Version 1.0: 1207

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology / Biology (Human) 6411 / 6413

Specification A

BYA5 Inheritance, Evolution and Ecosystems

Mark Scheme

2008 examination - January series

For Confidential Packs

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Question 1

(a) Energy lost (between trophic levels);
Due to movement/ excretion/ respiration/ heat/ faeces/ indigestible/ inedible/
10% is passed on/90% is lost; [*Reject growth]*2

(b) $\frac{45\,000 \times 0.54}{0.35 \times 0.02}$ *or* $\frac{45\,000 \times 50 \times 0.54}{0.35}$;

= 3 471 428 tonnes (*accept 3 471 xxx*); 2
(*x = any digit)*
(correct answer scores two marks, however derived)
128571.x = 1 mark 6942x = 1 mark 6428xxx = 1 mark

Total 4

Question 2

(a) Photolysis; 1

(b) Excited electrons lose energy;
Along electron transfer chain;
Energy from electrons used to combine ADP and Pi; 3

(c) Used to reduce GP (to TP)/ donate H/H^+ to GP; 1

Total 5

Question 3

(a) Oxidation;
Of ammonium/ ammonia to nitrate;
Via nitrite;
By nitrifying bacteria / correctly named example; 3 max

(b) Reduction;
Of nitrates to nitrogen gas;
By denitrifying bacteria; 2 max

Total 5

Question 4

(a) (i) Oldest / biggest/ four-year-old trees; 1

(ii) Maintains a range of habitats/ not all habitats destroyed;
Species/organisms not lost/ maintains biodiversity;

OR

Willow plantation is sustainable;
So reduce demands on other woodlands;

OR

Willow plantation is sustainable/ allows continuous production;
Continuous source of income/energy; 2

(b) Willows take in carbon dioxide;
By photosynthesis;
Little/No net increases in carbon dioxide in atmosphere;
Burning fossil fuels also releases sulphur dioxide; 3 max

Total 6

Question 5

(a) Stores / releases small amount of energy;
Has phosphate that can be transferred to another molecule;
Easily hydrolysed / hydrolysed in a one-step reaction/ one enzyme needed to hydrolyse;
Cannot pass out of cell; 2 max

(b) (i) Allow ADP and/or Pi to enter;
Allow ATP to leave;

OR

One protein allows Pi to pass;
One protein allows ATP and ADP to pass; 2

ATP, ADP and Pi pass with no reference to direction/wrong direction and no reference to protein/wrong protein = 1 mark
Reject references to entering/leaving cell

(ii) ATP cannot be synthesised / cannot leave mitochondria; 1

Total 5

Question 6

(a) Measure of the variation of the mean in different samples of the same population/ range of the means; 1

(b) (i) Condition 2 as for carbohydrates O_2 in = CO_2 out/ RQ = 1; 1

(ii) RQ is greater than 1;
Anaerobic respiration gives RQ of infinity;
So average/overall RQ is increased;

OR

RQ greater than 1;
More CO_2 out than O_2 in;
For some time no O_2 used by yeast 3

Total 5

Question 7

(a) 1 Homologous chromosomes pair up/ bivalents form;
2 Crossing over/ chiasmata form;
3 Produces <u>new combination</u> of **alleles**;
4 Chromosomes separate;
5 At random;
6 Produces varying combinations of chromosomes/ genes/ alleles (*not twice)* ;
7 Chromatids separated at meiosis II/ later; 6 max

Independent assortment/ random segregation = marking points 4 and 5

(b) (i)

Parental phenotypes	Agouti			White	
Parental genotypes	BbAa			bbaa	;
Gamete genotypes	BA Ba bA ba			ba	;
Offspring genotypes	BbAa	Bbaa	bbAa	bbaa	;
Offspring phenotype	Agouti	Black	White	White	;

4

Phenotypes must match genotypes
Allow marking points 2 and 3 if correctly derived from wrong parental genotypes

(ii)

Colour of offspring	***Observed (O)***	***Expected (E)***	***(O-E)***	***$(O-E)^2$***	***$\frac{(O-E)^2}{E}$***
Agouti	34	30	4	16	0.53
Black	35	30	5	25	0.83
White	51	60	9	81	1.35
					$\Sigma \frac{(O-E)^2}{E}$ = 2.71 or 2.72

;; 2

(χ^2 correct = 2 marks)
($(O-E)^2$ all correct = 1 mark)

(ii) p = 0.05;
2 degrees of freedom;
Differences due to chance/ no significant difference as χ^2 less than/ to left of critical value OR Not due to chance/ difference is significant as χ^2 greater than to right of critical value; 3

3

(as appropriate for candidates χ^2)

Total 15

Question 8

(a) (i) Animals share – (**two** of) kingdom, phylum and class; 1

(ii) Animals do not share – genus and species; 1

(b) (i) ***One*** mark for ***two*** of:

Addition (insertion) / deletion / substitution / inversion; 1

(ii) Some involve frameshift/ insertion or deletion of a base;
In frameshift mutation/ named example, all triplets / codons *after point of mutation* altered;
Amino acid sequence changed;

OR

Some involve frameshift/ insertion or deletion of a base;
In non-frameshift mutations/ named example only one triplet / codon affected;
May not change amino acid sequence / **code** is degenerate;
(Ignore references to examples)

OR

mutations in introns are neutral;
introns non-coding;
removed from mRNA / not used in protein production; 3

(iii) $q^2 = 0.02$;
2pq = 0.24x (*x = any digit)*;
Number of heterozygotes = 300 - 304; 3
(correct answer however derived = 3 marks)
(2pq = 0.24x, however derived = 2 marks)

(c) (i) Breed animals from different populations, should all produce fertile offspring; 1

(ii) Different environments/ different selection pressure;
Mutations;
Gene pools become increasingly different;
Leading to reproductive isolation; 3 max

(iii) Cheetahs are genetically very similar;
As all descended from same group/ few mutations;
OR
Few animals;
Few mutations; 2

Total 15

Question 9

(a)	1	Pioneers / colonisers;	
	2	Alter the environment / make conditions less harsh;	
	3	Suitable example – by adding humus to 'soil';	
	4	Allow more / different species to become established;	
	5	More habitats;	
	6	Increased biodiversity;	
	7	**Increase** in complexity of food webs / **increase** stability;	
	8	Shift from predominance of abiotic factors to biotic factors;	
	9	Climax reached;	5 max

(b)	1	Use of quadrats;	
	2	Grid created / co-ordinates;	
	3	Random;	
	4	From calculator / random number tables / random number generator;	
	5	Count number in each quadrat;	
	6	Obtain average;	
	7	Multiply by area of field;	6 max

(c)	1	Obtain sample of the animals and count ($\underline{N_1}$);	
	2	Mark (suitably qualified);	
	3	Allow time to re-integrate into population;	
	4	Obtain second sample (N_2) and count number marked (n);	
	5	Population = $\frac{\underline{N_1} \times \underline{N_2}}{n}$;	4 max

Total 15