests water will be retained under the plastic
  - protects the seedling maize (e.g. from wind damage)
  - weeds do not grow near the maize plants (only in the gaps)
  - leaching of soil nutrients is reduced
  - less soil erosion
  - protection against late frost
  - other appropriate advantage [2]
- (c) **Any three from**
- all varieties yield above average in Carrick-on-Suir
  - Hudson is the highest yielding in Carrick-on-Suir
  - Nancis and Loft are high yielding in Dromore
  - Rival and Janna produce poor yields in Dromore [3]
- (d) (i) Cattle fed on the grass-maize silage ate more; more energy is absorbed/stored; [2]
- (ii) **Any two from**
- energy is used in respiration/released as heat
  - energy is used in protein synthesis/used in muscle contraction/any use of ATP
  - energy is also lost in excretion [*not egestion/faeces*] [2]

**6 (a) Any four from**

- up to a concentration of 285 ( $\text{mOsmolkg}^{-1}$ ) there is no detectable ADH in the blood plasma
  - changes in plasma solute concentration are detected by osmoreceptors (in the hypothalamus)
  - a rise in plasma solute concentration/decrease in water level stimulates a rise in plasma ADH levels
  - ADH is released when water potential of plasma is lower/more negative than normal
  - ADH produced by hypothalamus
  - and stored in the (posterior lobe) of the pituitary gland/released from pituitary gland
- [4]

**(b)** Volume of urine produced would decrease/become more concentrated with higher ADH levels;  
ADH increases the permeability of the distal convoluted tubules and the collecting ducts (opens aquaporins);  
allowing more water to be reabsorbed back into the blood (to dilute the plasma);

[3]

**(c)** Beyond 285 ( $\text{mOsmolkg}^{-1}$ ) as plasma solute concentration increases, the person's thirst intensity increases;  
the resultant intake of water will dilute the blood/raise the water potential/thirst response is caused by withdrawal of water from cells (osmoreceptor cells);

[2]

**(d) Any four from**

- two groups of people selected (to allow for replication)
  - both groups of people are selected from same age group/gender/ other appropriate independent variable
  - all individuals are encouraged to empty their bladder/have not been drinking immediately before the trial
  - one group given isotonic drink the other given water to drink
  - both groups given the same volume to drink/maintained at the same ambient temperature for the same time period
  - volume of urine produced (during controlled time period) is measured for each individual
  - a mean for each group is calculated/percentage of intake loss as urine is calculated/other appropriate derived result/graphical analysis of data
- [4]

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7 (a) A denitrification;  
 B nitrification;  
 C decomposition/putrefaction/ammonification; [3]

(b) Any four from

- there was nitrogen in the soil before any application of nitrogen/ zero application still produces some yield
- some nitrogen is residual in the soil from previous applications/ natural processes (N-fixation, nitrification, decomposition) add to available nitrogen
- application of fertiliser stimulates growth of the crop/increased yield
- nitrogen is required for synthesis of amino acids/protein/other nitrogen containing compounds
- above 150 (kg ha<sup>-1</sup>), an increase in application of fertiliser produces no further increase/has a negative effect
- other factors become limiting (e.g. light/"crowding"/other soil nutrients/moisture)/nitrates no longer limiting
- 150 (kg ha<sup>-1</sup>) appears to be the optimum application/above this level of application is uneconomic
- surplus nitrogen contributes to environmental damage [4]

(c) Eutrophication causes an algal bloom;  
 the death of the algae greatly increases decomposer/bacteria populations;  
 the aerobic respiration of the bacteria causes a huge demand for oxygen; [3]

10

- 8 (a) (i) **Any three from**
- the number of species/diversity is reduced in the grazed area
  - Simpson's index would increase
  - as the reindeer show preferences for some species/some species fail to recover from the grazing/soil erosion prevents recovery of the plants
  - the vascular species, *Rostkovia magellanica*, which survives the grazing/is avoided by the deer
  - the lichens which survive have reduced cover/*Cladonia carneola* appears
  - mosses thrive [3]
- (ii) **Any three from**
- removing reindeer does not influence reindeer world population/not an endangered species
  - reindeer are a non-native/invasive species
  - removing the reindeer will prevent further destruction of the native flora/plants
  - some plants may be unique (endemic) to the island/are endangered species
  - native grazers/fauna more likely to survive
  - recovery of the biodiversity of the island/prevents extinction of some species
  - removing the reindeer will reduce soil erosion/habitat destruction
  - the reindeer can be humanely shot/less stressful than a long transportation to the mainland
  - killed rather than left to starve in the future when the plants are greatly reduced
  - no longer needed as food for whalers
  - other appropriate suggestion [3]
- (b) (i) **Any two from**
- this exponential curve is typical of unlimited population growth
  - young reindeer increase the breeding population
  - there are plentiful resources
  - no predators/competitors limiting the population increase/ low environmental resistance
- [allow for either of the last two bullets]* [2]
- (ii) The winter snow prevented grazing to the lowland grass; South Georgia data suggests the reindeer may have already over-grazed the lichen-rich banks/exceptionally heavy snow also covered the lichen banks (and so the reindeer starved); [2]  
**[1] for reference to starvation/lack of feeding if habitat not specified**
- (iii) **Any two from**
- the reindeer are nomadic/have seasonal migrations
  - move to fresh grazing/limiting the over-grazing of one area
  - there are predators which limit the explosion of the reindeer population/humans shoot/cull the reindeer [2]

## Section B

### 9 Any sixteen from:

- blood flowing out of a wound limits the entry of microbes/local dilation of arterioles brings extra blood/plasma to the site
- which brings polymorphs and monocytes to the site
- these phagocytes engulf and ingest bacteria
- involves lysosomes/hydrolytic enzymes
- clotting will prevent further entry
- specific responses are antibody-mediated (humoral) immunity responding to free pathogens
- and cell-mediated immunity responding to infected cells
- all foreign cells have antigens on their surfaces
- that are recognised as “non-self” by the body
- lymphocytes have receptor sites/recognise specific antigens
- some of the invading bacteria will be recognised by memory cells
- which are capable of developing into plasma cells on re-exposure to a previously encountered antigen
- resulting in a rapid response to the infection (a secondary response)
- B-lymphocytes divide by mitosis
- producing plasma cells which secrete antibodies
- which then react with the complementary antigen
- causing agglutination (clumping) of the invading cells (making it easier for phagocytes to engulf them)/marking the invading cells for destruction by polymorphs (phagocytes)/other appropriate description of antibody action
- specific memory cells are also produced/“new” pathogens will stimulate a slower response
- body cells subsequently infected by viruses present a surface antigen (that is recognised as “non-self”)
- these antigen presenting cells are recognised by T-lymphocytes
- which divide (by mitosis) to form three different types of cells
- killer T-cells destroy the infected cells
- by attaching to the antigens/using enzymes/perforins to destroy the cell membranes
- helper T-cells stimulate B-lymphocytes and intensify the response
- eventually the response will be reduced by T-suppressor cells [16]



Quality of written communication:

- [2] 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] 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] 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**

**18**

**Total**

**90**