



General Certificate of Education

Biology 6416

Specification B

BYB4 Energy, Control and Continuity

Mark Scheme

2007 examination - June series

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Question 1

- (a) (i) Pyruvate / pyruvic acid; 1
- (ii) Carbon dioxide; 1
- (b) Cytoplasm/cytosol; 1
- (c) (i) ATP production inhibited / stops; 1
- (ii) 1 No reduced NAD (released);
- 2 No pyruvate / link reaction / Krebs cycle inhibited;
- 3 Movement of electrons / protons / hydrogens (down the chain) stops;
(Accept no electrochemical gradient)
- 4 No (release of free) energy (to phosphorylate ADP); 3 max
(Do not accept "produced")

Total 7**Question 2**

- (a) (i) Photoreceptors / rods / cones / light sensitive cells;
Action potentials/impulses, along sensory neurones/optic nerve/ to the brain; 2
- (ii) Less light to enter / in bright light / parasympathetic, causes constriction of pupil;
Contraction of circular muscles;
More light to enter / in dim light / sympathetic, causes dilation of pupil;
Contraction of radial muscles;
Correct references to TS; 3 max
- (b) 1 Lens moves (forward in the octopus) / human lens does not move;
- 2 Ciliary muscle causes movement / human muscle contracts to change shape;
- 3 Lens remains the same shape / human lens accommodates/fatter/rounder;
- 4 No suspensory ligaments / human eye suspensory ligaments slacken;
- 5 Refraction/amount of bending is the same / refraction greater in humans;
- 6 Pupil becomes wider in octopus / humans stays the same or constricts; 4 max

Total 9

Question 3

- (a) 4; 1
- (b) (First division meiosis) C
- (Second division meiosis) B; 1
(both correct 1 mark)
- (c) Random alignment / independent assortment;
Different combinations of (maternal and paternal) chromosomes / alleles;
- OR
- Crossing over;
Different combinations of alleles;
- OR
- Mutation;
Different/ new alleles/genes; 4 max
- Total 6**

Question 4

- (a) Arrow away from / out of CNS, along motor neurone; 1
- (b) Sensory (area) / cerebral / cortex; 1
(Hemispheres must be qualified)
- (c) Bind to receptors;
Postsynaptic membrane;
Acetylcholine cannot bind / competes with acetylcholine / complementary to
receptor;
Reduce / stop depolarisation / description; 4
- Total 6**

Question 5

- (a) hhDD, hhDd; 1
(both correct 1 mark)
- (b) Epistasis;
 One gene controlling /inhibiting the expression of another; 2
- (c) Gametes correct HD, Hd, hD, hd, hd *(correct for both parents);*
 Genotypes HhDd, Hhdd, hhDd, hhdd ;
 Phenotypes wiry wiry non-wiry, short non-wiry, long
 Ratio 2 1 1 ; 3
- Total 6**

Question 6

- (a) Maintaining a constant internal environment; 1
- (b) Binds to (specific) receptor;
 On muscle / liver cell;
 Activation of enzymes (in liver);
 Hydrolysis of glycogen;
 (Facilitated) diffusion of glucose out of (liver cells) cells;
 Increases blood glucose levels; 4
- (c) (i) 0 / zero; 1
- (ii) 1 Filtration, out of blood (plasma) /into renal capsule;
 2 (Hydrostatic) pressure ;
 3 PCT;
 4 All reabsorbed;
 5 Active transport; 3 max
- Total 9**

Question 7

- (a) NADPH / reduced NADP; 1
- (b) (i) 2; 1
- (ii) 1 Less GP;
2 Reduced amount of TP / GALP / carbohydrate;
3 Less RuBP regenerated / made;
4 Less CO₂ taken up / less fixation; 3 max
- (iii) High levels of oxygen reduce photosynthetic rate, effect greater at higher temperatures;
Higher concentration more effective competitor / more RuBP combines with oxygen (instead of carbon dioxide) / greater chance of binding with the active site / colliding with the enzyme; 2

Total 7

Question 8

- (a) (i) Label myelin sheath on neurone; 1
- (ii) No saltatory conduction / description / all sections depolarise;
Slower transmission / reduced frequency / arrival of impulses to muscle; 2
- (b) 1 Entry of calcium ions (presynaptic membrane);
2 Vesicles fuse with membrane / exocytosis / release TS;
3 Neurotransmitter diffuses;
4 Binds to receptors, postsynaptic / membrane / muscle membrane;
5 Depolarisation / sodium ions enter;
6 Release of calcium ions (from within the muscle);
7 Removes tropomyosin / bind to troponin;
8 Exposing binding sites on the actin;
9 Cross bridge formation / myosin binds;
10 Myosin head moves / pulls the actin along;
11 Ratchet mechanism / description / detach and reattach;
12 ATPase activated; 7 max
- (c) (i) 1.3,
Maximum overlap / muscle (fully) contracted / actin sites all occupied /
no further cross bridge formation; 1
- (ii) Actin and myosin, no overlap / completely separated;
No cross bridge formation ;
The muscle cannot contract; 2 max
- (ii) Muscle is contracting;
Because binding sites available / interactions can occur;

Total 15**Question 9**

- (a) Smaller groups within big groups / hierarchical;
Based on similarities / features in common / named example;
Evolutionary relationships / common ancestry / phylogenetic; 3
- (b) (i) Class, *Drosophila melanogaster* ; 1
- (ii) 1, 6, 7, 2, 3, 4, 5; 1

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- (c)
- 1 Geographical Isolation of fruit flies;
 - 2 No interbreeding / gene flow;
 - 3 Range of habitats / environmental conditions;
 - 4 Different selection pressures in separate populations;
 - 5 Mutation;
 - 6 Variation amongst fruit flies;
 - 7 Some more suited to environment than others /differential survival;
 - 8 Beneficial allele /gene passed on;
 - 9 (Populations) unable to produce fertile offspring / reproductively isolated;
- 6 max
- (d)
- 1 Hawaiian islands isolated / Britain less isolated;
 - 2 Few colonising species;
 - 3 More environments / niches/habitats available / more suitable environments;
 - 4 Less competition;
 - 5 Adapted;
 - 6 British % 0.15, Hawaiian % 7.70 / higher proportion of insects in Hawaii;
 - 7 Rapid evolution of species of drosophila;
- 4 max

Total 15

QWC 1