



ADVANCED
General Certificate of Education
January 2013

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

FRIDAY 11 JANUARY, AFTERNOON

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	(a) Phytochrome P660 to P730/P _r to P _{fr} <i>[must have P prefix]</i> ; darkness;	[3]	3
2	(a) (i) Afferent arteriole (capillary); Bowman's capsule/renal capsule;	[2]	
	(ii) Basement membrane accurately labelled;	[1]	
	(b) Capillary + 3.0 kPa and renal filtrate +0.7 kPa (both needed); Net filtration force (+) 2.3 kPa (consequential to values above);	[2]	
	(c) In individual with high blood pressure protein is filtered into the nephron and not reabsorbed/kidney basement membrane damage;	[1]	6
3	(a) Any two from		
	<ul style="list-style-type: none"> • in winter plants/crops not growing/too cold for growth/day length too short for growth • fertiliser will not be used/absorbed by plants • excessive rain/ground frozen in winter would lead to more run-off • artificial fertiliser more soluble 	[2]	
	(b) (i) Any three from		
	<ul style="list-style-type: none"> • decomposers (bacteria/fungi) require oxygen for respiration/ release of ammonia • nitrification/nitrifying bacteria require(s) oxygen • ammonia converted to nitrate • denitrification reduces nitrate levels/converts nitrates to nitrogen • denitrification is an anaerobic process • oxygen required for active uptake of nitrate 	[3]	
	(ii) Removes nitrate (ammonia) from the environment/prevents nitrate causing eutrophication (algal blooms);	[1]	
	(iii) Any two from		
	<ul style="list-style-type: none"> • more cost effective (e.g. than extending sewage systems to some rural areas/cheaper running costs qualified) • deals effectively with lightly contaminated outflow from septic tanks/farms • creates habitats/increases biodiversity • aesthetic reasons/country crafts (e.g. making wicker baskets) • self-maintaining 	[2]	
	(c) Increased penetration of UV radiation leads to increased risk of skin cancer/eye cataracts;	[1]	9

- 4 (a) (i) Choroid layer; [1]
- (ii) Nuclei; [1]
- (iii) To reach photoreceptor cells light has to pass through neurones/photoreceptor cells not at the front of retina where light enters/neurones lie over the photoreceptor cells; detection of light compromised (e.g. not fully reaching photoreceptors)/ blind spot where neurones leave the eye necessary in this arrangement; [2]
- (b) Each cone cell synapses with one bipolar neurone while several rods synapse with a bipolar neurone/rod bipolar neurones synapse with one ganglion cell;
- Any three from**
- convergence of rods allows summation of light stimuli
 - increased visual sensitivity of rods
 - decreased visual acuity of rods/visual acuity provided by cones
[distinction between sensitivity and acuity must be clear if words not used]
 - cones only reach threshold levels in bright light/reduced sensitivity [4]

8

- 5 (a) (i) **Any two from**
- Increasing light intensity/day length
 - nutrient levels high/increasing temperature
 - explanation of one of the above
- [2]
- (ii) **Any two from**
- nutrient levels increasing/high
 - due to decomposition of phytoplankton (from earlier peak)/summer run-off
 - light levels still relatively high
 - reduced competition
- [2]
- (iii) Mirror phytoplankton numbers (at least for first peak) but time lag;
- Any two from**
- zooplankton numbers lower than phytoplankton numbers
 - numbers rise rapidly when increase in phytoplankton/food availability/prey (for growth/reproduction)
 - time lag due to time taken to reach reproductive maturity/specific reference to reproduction (e.g. developing eggs)
 - reduction when phytoplankton (food) availability reduces/competition increases
 - reference to temperature for increased respiration/metabolism (only if one peak in spring/summer)
- [3]
- (iv) 'Boom and bust' typical of r-strategists/rapid growth/short-lived; [1]
- (b) (i) Too variable for type-C/some type-C cells empty/small numbers overall; [1]
- (ii) 18; [1]
- (iii) Volume $(0.04 \times 0.1) = 0.004 \text{ mm}^3$;
 $18 \times 250 = 4500$; **[consequential to value for volume and/or value for (ii)]** [2]
- (c) (i) Sampling from similar depth/same area of lake/same time of day/same day each month; [1]
- (ii) Shake/stir container/sample from same depth of container/added to haemocytometer to enter space by capillarity/if sample enters the grooves of haemocytometer the procedure will need to be repeated; [1]

14

- 6 (a) **Any four from**
- water-filled ditches provide a range of habitats (not found in East Down)
 - damper Fermanagh habitats encourages more mosses/ferns
 - semi-natural vegetation has greater species range (than silage/crops)
 - colonisation from adjacent land
 - increased flowering plants encourage insects
 - trimming hedgerows causes loss of species/habitats (niches)
 - fertiliser/pesticides reduce biodiversity
 - grazing/cutting silage reduces biodiversity (removes some plant species at fringe of hedgerows)
 - drainage of East Down agricultural ground [4]

- (b) (i) Simpson's Index will not take account of different plant groups/will require the determination of abundance for each species; [1]

- (ii) Simpson's Index a better indicator of species' evenness/takes account of abundance/allows comparison of a quantitative value (small index indicates high biodiversity); [1]

- (c) Climax community prevented due to trimming/grazing/woody composition controlled by man (trees cut); [1]

(d) **Any two from**

- exposes soil to rain/wind
- increased effect of run-off
- soil not bound by roots (of trees and shrubs) [2]

9

- 7 (a) (i) Heightened awareness of immune system/insulin-producing cells may be invaded by virus; [1]

- (ii) Cell-mediated immunity destroys (infected) cells; antibody-mediated immunity destroys microbes in blood (body fluids); [2]

(iii) **Any four from**

- T-cells sensitised activated by foreign antigens/antigens present in cell surface (possibly presented by macrophage)
- sensitised T-cell (lymphocyte) produces different types of T-cells
- killer T-cells destroy membrane (causing lysis/death of cell)
- helper T-cells stimulate B-cells to produce plasma cells/increase antibody production
- helper T-cells stimulate phagocytosis/action of killer T-cells
- memory T-cell enables fast reaction if further contact with antigen/microbe [4]

(b) **Any three from**

- during Sean's birth Rh⁺ blood cells/antigens enter Sarah's blood
- Sarah produces Rh antibodies (anti-D)
- Although Sean Rh⁺, not at risk/at reduced risk as it takes time for Sarah to produce antibodies
- Aoife (Rh⁺) blood will agglutinate/lyse when mixed with Sarah's Rh antibodies [*must refer to agglutination or explained – not clotting*]
- across the placenta (either foetal antigens or maternal antibodies)

Method of reducing risk, e.g. blood transfusion/inject Sarah with anti-D during pregnancy or immediately after birth of Sean; [4]

11

8 (a) (i) Action potential;	[1]	BLE
(ii) Any four from <ul style="list-style-type: none"> • resting potential at X • stimulation causes depolarisation • threshold level reached leading to an action potential • repolarisation of membrane • refractory period is period when impulse unable to fire (during repolarisation) • correct references to ion distribution 	[4]	
(b) Any four from <ul style="list-style-type: none"> • speed of impulse measured in both myelinated and non-myelinated neurones <i>[must refer to neurones/nerve cells not nerves]</i> • reference to standardised method of recording, e.g. record from stimulation to peak of action potential • reference to accurate measurement of rate involving both distance (A to B) and time data • intensity of stimulation must be above threshold • neurones must be of same diameters (controlled variable) • diameter explained (e.g. excluding myelin sheath) • experiment carried out at same temperature (controlled variable)/ neurones obtained from same (fresh) animal/same composition of bathing solution 	[4]	
(c) Animals killed; increases understanding of science/workings of nervous system/medical research; specific benefit to humans explained, e.g. better quality of life/eliminating some neurone diseases/longer life span;	[3]	12
Section A		72

Section B

9 (a) Any ten from

- <1% of solar energy used by producers
- due to reflection in atmosphere/absorption in atmosphere/missing leaves
- (of light energy reaching leaves) some is reflected/some misses chlorophyll molecules/some wrong wavelength
- loss due to biochemical inefficiency in photosynthesis (heat)
- $GPP = NPP + \text{respiration}$
- transfer between plant and primary consumer between 5–20% typically
- some material not consumed by (primary/secondary) consumer explained, e.g. roots, bones, hair, horn
- cellulose not digested
- some excreted (or by explanation)
- loss of energy by respiration
- greater loss by endotherms
- transfer between primary consumer and secondary consumer may be greater than between producer and primary consumer
- less energy available at each successive trophic level/reference to short food chains
- energy losses to decomposer chain [10]

(b) Any six from

- NPP higher if energy losses reduced due to respiration/increased GPP
- use of fertilisers to increase plant growth
- use of pesticides to reduce effect of pests reducing plant productivity
- use of herbicides to reduce competition from other plants affecting productivity
- plastic ground cover to increase temperature/reduce competition
- other methods of increasing plant productivity explained (e.g. increased lighting in glasshouses, crop rotation, legumes, use winter cereals, AI – with appropriate explanation) (Any **two**)
- high energy foods (silage)/high protein foods
- importance of efficient stocking levels/seed density
- keeping livestock in warm conditions so less energy used in generating heat/less heat loss
- confinement to reduce energy loss in movement
- profit a balance of increased productivity and increased investment [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]

18

Section B

18

Total

90