



**ADVANCED**  
**General Certificate of Education**  
**January 2012**

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## **Biology**

**Assessment Unit A2 1**

*assessing*

**Physiology and Ecosystems**

**[AB211]**

**WEDNESDAY 25 JANUARY, MORNING**

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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*

AVAILABLE  
MARKS

### Section A

- 1 (a) Bacteria surrounded by cell membrane/enclosed in a phagosome/  
vacuole/engulfed by phagocyte (macrophage, polymorph); [1]

(b) **Any two from**

- lysosomes fuse with vacuole/phagosome
- release (hydrolytic) enzymes into (vacuole)/onto bacteria
- bacteria digested/broken down [2]

3

- 2 (a) (i) X – fovea/yellow spot;  
Y – blind spot; [2]

- (ii) More centrally to improve vision at periphery/fewer at side since there  
is overlap with other eye; [1]

- (iii) Lower density of cones (in the periphery of the retina);  
rods do not provide acuity since there is retinal convergence; [2]

(b) **Any three from**

- (circular muscles in) ciliary body relaxes
- tension in wall of eye transferred (to suspensory ligaments)
- suspensory ligaments pulled taut [*suspensory ligaments are pulled taut by contraction not allowed*]
- lens pulled into flattened shape/thin lens [3]

8

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| <p>3 (a) Final/stable stage of a succession/community in equilibrium with the environment the composition of which is dictated by the climate; [1]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <div>AVAILABLE MARKS</div> |
| <p>(b) (i) <b>Any two from</b></p> <ul style="list-style-type: none"> <li>• soil already formed/nutrients present</li> <li>• underground root systems/storage organs can regenerate</li> <li>• seeds in the soil</li> <li>• other appropriate answer [2]</li> </ul> <p>(ii) <b>Any four from</b></p> <ul style="list-style-type: none"> <li>• general sequence – herbs dominant initially, then shrubs, then trees</li> <li>• herbs produce more seed/seed better adapted for dispersal/ r-selected (allow converse)</li> <li>• in first five years herbs dominate due to limited competition/by example, e.g. light availability</li> <li>• shrubs outcompete herbs/tree growth causes reduction in shrubs</li> <li>• due to light shading/competition for water/nutrients</li> <li>• trees only dominant after 15 years as they are slower-growing/ have a slower life cycle/K-selected [4]</li> </ul> <p>(iii) <b>Any two from</b></p> <ul style="list-style-type: none"> <li>• some biomass from previous community distorting results</li> <li>• difficult to obtain entire root systems</li> <li>• less damage to ecosystem/plants killed if roots removed for measurement</li> <li>• secondary succession can continue</li> <li>• other appropriate suggestion [2]</li> </ul> | <div>9</div>               |
| <p>4 (a) (i) A: myosin;<br/>B: actin;<br/><b>[one mark allowed for both answers but in incorrect order]</b> [2]</p> <p>(ii) A-band (dark/anisotropic)/region of overlapping filaments; [1]</p> <p>(iii) <b>Any three from</b></p> <ul style="list-style-type: none"> <li>• calcium ions cause binding sites on actin filaments to be available/allows myosin and actin to bind</li> <li>• myosin head rotates</li> <li>• pull actin filaments over the myosin</li> <li>• ATP allows myosin to detach from actin</li> <li>• myosin head returns to original position and re-attaches to actin further along/(repeat of process/ratchet mechanism) [3]</li> </ul> <p>(b) (i) Synapse results in muscle contraction (and not further nerve impulses/depolarisation of sarcolemma)/T-tubules not in membrane of adjacent neurone; [1]</p> <p>(ii) Number of muscle fibres contract simultaneously [<i>correct muscle terminology needed</i>]; [1]</p>                                                                                                                                                                                                                                                                                                                                    | <div>8</div>               |

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| <p>5 (a) (i) Flowering only initiated when <math>P_{730}</math> reaches a (critically) lower level (when inhibitory effect of <math>P_{730}</math> is removed); [1]</p> <p>(ii) Artificially increase light duration [<i>must be duration not intensity</i>]/ red-light treatment; light/red-light causes the conversion of <math>P_{660}</math> to <math>P_{730}</math> (so inhibitory effect is maintained); [2]</p> <p>(b) (i) Hormone (auxin) from coleoptile tip diffuses into the agar block; subsequently causing growth/cell elongation of the decapitated coleoptile; [2]</p> <p>(ii) Positive correlation between time tip on agar block and growth of coleoptile (up to a maximum (4 hrs) when growth levels off); with increased time more hormone can diffuse into agar block/more hormone available for cell elongation; levels off as agar block can only hold so much hormone/limit to how much a cell can elongate/other appropriate response; [3]</p> <p>(iii) Variation due to agar blocks containing different amounts of hormone/quality of contact between agar block and decapitated tip variable/hormone diffuses more readily in some decapitated coleoptiles than others/some tips have more hormone than others/variation in quality of coleoptiles (tips)/other appropriate response; [1]</p> | 9               |
| <p>6 (a) (i) Glomerulus; [1]</p> <p>(ii) A: cortex; B: medulla; [2]</p> <p>(b) (i) Hypothalamus; [1]</p> <p>(ii) Reabsorbed in proximal tubule; by osmosis; [2]</p> <p>(c) <b>Any four from</b></p> <ul style="list-style-type: none"> <li>• drinking water causes the blood to become more dilute/water potential of the blood to increase</li> <li>• (osmo)receptors/hypothalamus detects the water potential of the blood</li> <li>• less ADH produced</li> <li>• walls of collecting ducts become less permeable</li> <li>• therefore less water reabsorbed (from the collecting ducts)/more dilute urine</li> <li>• decreased water potential (of blood) causes ADH levels to increase [4]</li> </ul> <p>(d) (i) Clinistix; [1]</p> <p>(ii) <b>Any two from</b></p> <ul style="list-style-type: none"> <li>• higher level of glucose is filtered into the kidney tubules</li> <li>• active reabsorption (of glucose) involves carriers</li> <li>• carriers become saturated/other appropriate response [2]</li> </ul>                                                                                                                                                                                                                                                                                                | 13              |

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| <p>7 (a) 2 hours 0.6 – 4 hours 3.3;<br/>1.35 thousands <math>\text{cm}^{-3} \text{hr}^{-1}</math>; [2]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <div>AVAILABLE MARKS</div> |
| <p>(b) Any four from</p> <ul style="list-style-type: none"> <li>• lag phase (0–2 hrs) nutrient assimilation/enzyme production for glucose metabolism</li> <li>• log/exponential phase (2–4 hrs) rapidly dividing/little competition/abundant resources/glucose not limiting</li> <li>• second lag phase (4–6 hours) maltose being broken down into glucose/monosaccharides</li> <li>• second exponential phase (6–8 hrs) rapidly dividing/little competition/available resources/glucose <b>[allow once only]</b></li> <li>• reduced growth rate (8+ hrs) resources limiting/build-up of waste/environmental resistance [4]</li> </ul> |                            |
| <p>(c) (i) Any three from</p> <ul style="list-style-type: none"> <li>• explanation of sampling technique from bacterial culture</li> <li>• initial calibration of colorimeter (e.g. when no bacteria in culture)</li> <li>• % transmission will be lower/higher % absorbance for a more dense bacterial population</li> <li>• the population becomes more dense/more turbid (% transmission falls) over time/as population grows</li> <li>• comparison against known calibration values of bacterial numbers [3]</li> </ul>                                                                                                            |                            |
| <p>(ii) Faster/less time-consuming/able to obtain more values; [1]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>10</p>                  |

- 8 (a) Tree smallest step (and at bottom of pyramid);  
holly leaf miners larger than the parasitic wasps (at top of pyramid); [2]
- (b) Kills host over a period of time/lives in or on host causing it harm; [1]
- (c) (i) **Any four from**
- undertake investigation only when leaf miner emerges
  - sample of both common and variegated varieties
  - random sampling of holly tree, e.g. use of coordinates
  - random sampling of leaves in each holly tree/sample at least 30 leaves
  - number of leaves containing mines recorded
  - leaf miner death due to parasitic wasp identified by examining for evidence of larvae consumed/parasitic wasp exit hole
  - death by other cause identified by presence of mines but no exit hole
  - exit hole of leaf miner (shows successful emergence)
  - other appropriate response/large sample size to improve reliability [4]
- (ii) Smaller percentage of variegated leaves affected [*not smaller numbers affected*]/fewer proportionally; [1]
- (iii) Variegated holly trees in residential gardens are not in wasp's natural habitat/holly trees less likely to be clumped in same area/variegated leaves less nutritious/other appropriate response [1]
- (d) (i) Less attractive/affect sales; [1]
- (ii) Leaves – difficult to penetrate thick cuticle/shading effects of other leaves/easier washed off by rain/new leaves not affected/kills beneficial insects;  
Roots – loss of pesticide due to leaching/damages soil ecosystem; [2]

AVAILABLE  
MARKS

12

Section A

72

## Section B

AVAILABLE  
MARKS

## 9 (a) Any ten from

- (increased) combustion of fuels releases  $\text{SO}_2/\text{NO}_2$
- reaction with water (in clouds) forms acid rain
- releases aluminium (from bedrock)
- which causes mucus to coagulate on fish gills (resulting in asphyxiation)
- in acidified waters, trout eggs fail to hatch (below pH of 4.5)
- (excess levels of) artificial fertiliser may enter waterway causing eutrophication/rich in nitrate or phosphate/detergent with phosphate
- enter waterways due to leaching/being applied in rain/on sloping ground/too close to waterways
- algal blooms develop
- leakage of slurry/(untreated) sewage/silage effluent into waterway/milk
- (organic matter) fed on by (saprophytic) bacteria (decomposers) which uses up oxygen/increases BOD
- and consequent reduction in biodiversity/loss of fisheries
- high oestrogen levels in domestic sewage affects aquatic fauna
- possible toxic residues of veterinary medicine/industrial spillage/oil spills
- health risk from contamination of drinking water (by toxic algae)
- pesticides leaching into water
- warm water from industrial (cooling) systems has reduced oxygen levels
- other appropriate response/zebra mussels transported by boats [10]

## (b) Any six from

- reduce dependence on fossil fuels/energy efficiency/alternative fuels/encourage industries to add filters to chimneys (reduce acid rain)/catalytic converters
- add lime to acidified lakes
- monitor water bodies (indicator species)
- apply fertiliser/slurry to match soil/crop requirements (soil tested for nutrient levels)
- only apply fertiliser/slurry immediately prior to growth/appreciate the need for closed periods
- avoid applying fertiliser/slurry when rain expected/or close to waterways/ploughing across slope to reduce run off
- European Nitrates Directive is legislation restricting the use of fertilisers in agriculture/education (DARD NI Code of Good Agricultural Practice for the Prevention of Pollution in water)/grants
- appropriate storage facilities for slurry/silage effluent
- use of more organic fertiliser noting benefits (e.g. slower release of nutrients)
- ensure efficient treatment of sewage/remove phosphate before allowing sewage effluent into waterway/use phosphate-free detergents
- construct reed beds to treat (lightly contaminated) farm waste/straw to reduce algal bloom
- method of reducing pesticide use described (e.g. polyculture, use of predator strips)
- responsibility of industries/Government legislation to ensure pollutants do not enter waterways (e.g. cooling of warm water from power stations)
- other appropriate response [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  
MARKS**

18

**18**

**90**