



## **General Certificate of Education**

# **Biology 6416**

## *Specification B*

**BYB4      Energy, Control and Continuity**

# **Mark Scheme**

*2008 examination - January series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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**Question 1**

- (a) (Rapid) response to stimulus/named example with stimulus and response;  
Which is automatic/not under conscious control; 2
- (b) A – motor  
B – relay/inter(nuncial)  
C – sensory; 1
- (c) Reference to transmitters/principle of chemical rather than electrical;  
Process of transmission takes time e.g.transmitter diffusion; 2
- (d) Myelinated – impulse jumps from node to node/depolarisation or action potentials only occur at the nodes;  
Non-myelinated – impulse travels whole length (of axon membrane); 2

**Total 7****Question 2**

- (a) (i) Renal capsule/Bowman's capsule/glomerulus/basement membrane; 1
- (ii) blood cells/platelets/proteins/named plasma protein; 1
- (b) 75 divided by 60/ 75 divided by 0.01; 1
- Answer 125; 1  
(Correct answer gains two marks)
- (c) (Many) mitochondria provide ATP/energy for active transport;  
(Many) carrier proteins for active transport/channel proteins for facilitated diffusion;  
Microvilli/brush border provide large surface area (for absorption); 2 max

**Total 6****Question 3**

(a)

	Muscle that contracts due to sympathetic nervous system	Muscle that contracts due to parasympathetic nervous system
Control of pupil size	Radial (iris)	Circular (iris)
Control of bladder emptying	(Bladder) sphincter	Walls of bladder

3

- (b) Pupil size/muscles – antagonistic;  
Tear/gland secretion – (continual) only need to increase /either secrete or no effect; 2

**Question 4**

- (a) Oxygen produced in light dependent reaction;  
 Light energy absorbed by chlorophyll/excites electrons in chlorophyll;  
 Electrons leave chlorophyll;  
 Dissociation of water;  
 Electrons replaced in chlorophyll; 3 max
- (b) Red light leads to more photosynthesis/more oxygen produced (than green light);  
 (More of) red light absorbed (by chlorophyll);  
 (Most) green light reflected;  
 Bacteria need oxygen to respire; 3 max

**Total 6****Question 5**

- (a) (i) *Certhidea olivacea*; 1
- (ii) 5; 1
- (iii) *Camarhynchus* and *Cactospiza*; 1
- (b) Anatomy/morphology/ecology/biochemistry/fossils/embryological/behaviour/  
 valid examples;;  
 (any two) 2 max
- (c) 1 Variation in beak shape present in original population;  
 2 No gene flow between islands/geographical isolation;  
 3 Selection of individuals with beaks suitable for eating small seeds on one island/selection of beak suitable for eating large seeds on another;  
 4 Those with the most suited beaks (survived) to reproduce/pass on their alleles/genes for beak shape;  
 5 Allele frequency changed on each island / populations became genetically different;  
 6 So that individuals from different islands unable to reproduce to produce fertile offspring; 4 max

**Total 9**

**Question 6**

- (a) Enzyme/specific protein denatures;  
Effect of this denaturation e.g. physiology/named physiological process/  
metabolism less efficient;  
Prevents positive feedback/lose thermoregulatory control; 2 max
- (b) Heat used (in evaporation of sweat from skin);  
Cools the blood; 2
- (c) (i) Temperature rises in the day and falls at night;  
Greater variation when camel dehydrated/Graph B;  
Some reference to data (e.g. upper and lower temperatures/difference  
in upper temperature when hydrated/dehydrated); 2 max
- (ii) Principle of water conservation;  
If body temperature is allowed to rise;  
there will be less water lost in sweating/evaporation;  
(In dehydrated camel) greater rise in temperature;  
as less water available (within camel) to evaporate/through sweating;  
Lower environmental temperature at night causes body temperature to  
fall;  
Body temperature drops as camel stops shivering/lowers metabolism; 3 max

**Total 9****Question 7**

- (a) Cell wall containing chitin; 1
- (b) Division of zygote/previous stage chromosome number halved/ $2n \rightarrow n$  (so  
must be first stage of meiosis);  
In second stage separation of chromatids occurs (so chromosome number  
remains constant)/(2 haploid go to) 4 haploid cells produced; 2
- (c) Independent assortment / each one of a pair of homologous chromosomes  
separates independently of any other pair;  
Crossing over / exchange of genetic material between homologous pairs of  
chromosomes;  
Mutation / change in the base sequence of DNA; 2
- (d) (i) Unequal numbers of the four types of gamete / if on different  
chromosomes would have equal frequency of all four types of gamete; 1
- (ii) Higher proportion/more of Ab, aB gametes (than AB and ab/crossovers); 1
- (iii) Very low percentage/few of AB, ab genotypes (due to cross-overs); 1

**Total 8**

**Question 8**

- (a) Only 2 types of cone/no red sensitive cones present;  
(Majority of) green and orange light only detected by one pigment/one type of cone;  
Blue and green detected by two different pigments/types of cone; 2
- (b) Only rods functional;  
Rhodopsin bleached/broken down by bright light;  
Slow/little resynthesis of rhodopsin/pigment;  
No (light sensitive) cells in fovea where detailed vision occurs;  
No detail/acyuity as several rods connected to one (bipolar) neurone / each cone cell connected to one (bipolar) neurone;  
4 max
- (c) (i) Male  $BX^G, BY, bX^G, bY$   
Female  $BX^G, bX^G, BX^g, bX^g$ ; 1
- (ii) 0.1875 or 3/16;; 2
- (BB  $X^gY$  = colour blind boy:)
- |        |              |            |              |            |
|--------|--------------|------------|--------------|------------|
|        | $BX^G$       | $BY$       | $bX^G$       | $bY$       |
| $BX^G$ | $BB X^G X^G$ | $BB X^G Y$ | $Bb X^G X^G$ | $Bb X^G Y$ |
| $bX^G$ | $Bb X^G X^G$ | $Bb X^G Y$ | $bb X^G X^G$ | $bb X^G Y$ |
| $BX^g$ | $BB X^G X^g$ | $BB X^g Y$ | $Bb X^G X^g$ | $Bb X^g Y$ |
| $bX^g$ | $Bb X^G X^g$ | $Bb X^g Y$ | $bb X^G X^g$ | $bb X^g Y$ |
|        | girls        | boys       | girls        | boys       |
- (Correct Punnet square with correct parental gametes but wrong answer – 1 mark)
- (d) (i) P –  $BBX^gX^g$ ;  
 $BbX^gX^g$ ; 2
- (ii) Q -  $bbX^G Y$ ; 1
- (iii) S –  $BbX^g Y$ ; 1
- (e) Red-Green Colour Blindness - Males only need to inherit one recessive allele to be red-green colour blind;  
Complete Colour blindness - Equal chance of males and females being homozygous recessive (for non sex-linked genes to be expressed); 2

**Total 15**

**Question 9**

- (a) (i) Lightest band only actin;  
 Grey area only myosin;  
 Darkest region actin and myosin; 2 max  
 Myosin thicker than actin; 1
- (ii) Sliding of filaments/greater overlap of filaments; 1
- (b) 1 Calcium (ions) bind to tropomyosin/troponin;  
 2 Tropomyosin/troponin changes shape/displaced;  
 3 Binding site on actin exposed;  
 4 Actin binds with myosin/actino-myosin cross bridges formed;  
 5 Ratchet mechanism moves actin filaments/description;  
 6 Calcium ions activates ATPase;  
 7 ATP needed to break actino-myosin bridges; 5 max  
*(Allow ATP used to form cross bridges/move myosin head as alternative to last Marking point)*
- (c) 1 ATP produced in glycolysis;  
 2 Involving the oxidation of glucose/TP to pyruvate;  
 3 ATP production directly from Krebs cycle;  
 4 Glycolysis/Krebs cycle produce reduced NAD/FAD/co-enzyme (in context);  
 5 Reduced NAD/FAD transfer electrons/H to chain of electron carrier molecules/electron transport chain;  
 6 Electrons transferred down a chain of carriers;  
 7 (Carriers) at decreasing energy levels;  
 8 Energy (lost by electrons) used to produce ATP;  
 9 From ADP and (inorganic) phosphate; 6 max  
*(Allow energy used to move ions actively across inner mitochondrial membrane)*  
*(Allow hydrogen ions release energy when they return to matrix)*

**Total 15**