



General Certificate of Education

Biology/Human Biology 6411/6413 *Specification A*

BYA5 Inheritance, Evolution, Ecosystems

Mark Scheme

2006 examination – June series

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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Question 1

- (a) group of organisms with similar features;
can (interbreed to) produce fertile offspring; 2
- (b) directional selection;
any TWO from
selection against one extreme / for one extreme;
against broadest beaks in **B** and narrowest beaks in **A** / for narrowest in **B**
and broadest in **A**;
whole distribution / range / mean / mode / median is shifted towards favoured
extreme; 3 max
- Total 5
-

Question 2

- (a) (i) Taxon **A** – there is more than one level/taxon below it / genus only has species /
only has one level / taxon above it;
- (ii) Taxon **C** – there is more than one level/taxon above it / phylum only has kingdom /
only has one level taxon above it; 2
- (b) chitin cell wall; *ignore non – cellulose*
mycelial habit / hyphae;
coenocytic / eq.;
ignore references to being non-photosynthetic, eukaryotic.
accept reproduce by spores. 2 max
- Total 4
-

Question 3

- (a) pyruvate; 1
- (b) Krebs cycle; 1
- (c) ATP formed as electrons pass along transport chain;
oxygen is terminal electron acceptor / accepts electrons from electron transport chain;
electrons cannot be passed along electron transport chain if no O₂ to accept them;
forms H₂O / accepts H⁺ from reduced NAD/FAD / oxidises reduced NAD/FAD; 3 max
- Total 5
-

Question 4

- (a) (i) ecosystem is (self-supporting) system in which all organisms / community
interact with physical environment / community + environment / biotic + abiotic; 1
- (ii) A + B + E + F + G + I; 1
- (b) pygmy weed competes for CO₂ / light / nutrients;
reduction in numbers of original plants;
some of original plant species lost;
loss of habitats / niches / shelter / food sources;
consumers die / some migrate; 3 max
- Total 5
-

Question 5

- (a) (i) 0.875, (allow 0.87 / 0.88) however derived; 2
wrong answer, but working clearly showing $\frac{CO_2 \text{ produced}}{O_2 \text{ used}} = 1$ mark
- (ii) *either:*
respiring protein;
RQ protein is 0.9;
- Or:*
respiring carbohydrate + lipid / carbohydrate + protein / respiring all three;
RQ of carbohydrate is 1 and lipid/protein have lower RQs / actual values; 2
- (b) microorganisms are decomposers / microorganisms break down detritus;
respire (products of decomposition);
CO₂ produced (passes into air);
CO₂ used (by plants) in photosynthesis (*CO₂ taken up by roots cancels this point only*); 3 max
- Total 7
-

Question 6

- (a) polygenic inheritance / several genes;
many categories / continuous range / single or multiple allele inheritance would
produce discrete categories / eq.; 2
- (b) (SE gives idea of) variability of mean;
time / population mean would lie within these limits in 68% / 70% / 2/3 of samples; 2
- Total 4
-

Question 7

Throughout this question accept A,B,O for I^A, I^B, I^O provided there is no possible confusion with antigens

- (a) (i) alleles I^A and I^B are co-dominant / are both dominant / both expressed;
both antigens are produced; 2
- (ii) I^A and I^B are on different chromosomes of homologous pair / bivalent;
chromosomes separated / independent assortment / eq;
at anaphase I;
only one allele in each gamete / haploid gamete; *Reject gene*
gametes contain I^A or I^B ; 3 max

- (b) (i) *parental phenotypes* [A B]
parental genotypes $I^A I^O$ $I^B I^O$;
gametes I^A and I^O I^B and I^O ;
offspring genotypes $I^A I^O$ $I^B I^O$ $I^A I^B$ $I^O I^O$
and
offspring phenotypes A B AB O ; 3

ii)

Blood group	Observed (O)	Expected (E)	(O – E)	(O – E) ²	$\frac{(O - E)^2}{E}$
A	26	30	-4	16	0.53
B	31	30	1	1	0.03
AB	39	30	9	81	2.7
O	24	30	-6	36	1.2
$\Sigma \frac{(O - E)^2}{E} = 4.46$					

$\chi^2 = 4.46 / 4.466 / 4.47 / 4.7/15$ - 2 marks.

If incorrect allow 1 mark for all $(O - E)^2$ numerically correct (*ignore minus signs*) 2

- (iii) > 5% probability;
results due to chance;
OR
< 95% probability;
results have biological cause;

χ^2 value is less than critical value;
Accept converse if candidate $\chi^2 > 7.82$ 2 max

- (c) $q = 0.8$;
 $q^2 = 0.64$;
 $750 \times 0.64 = 480$ are blood group O; 3

*answer 480 = 3 marks, answer 0.64 = 2 marks (however derived),
neither of these but evidence of correct method = 1 mark*

Total 15

Question 8

- (a) (i) pyramid correctly drawn and labelled;
ignore organic matter 1
- (ii) energy lost/not transferred between trophic levels;
in respiration /as heat / in excretory products / movement;
ignore in urea / in faeces. 'Growth' cancels 2nd marking point only 2
- (b) (i) decomposers convert (nitrogen in organic compounds) into ammonia/ammonium;
suitable example of “organic nitrogen” – protein/urea/amino acid etc. (e.g. linked to
process);
nitrifying bacteria / correctly named convert ammonium to nitrate;
via nitrite; 3 max
- (ii) convert nitrogen (gas) into ammonium / ammonia / amino acids;
add usable/available nitrogen to an ecosystem / eq.; 2
- (c) (i) 1. numbers of dispersed bacteria increase as they feed on organic matter;
2. numbers of free-swimming protoctistans increase because number of bacteria increase;
3. dispersed bacteria decrease as amount of dispersed organic matter decreases / due to lack
of food / as organic matter is converted to flocs;
4. decrease as are preyed on by free-swimming protoctistans;
5. decrease in free-swimming protoctistans due to lack of dispersed bacteria; 3 max
- (ii) 1. (in a succession) organisms (enter an area and) change the environment/conditions;
2. creating new niches / habitats;
3. allows different species / different types of organisms to enter / be successful;
4. dispersed bacteria change dispersed organic matter to flocs;
5. presence of flocs allows crawling protoctistans to enter / to increase /
to be successful; 4 max

Total 15

Question 9

- (a)
1. 5C/RuBP combines with CO₂;
 2. to form 3C compound / TP / GP;
 3. using ATP;
 4. and reduced NADP / eq;
 5. 2 molecules of 3C compound/ TP / GP form hexose;
 6. all RuBP is regenerated;
 7. 10 molecules of 3C/TP/GP form 6 molecules of 5C/RuBP;
- 6 max
- (b)
1. electron transport chain accepts excited electrons;
 2. from chlorophyll / photosystem;
 3. electrons lose energy along chain;
 4. ATP produced;
 5. from ADP and P_i;
 6. reduced NADP formed;
 7. when electrons (from transport chain) and H⁺ combine with NADP;
 8. H⁺ from photolysis;
- 6 max
- (c)
1. some hexose/biomass/eq. used in respiration; *growth cancels this point*
 2. CO₂ produced (is lost to air);
 3. some parts of the plant are eaten;
 4. some parts lost to decomposers / in leaf fall;
- 3 max

Total 15