



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

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**Biology**

Assessment Unit A2 1

*assessing*

Physiology and Ecosystems

**[AB211]**

**MONDAY 16 MAY, 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*

**Section A**

- |          |  |     |   |
|----------|--|-----|---|
| <b>1</b> | <p><b>(a) (i)</b> A – 1;<br/>                 B – 4;<br/>                 C – 2;</p>   | [3] |   |
|          | <p><b>(ii)</b> X: anywhere on membrane of post-synaptic neurone;<br/>                 Y: on myelin sheath;</p>   | [2] |   |
|          | <p><b>(b)</b> Synaptic knob only at one end of neurone/transmitter substance on one side of synapse only/receptors on one side only/location of receptors;</p>   | [1] | 6 |
| <b>2</b> | <p><b>(a) (i)</b> A – I (isotropic)/light band;<br/>                 B – Z line;<br/>                 C – sarcomere;<br/>                 D – mitochondrion;</p> | [4] |   |
|          | <p><b>(ii)</b> Muscle contracted;</p>  | [1] |   |
|          | <p><b>(b)</b> Free myosin binding sites on the actin filaments;</p>  | [1] | 6 |

- 3 (a) (i)  $8.5 - 0.4$ ;  
 $8.1 \div 8.5 \times 100 = 95.3\%$ ; [2]
- (ii) **Any three from**
- organic content of sewage is fed on by saprophytic microbes/decomposers/bacteria feed on sewage
  - population explosion of these organisms
  - increased respiration/aerobic activity of these organisms (causes fall in oxygen levels)/use of oxygen in respiration
  - increased turbidity of water would reduce photosynthesis [3]
- (b) **Any two from**
- bacterial/saprophytic population declines/less sewage available
  - reeds remove sewage/produce oxygen
  - dilution factor downstream
  - increased photosynthesis (produces more oxygen due to less turbidity/nitrate-rich water)
  - fast flowing (river) water will gain oxygen through mixing/turbulence [2]
- (c) Sample point 2;  
 anoxic conditions will only favour specialist species/most river species unable to survive in very low oxygen levels; [2]
- (d) **Any two from**
- Each group of indicator species can tolerate particular conditions/particular level of anoxic conditions/pollution;
  - indicator species act as long term monitors of  $O_2$  levels;
  - chemical tests only at specific times/give measurement at specific times;
  - measuring oxygen level using a chemical test does not indicate its effect on aquatic life. [2]

- 4 (a) (i) Ruderals; [1]
- (ii) Less energy allocated to reproductive effort compared to ruderals/favour stable habitats as provided on farms; grow more quickly than stress tolerators/do not have to survive difficult growing conditions; [2]
- (b) (i) An organism that causes economic damage (to a commercial/valuable crop species); [1]
- (ii) **Any two from**
- less specific to controlling target species/may kill useful species
  - harms other ecosystems
  - bioaccumulation/food chain
- [2]
- (c) Fertiliser/drainage; [1] 7
- 5 (a) (i) Phytochrome; [1]
- (ii) Leaves; [1]
- (iii) Short day plant; flowers only where there is more than twelve hours (a critical length) of continuous darkness; [2]
- (iv) **Any three from**
- flowering in short day plants is inhibited by  $P_{730}$
  - in light regime 3 the dark period is long enough to allow  $P_{730}$  to be converted to  $P_{660}$
  - so the lack of  $P_{730}$  allows flowering to occur/the inhibitory effect is removed
  - in light regime 4 the flash of light converts the accumulated  $P_{660}$  back to  $P_{730}$  (and there is not enough time to reconvert it all into  $P_{660}$ )
- [3]
- (b) (i) Hormone A/auxin stimulates cell elongation; Hormone B/cytokinin stimulates cell division; A is auxin and B is cytokinin; [3]
- (ii) Third shoot with agar block without hormone; to compare with hormone action (in A and B)/to show that agar has no effect; [2] 12

6 (a) Succession: the change in species composition over time;  
 climax community: the final stage of a succession that is in equilibrium with  
 its environment/stability; [2]

(b) Any four from

- reeds and water lilies are aquatic plants/hydrophytes (from A to B)
- dead vegetation leads to soil formation/water level becomes shallower
- a community of grasses and small plants/herbaceous plants succeeds on land (after B)
- soil formation continues/level of land increases
- larger/woody plants succeed (at C)/longer-lived
- with a greater variety of species
- and a greater biomass [4]

(c) (i) The conversion of atmospheric nitrogen into ammonium/nitrate/  
 organic nitrogen (amino acids/proteins) (by nitrogen fixing bacteria); [1]

(ii) Their proteins/amino acids are broken down;  
 by decomposers to ammonium;  
 which is converted into nitrates by nitrifying bacteria; [3]

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7 (a) (i) Contains lysozyme enzyme (to break down microbes); [1]

(ii) Protein has tertiary/globular structure/3D structure;  
 variety of shapes/a specific shape;  
 which is complementary to shape of antigen [*insist on complementary  
 not same*]; [3]

(b) Any four from

- similar antigens detected
- memory cells produced in response to earlier virus
- if infected with swine flu/virus stimulates plasma cell production/  
 T killer cell production/secondary response;
- produce antibodies complementary to swine flu antigens/T killer cells  
 with complementary receptors;
- antigen–antibody reaction (agglutination)/T killer cells destroy  
 infected cells;
- rapid response (prevents illness) [4]

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- 8 (a) **Any two from**
- even out shading effects
  - due to closeness of trees/gaps in canopy
  - even out effects of cloud
  - number of readings increases reliability [2]

(b) (i) Oak forest;

**Any three from**

- higher light levels overall
- high light window in spring/autumn/greater range of light intensities
- encourages plants favouring different light conditions/different layers of vegetation
- producers at start of food chain/will provide food for animals
- decomposition of leaves enriches soil
- more habitats
- spruce harvested/habitats not given time to develop [4]

(ii) Didn't record species that only grow in earlier/later seasons/  
 didn't record species in trees/in soil/limitation of quadrats for  
 estimating the presence of animal species [1]

(c) **Any five from**

- formula – number in first sample × number in second sample divided by number of marked beetles in second sample
- method of capture described, i.e. pitfall trap
- permanency of marking technique
- release and allow time for released beetles to redistribute to ensure that marked animals evenly spread
- ensure marking doesn't affect survival (not toxic/or more obvious to predators)
- retain some marked beetles to confirm above point
- repeat each year using a different "mark"
- discussion of assumptions inherent in sampling technique/large sample size explained [5]

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**Section A**

**72**

## Section B

## 9 (a) Any eleven from

- blood entering glomerulus is under high hydrostatic pressure
- because the afferent arteriole is wider than the efferent arteriole
- consequently ultrafiltration occurs from the glomerulus to Bowman's capsule
- composition of the filtrate is the same as plasma minus plasma proteins
- because some molecules are too big to pass through the basement membrane/the basement membrane acts as the filter
- the lining of the capsule is otherwise leaky due to the structure of podocytes
- water potential/solute potential of plasma is lower than that of the filtrate due to the presence of the plasma proteins
- which causes a solute potential (osmotic) gradient from filtrate to blood
- the hydrostatic pressure in blood must be high enough to overcome this osmotic gradient
- throughout the rest of the nephron/tubule toxic substances remain in the filtrate, while useful substances are reabsorbed
- within the proximal tubule glucose/salts/amino acids are reabsorbed by active transport (selectively reabsorbed)
- microvilli/brush border in the proximal tubule increase the surface area for this reabsorption
- and numerous mitochondria provide the energy for active transport
- water potential gradient is from proximal convoluted tubule to capillary network/hydrostatic pressure within capillary network is greatly reduced
- so that water leaves by osmosis
- small proteins are reabsorbed by pinocytosis
- the loop of Henlé produces a high osmotic gradient in the medulla (lowers the water potential in the medullary tissue)
- which allows water to be reabsorbed from the collecting ducts as they pass through the medulla
- salts actively reabsorbed from distal convoluted tubule/urea or creatinine absorbed into the distal convoluted tubule [11]

## (b) Any five from

- water potential/concentration of blood is monitored by osmoreceptors in the hypothalamus
- low water potential/concentrated blood causes secretion of ADH
- ADH is then released into the blood from the pituitary gland
- in the kidney ADH increases the permeability of the collecting ducts (and distal tubule)/opening aquaporins
- so that increased amounts of water can be reabsorbed
- results in a concentrated urine
- drinking water raises the water potential of the plasma [if the blood is dilute the loss of water in the urine lowers the water potential of the plasma]
- when the water potential of plasma returns to normal/is high the levels of ADH secretion is reduced [5]

**Allow reverse argument for osmoregulation, beginning with high water potential in blood and resulting in a large volume of dilute urine.**

**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]

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**Section B**

**18**

**Total**

**90**