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ASSESSMENT and QUALIFICATIONS ALLIANCE

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 – <u>all</u> organisms of one species in an area/habitat/ecosystem/community at one time;
Community – <u>all</u> organisms / <u>all</u> 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/<u>suitable</u> 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; 2
Accept these points from LABELLED genetic diagrams.

(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 (kJ m^{-2} 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 $^5/_6$ TL3 and $^4/_7$ 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→2c;
4 During the Krebs cycle;
5 Conversion of 6C → 5C (*Accept citrate to α-ketoglutarate*);
6 Conversion of 5C → 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