



General Certificate of Education

Biology/Human Biology 6411/6413 *Specification A*

BYA5 Inheritance, Evolution, Ecosystems

Mark Scheme

2005 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.

BYA5

Question 1

- (a) light is wrong colour/frequency/wavelength/does not strike chlorophyll molecule/chloroplasts/there is another limiting factor; 1
(reject light is reflected/ is lost as heat and use as cancel)
- (b) energy is lost in respiration;
(small amount is) lost as heat;
lost to decomposers/lost in excretion/leaf fall/death and decay;
part of oak tree not eaten/not digested; 2 max
- (c) each bird has several/many parasitic mites;
but total mass/energy of mites is less than that of one bird; 2 max
- Total 5
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Question 2

- (a) deforestation removes many habitats/niches;
fewer species/ fewer types of organisms; 2
(do not credit just fewer organisms)
- (b) 1. ammonium nitrate contains more nitrogen per molecule than potassium nitrate;
2. nitrate ions in fertiliser available/ absorbed immediately;
3. ammonium converted to nitrate;
4. by nitrifying bacteria/Nitrosomonas and Nitrobacter;
5. fertiliser would provide only the initial release of nitrate/potassium nitrate; 3 max
- Total 5
-

Question 3

- (a) (i) chlorophyll molecule/electron gains energy/becomes excited/is raised
higher energy level;
chlorophyll molecule loses (excited) electron/becomes positively charged; 2
- (ii) energy lost by electrons (is used to “drive” reaction between ADP and Pi.); 1
- (b) reduction/described;
of GP to triose phosphate; 2
- Total 5
-

Question 4

- (a) (i) Two, as white blood cells are diploid cells/alleles are present on each chromosome of an homologous pair/one maternal and one paternal; 1
- (ii) **A and B** 1
(reject I^A and I^B)
- (b) 1 in 8/ $1/8$ / 12.5%/ $1:7$ / 0.125;
(Reject 1:8)
parents $I^A I^O$ and $I^B I^O$;
give $1:3$ / $1/4$ / 1 in 4/ 25% probability of blood group A and half will be male;
(accept 2nd and 3rd points from a suitable genetic diagram) 3
- Total 5

Question 5

- (a) (i) there are no fertile hybrids found in the overlapping regions; 1
- (ii) even if mating took place, there would be no fertile hybrids/
different chromosome number/gene pool/evolutionary history/many
morphological/biochemical/serological differences; 1

(b) (i)	Kingdom	Animalia/Animals
	Phylum	Chordata
	Class	Mammalia
	Order	Xenarthra
	Family	Dasypodidae
	Genus	<i>Dasypus</i>
	Species	<i>(D.) novemcinctus</i>
	1 mark per correct column	

2

- (ii) Family, as all three belong to different genera; 1

Total 5

Question 6

- (a) (meiosis) anaphase I;
chromosomes are moving apart;
 chromosomes still double structures; 3
- (b) chromosomes in each (homologous) pair twist around each other;
 chromatids break and rejoin to chromatid on sister chromosome;
(accept points from a suitable diagram) 2
- Total 5

Question 7

- (a) (i) glycolysis; 1
- (ii) oxygen removed from pyruvate/ reduced NAD is oxidised/ donates
 hydrogen/donates electrons; 1
- (iii) allows NAD to be recycled/re-formed;
 so that glycolysis/described/candidates answer to (i) can proceed/so that
 (more) glucose can be converted to pyruvate/so that process X can continue; 2
- (b) (i) ATP formed/used;
 pyruvate formed/reduced;
 NAD/reduced NAD;
 glycolysis involved/two stage process; 2 max
- (ii) ethanol/alcohol formed by yeast, lactate (*allow lactic acid*) by muscle cell;
 CO₂ released by yeast but not by muscle cell;
(note: need both parts of the comparison for the mark) 2
- (c) (i) allows anomalies to be identified/increases reliability (of means/
 averages/results);
 allows use of statistical test; 2
- (ii) $\frac{38.3 + 27.6 + 29.4}{3} = 31.8/ 31.76/ 31.77;$
(units not required)
- $\div (5 \times 60) = 0.106/ 0.11/ 0.1;$ 2
(correct answer scores two marks, however derived.)
(correct mean volume (31.8cm³) however derived scores 1 mark)
- (iii) Volume(s) less/ no gas evolved;
 Glucose has RQ of 1.0;
 So (volume) CO₂ evolved = (volume of) O₂ taken in; 3

Total 15

Question 8

- (a) collect a sample (of insects in each area) and mark unobtrusively/in a way not harmful to insects;
 release and allow time to re-integrate with rest of population/eq.;
 collect second sample and count number marked;
 number in population estimated by:
- $$\frac{S1}{\text{Number marked in 2}^{\text{nd}} \text{ sample}} \times \frac{S2}{\text{Number marked in 2}^{\text{nd}} \text{ sample}} = \frac{\text{Population}}{\text{second sample}} ;$$
- 4
- (b) (i) 1; 1
- (ii) (p =) 0.05/ 5%; 1
(ignore 95%)
- (iii) value for χ^2 exceeds critical value/ 125.8 > 10.8 ;
 results unlikely to be due to chance/ have a biological cause;
 P < 0.1% / < 5% ; 2 max
- (c) (i) biomass respired/ GPP – respiration = NPP;
 biomass lost as CO₂; 2
- (ii) more food for insects; 1
- (iii) decomposers/ saprotrophs;
 release enzymes and digest detritus/ substances found in detritus/ eq.;
 absorb products of digestion/ suitable e.g. that relates to candidates 2nd point;
 respired and CO₂ released;
 used by plants in photosynthesis/ enters leaves; 4 max

Total 15

Question 9

- (a) (i) 1. frequent use of antibiotic creates selection pressure/ antibiotic kills bacteria;
2. bacteria with mutation/ resistance have (selective) advantage over others / described;
3. (survive to) reproduce more than other types;
4. pass on advantageous allele/ mutated allele in greater numbers;
5. frequency of (advantageous) allele increases in subsequent generations;
(penalise use of "gene" instead of allele once only)
6. frequency of resistant types increases in subsequent generations; 5 max

- (ii) 1. deletion removes a base;
2. substitution replaces a base with a different one;

AND

four marks for correct reference to four of:

3. frameshift occurring/ not occurring;
4. alteration of triplets after point of mutation;
5. alteration of sequence of amino acids after point of mutation;
6. concept of degenerate code;
7. alteration of tertiary structure/ shape of protein/ receptor;
(for deletion, allow protein not made)
(ignore references to active site)
8. ability of antibiotic to bind; 6 max

- (b) correct answer = 0.18;
And three marks for three of:
 $p + q = 1$ and $p^2 + 2pq + q^2 = 1$;
 $0.01 = q^2$;
 $q = 0.1$;
 $p = 0.9$
frequency of heterozygotes = $2pq = 2 \times 0.1 \times 0.9$ /
2 x candidates p x candidates q;

4 max

Total 15
