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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology 6416

Specification B

BYB4 Energy, Control and Continuity

Mark Scheme

2008 examination - January series

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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

Total 5

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 → 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/acuity 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^GX^G	BB X^GY	Bb X^GX^G	Bb X^GY
bX^G	Bb X^GX^G	Bb X^GY	bb X^GX^G	bb X^GY
BX^g	BB X^GX^g	BB X^gY	Bb X^GX^g	Bb X^gY
bX^g	Bb X^GX^g	Bb X^gY	bb X^GX^g	bb X^gY
	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^GY; 1

(iii) S – BbX^gY; 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