



General Certificate of Education

Biology 6416

Specification B

BYB4 Energy, Control and Continuity

Mark Scheme

2008 examination - June series

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Question 1

- (a) (i) Cytoplasm;
- (ii) Mitochondrion; 2
(Reject cristae)
- (b) Reduced NAD; 1
(Accept NADH_2 / NADH)
(Reject FAD)
- (c) Pyruvate reacts with coenzyme A;
To produce acetyl coenzyme A / acetyl coA;
And carbon dioxide produced;
NAD is reduced / reduced NAD is formed;
Acetylcoenzyme A combines with a 4C molecule (in the Krebs cycle) ; 3 max
(Accept oxaloacetate)
- (d) In glycolysis no oxygen required / direct link to reaction
(Accept substrate level phosphorylation)

OR

In electron transport oxygen required / linked to electron carriers / electrons from
reduced coenzyme; 1
(Accept oxidative phosphorylation)

Total 7

Question 2

- | | | | |
|-----|------|--|---|
| (a) | (i) | (Large) groups are divided into smaller groups; | 1 |
| | (ii) | Based on evolutionary history / linked to common ancestors; | 1 |
| (b) | (i) | Pongo; | 1 |
| | (ii) | Primates / Primata; | 1 |
| (c) | (i) | In the old classification / Figure 2, humans are in the same family as the apes / all classed as Hominidae | |

OR

In the new classification / Figure 1/ now, humans are in a different family / only humans classed as Hominidae; 1 max

- (ii) One suitable source of evidence;

e.g.

DNA hybridisation;

DNA / base sequences;

Amino acid sequences (in proteins);

Fossils;

Immunology;

Embryology;

1 max

Total 6

Question 3

- | | | | |
|-----|------|---|---|
| (a) | (i) | Continuous; | 1 |
| | (ii) | Several genes / a number of genes / polygenes;
(Accept any stated number provided larger than 2) | 1 |
| (b) | | (Range of) similar beak sizes/correlation between beak sizes (in parents and offspring); | 1 |
| (c) | | Lack of food for birds with smaller beaks;
More / only birds with larger beaks survive;
These breed and pass on alleles / genes for larger beaks;
Increased frequency of alleles for larger beaks; | 4 |

Total 7**Question 4**

- | | | | |
|-----|------|---|-------|
| (a) | | Changes base sequence / named mutation;
In different places within gene; | 2 |
| (b) | | Effect (of recessive allele) not seen when dominant allele present;
Recessive <u>allele</u> codes for <i>or</i> produces no/non-functional protein;
Dominant <u>allele</u> codes for <i>or</i> produces (functional) protein; | 2 max |
| (c) | (i) | Capable of pairing (during meiosis);
Similar/same (sequence of) genes / loci; | 2 |
| | (ii) | Gametes have different allele combinations;
As chromosomes are shuffled/combined in different ways; | 2 |

Total 8

Question 5

- (a) (i) Receptors in hypothalamus; 1
- (ii) Pituitary stimulated (by hypothalamus);
ADH released;
Increased permeability (to water) of collecting ducts/distal tubule (walls);
(Accept role of aquaporins)
Increased uptake of water from collecting duct/distal tubule; 2 max
(1 mark for less/no ADH if effect of increased water potential described)
- (b) (i) Greater urine production than water intake; 1
- (ii) Low volume of concentrated urine; 1
- (c) High concentration of sodium (ions)/chloride (ions)/salts surrounding the loop;
Active removal of ions from ascending limb which is impermeable to water/due
to counter-current multiplier;
(With long loops there will be a) greater gradient/difference in water potential
between collecting duct and medulla;
Greater uptake of water from collecting duct; 3 max

Total 8**Question 6**

- (a) (i) Na^+ actively removed / pumped out;
 K^+ diffuse out more rapidly than Na^+ in / membrane higher permeability
to K^+ than Na^+ ; 2
- (ii) Sodium gates / channel (proteins) open;
 Na^+ (rapidly) diffuse in; 2
- (b) Impulse jumps from node to node / depolarisation only at node;
Fewer jumps / depolarisations to travel length of axon; 2
- (c) ATP required for active transport;
 Na^+ (actively) moved out only at nodes in myelinated / Na^+ (actively) moved out
along whole length of axon in non-myelinated; 2

Total 8

Question 7

- | | | |
|-----|---|---|
| (a) | Reduced NADP;
(Accept $\text{NADPH}_2/\text{NADPH}$)
ATP; | 2 |
| (b) | Oxygen produced / carbon dioxide uptake; | 1 |
| (c) | Ensure high rate of photosynthesis / enough product formed / neither factor limiting; | 1 |
| (d) | More photosynthesis when dark period increased from 3 to 17 ms;
(Even though) amount of light is the same; | 2 |
| (e) | Products made in light dependent stage have been used up (in 17 ms); | 1 |

Total 7

Question 8

- (a) aabb; 1
- (b) AaBb and aabb; 1
- (c) Pea comb offspring will produce blue eggs;
Alleles **A** and **B** are inherited together / are on the same chromosome; 2
- (d) Reference to crossing over;
Reduce chance of genes being separated (by crossing over);
If crossing over occurred some gametes will contain alleles **A** and **b**; 2 max
- (e) Two suitable environmental factors;;

e.g.
Diet / named component of diet;
Temperature;
Light intensity / duration;
Disease; 2 max
- (f) Cross C / $X^f X^f$ and $X^F Y$; 1
(Only) cross where all males are one phenotype and all females are a different phenotype;
Cross showing all males are slow feather production, all females fast feather production; 2
- (g) Two alleles for each gene present in male / chromosomes are homologous in male;
Female has one allele for each gene;
Recessive alleles always expressed in female;
Males need two recessive alleles for allele to be expressed / in males recessive alleles can be masked by dominant allele 3 max

Total 14

Question 9

- (a)
- | | | |
|---|---|-------|
| 1 | Light refracted; | |
| 2 | (Refraction at) cornea; | |
| 3 | Lens originally thin / long focal length (for focussing on castle); | |
| 4 | (Thin due to) tension in suspensory ligaments; | |
| 5 | For close object (focussing) ciliary muscles contract; | |
| 6 | Suspensory ligaments go slack / lose tension;
(Reject relax) | |
| 7 | Lens bulges / becomes <u>more</u> convex / becomes <u>fatter</u> ; | |
| 8 | (Bulges) due to its elasticity; | |
| 9 | More refraction / shorter focal length; | 6 max |
- (b) Rhodopsin (absorbs light energy);
Converted to retinine/retinal and opsin/scotopsin; 2
- (c) Transmitter causes impulses along optic nerve, so must have stimulatory effect;
No transmitter causes depolarisation of bipolar cell, so transmitter must have inhibitory effect; 2
(1 mark if no reference to stimulatory or inhibitory effect)
- (d) (i)
- | | | |
|---|---|-------|
| 1 | Stereoscopic vision; | |
| 2 | Optic nerve fibres from each eye cross over at the optic chiasma; | |
| 3 | Impulses from each eye go to both sides of cortex/brain; | |
| 4 | Impulses from right (visual field) go to left visual cortex / vice versa; | |
| 5 | Each side of brain has slightly different images (of visual field); | |
| 6 | Distance judged by comparing images; | |
| 7 | Ability to judge distance is learned; | 4 max |
- (ii) Visual association area; 1

Total 15