



General Certificate of Education

**Biology / Human Biology
6411 / 6413**

Specification A

**BYA5 Inheritance, Evolution and
Ecosystems**

Mark Scheme

2008 examination - June series

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Question 1

- (a) Regular measurements/systematic sampling;
To establish pattern / detect changes in numbers/detect trends; 2
- (b) Increases sample size;
More representative sample / reduces impact of anomalies;
Increases reliability; 2 max
- Total 4

Question 2

- (a) Habitat – physical place occupied by an organism/population;
Population – all organisms of one species in an area/habitat/ecosystem/community at one time;
Community – all organisms / all populations in an area/ecosystem at one time; 3
- (b) (Unsuccessful) competition with other species / outside realised niche;
Because less well adapted/condition less favourable; 2
- Total 5

Question 3

- (a) Different niches/habitats;
Different reproductive behaviour;
Gamete incompatibility; 2 max
- (b) Geographical isolation/suitable example/allopatric speciation;
No / reduced gene flow between populations;
Difference in mutations in each population;
Different selection pressures (on A and B);
Increasing differences in gene pools/increased genetic differences (between A and B);
Causing reproductive isolation / eventually, interbreeding is impossible; 3 max
- Total 5

Question 4

- (a) Regenerate NAD;
Oxidises reduced NAD /remove H⁺ from reduced NAD;
NAD needed for glycolysis; 2 max
- (b) Some energy still in lactate / incomplete breakdown of glucose;
No Krebs cycle;
No electron transport chain/no oxidative phosphorylation;
As oxygen is terminal electron acceptor;
Most ATP formed along electron transfer chain/in oxidative phosphorylation; 3 max
- Total 5

Question 5

- (a) Substitution; *Accept inversion*
Alters single triplet/codon/bases only / does not result in a frameshift/eq.; 2
- (b) (i) High(er) frequency of Hb^S;
Due to heterozygotes;
Who would have selective advantage;
Due to resistance to malaria; *Reject immunity*
(Survive to) reproduce in greater numbers; 2 max
- (ii) Frequency of p/q = $1 - 0.15 = 0.85$; (*Reject $p^2/q^2 = 0.85$*)
Frequency of Hb^A homozygote = $0.85^2 = 0.7225$; 2
(*Accept correct answer however derived = 2 marks*)
- Total 6

Question 6

- (a) (i) Only males/ no females show the condition; 1
- (ii) Individuals 1 and 2/unaffected produce 4 / 6 /affected; 1
- (b) X^BX^b;
Must carry X^B as normal vision;
Must carry X^b as 4/6 sons are affected; 3
- Total 5

Question 7

- | | | | |
|-----|-------|---|-------|
| (a) | (i) | Polygenic – several different genes influence same feature;
Multiple allele – more than two alleles of one gene; | 2 |
| | (ii) | Influence of environment/suitable example;
As they are genetically identical (with respect to flower length); | 2 |
| | (iii) | All heterozygous for flower-length genes;
Parents were homozygous for long or short alleles / inherit (one) long allele from one parent and (one) short allele (for each gene) from the other;
<i>Accept these points from LABELLED genetic diagrams.</i> | 2 |
| | (iv) | Crossing over;
Independent assortment/random segregation;
Random fertilisation;
Environmental influence; | 3 max |
| (b) | (i) | Similarity – carry genes for same features / same genes / made from two identical chromatids;
Difference – different alleles (of some/all genes)/different sequences of bases/from different parents; | 2 |
| | (ii) | Crossing over / chiasma formation; | 1 |
| | (iii) | <u>Prophase I</u> ; | 1 |
| | (iv) | Produces new combinations of alleles;
Introduces (genetic) variation;
Into gametes / offspring; | 2 max |

Total 15

Question 8

- (a) 1 Electrons in chlorophyll/photosystems excited by light (energy);
 2 Pass along transfer chain;
 3 Energy lost used to produce ATP from ADP and Pi;
 4 Electrons combine with H^+ and NADP (to form reduced NADP);
 5 H^+ from breakdown of water/photolysis; 5
- (b) (i) 90 000 ($\text{kJ m}^{-2} \text{y}^{-1}$); 1
- (ii) Correct answer (however derived) (0.686/1.46 or 35:24/24:35) ; 2
Calculate proportions correctly (83.3% TL3 and 57.14% TL2 or $\frac{5}{6}$ TL3 and $\frac{4}{7}$ TL2) scores 1 mark
- (iii) Trophic level 2 is herbivore/feeds on plants and TL3 is carnivore /
 feeds on animals;
 Trophic level 3 must chase prey / more movement to obtain food;
 More respiration in trophic level 3; 3
- (c) (i) Decomposition/ammonification/putrefaction/decay/deamination / from
 organic nitrogen compounds/proteins/amino acids/DNA;
 Nitrogen fixation / from nitrogen gas; 2
- (ii) Oxidative/need oxygen/ H^+ removed;
 Releases energy /ATP produced; 2
Reject produces energy
- Total 15

Question 9

- (a)
- 1 Decarboxylation;
 - 2 During link reaction;
 - 3 Conversion of pyruvate to acetylcoenzyme A/ $3c \rightarrow 2c$;
 - 4 During the Krebs cycle;
 - 5 Conversion of $6C \rightarrow 5C$ (Accept citrate to α -ketoglutarate);
 - 6 Conversion of $5C \rightarrow 4C$ (Accept α -ketoglutarate to oxaloacetate);
- 4 max
- (b)
- 1 CO_2 combines with RuBP;
 - 2 Forms (2 x) GP;
 - 3 GP to triose phosphate;
 - 4 ATP supplies energy;
 - 5 Reduced NADP supplies 'reducing power' / H^+ ;
 - 6 (Some) triose phosphate recycled to RuBP;
 - 7 (And some triose phosphate) converted to glucose/hexose/useful carbohydrates;
 - 8 Correct proportions (5/6 to RuBP 1/6 to hexose);
- 6 max
- (c)
- 1 Reduction in rain forest reduces photosynthesis;
 - 2 Reduction in uptake of CO_2 ;
 - 3 Decay/burning raises CO_2 concentration;
 - 4 More phosphate available increases metabolism of soil microorganisms;
 - 5 Increased respiration of microorganisms;
 - 6 Increased release of CO_2 ;
- 5

Total 15