ASSESSMENT and QUALIFICATIONS ALLIANCE

# Mark scheme June 2003

## GCE

# Biology / Human Biology A

### Unit BYA5



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## *Question 1*

(a) (Energy release) only involves a single reaction/one-step/
(energy released) in ATP → ADP (+Pi)/
energy transfer direct to reaction requiring energy; 1
[*Ignore: reference to speed*] [*Reject: "not many steps"*]

(b) Any **two** from:

Need more ATP (than can be produced in photosynthesis)/not enough;
Photosynthesis cannot produce ATP in dark;
Cannot be produced in cells lacking chlorophyll/chloroplasts/
ATP cannot be transported; max 2

(c) Glycolysis/anaerobic respiration/"fermentation";
Does not occur in mitochondria/takes place in cytoplasm; 2

Total 5 marks

## *Question 2*

(a) (i) Any feature shared by all plants but not shared by all members of any other kingdom - e.g. cellulose cell wall/large vacuole/permanent vacuole; 1

(ii)

| | Plant(ae) |
|---|---|
| Phylum | |
| Class | |
| Order | |
| Family | |
| | Orobanche |
| | (O.) minor |

; ;
[*Note: One mark for each correct column*] 2

(b) Attempt cross between hybrid plants;
If different species, will be sterile/infertile/seeds will fail to germinate/no seeds; 2

Total 5 marks

***Question 3***

(a) (i) $\mathbf{A^dA^d}$ ; 1

(ii) Must have one female or one hermaphrodite parent/cannot have two male parents;
Must receive $\mathbf{A^d}$ /$\mathbf{A^+}$ from female / from hermaphrodite/(To be $\mathbf{A^DA^D}$) would need to receive $\mathbf{A^D}$ from <u>both</u> parents; 2

(b) Parental genotypes: $\mathbf{A^+A^d}$ $\mathbf{A^+A^d}$
AND Gametes: ($\mathbf{A^+}$) $\mathbf{A^d}$ ($\mathbf{A^+}$) $\mathbf{A^d}$ ;
Offspring genotype: $\mathbf{A^d\ A^d}$ correctly derived & identified as female ; 2

Total 5 marks

***Question 4***

(a) <u>The</u> alleles/genes / all the alleles/genes; [*Reject: "the no. of alleles/genes"*]
In a population / in a group of organisms of one species (in an area); 2

(b) (i) Correct answer: 0.22 / 22%;; = 2 marks
Incorrect answer / no answer but frequency of white-flowered plants determined: $\frac{17}{344}$ ; = 1 mark max 2

(ii) No selection/mating/pollination/fertilisation at random / no mutation / large population / no immigration/emigration; 1

Total 5 marks

***Question 5***

(a) In boxes on diagram, in sequence: 6 3 3; 1

(b) (i) Acetylcoenzyme A; [*Allow: Acetyl coA*] 1

(ii) Link reaction AND Krebs cycle; 1

(c) Converted back to NAD/is dehydrogenated/H removed/is oxidised;
Passes H to pyruvate/reduces pyruvate/produces lactate; 2

Total 5 marks

## *Question 6*

| | | |
|---|---|---|
| (a) | Polygenic/several genes involved/multiple alleles;<br>[*Allow: 'more than one gene' involved*] [*Reject*: *"more than 1 allele"*] | 1 |
| (b) | Graph symmetrical/mean and mode identical/not skewed/even distribution around middle;<br>[*Accept: 'bell-shaped curve'/'more in middle of range & few at extremes'*]<br>[*Reject: 'the graph shows a normal distribution'* ]<br>[*Ignore: drawing*] | 1 |
| (c) | Mean – no change; [*Accept: "7"*]<br>Standard deviation – decreases;<br>Reason – selects against/removes (both) extremes/extremes die/better survival of middle nos.; | 3 |

Total 5 marks

## *Question 7*

| | | | |
|---|---|---|---|
| (a) | (i) | $CO_2$ combines with RuBP/with ribulose bisphosphate;<br>(Product) splits in two/production of two molecules of GP/use of RubisCo; | 2 |
| | (ii) | Amount formed = amount broken down/used/reference to Equilibrium; | 1 |
| (b) | | Any **three** from:<br>No ATP made (in dark);<br>No reduced NADP / NADPH (in dark); [*Note: NOT "NADH"*]<br>GP not converted (in dark);<br>TP not formed (in dark); max | 3 |
| (c) | (i) | During day/light photosynthesis occurs;<br>(Photosynthesis) uses/takes in $CO_2$ ;<br>[*Accept*: *converse explanation during darkness*] | 2 |
| | (ii) | Higher;<br>Less light/cooler/fewer leaves/$CO_2$ formed from soil organisms/decay in soil/respiration in soil; | 2 |
| (d) | | Wind mixes air (with surrounding air)/removes $CO_2$/supplies $CO_2$;<br>Introduces another variable/makes data unreliable/takes account of wind; | 2 |
| (e) | | Any **three** from:<br>Detritivores/worms/woodlice/other e.g./decomposers/microorganisms/ bacteria/fungi;<br>Digestion/hydrolysis (of organic matter/of leaves)/decay/decomposition/ rotting;<br>Respiration;<br>Releases $CO_2$; max | 3 |

Total 15 marks

## *Question 8*

(a) Cannot make (active) enzyme A (which converts precursor to linamarin)/cannot make linamarin; 1

(b) (i) **AL** + **Al** + **aL** + **al** ; 1

(ii) Meiosis separates alleles/homologous chromosomes/pairs of chromosomes;
Independent assortment/ means either of **A** / **a** can go with either of **L** / **l**; 2
[*Accept: 'random segregation'*] [*Cancel: if reference to crossing-over*]

(c) From parental genotypes: **AaLl** x **AaLl** (no mark)
[*Note: If wrong parental genotypes / wrong gametes: ALLOW correct derivation of offspring genotypes*] (= max 1)
Correct derivation of offspring genotypes:

| | **AL** | **Al** | **aL** | **al** |
|---|---|---|---|---|
| **AL** | AALL | AALl | AaLL | AaLl |
| **Al** | AALl | AAll | AaLl | Aall |
| **aL** | AaLL | AaLl | aaLL | aaLl |
| **al** | AaLl | Aall | aaLl | aall |

;

Correct identification of offspring genotypes with at least one **A** and two **l** alleles (= grey cells in above table);
Correct proportion: 3/16 / 3:13 / 18.75% ; 3

(d) (i) There was no (significant) difference in damage between cyanogenic and acyanogenic/being cyanogenic has no effect; 1

(ii) The difference (from expected / from chance variation) is significant/difference /results not just due to chance;
Reject null hypothesis;
Being cyanogenic does help protect from slug damage; 3

(e) High slug population:
1 Find only cyanogenic plants/only cyanogenic plants survive;
2 (Cyanide release) limits/stops feeding by slugs/slugs killed;
[*Accept: converse argument re. acyanogenic plants*]

Low slug population:
3 Find both types of plant;
4 Less selection pressure from slugs/no selective advantage/no selection/ described; 4

Total 15 marks

## *Question 9*

(a) (i) Any **four** from:

1 Several/> 1 traps in each of the two habitats;
2 Place traps at random;
3 Details of method of achieving random layout/random coordinates generated e.g. tables/calculators; [*Reject: "throwing"*]
4 Named factor held constant – e.g. same size traps/same length of time/same time of day;
5 Count number of insects of each kind/type/species/count number of kinds/ types/species present;
6 Calculate index of diversity (for forest and for field);
e.g. $d = \frac{N(N-1)}{\Sigma n(n-1)}$ = 1 mk + key to symbols = 2 mks

max 4

(ii) Any **four** from:

In forest: Greater diversity of insects;
Greater number of plant species/higher diversity of plants;
Greater number/variety of (ecological) niches/habitats;
Greater variety of food;
Less competition for resources/more food available;
Less harsh environment (abiotic) in forest; max 4

[*Accept: converse for cultivated field*]

(b) (i) Any **two** from:

Harvesting/crops are removed;
Less material available for decomposition;
Nitrates/ammonium/soluble compounds/ions leached;
Low initial N-content due to burning; max 2

(ii) Any **five** from:

1 Nitrogen (gas) converted to NOx/nitrates;
2 By lightning/atmospheric nitrogen fixation;
3 Nitrogen (gas) converted to ammonia/ammonium compounds/amino acids;
4 By nitrogen-fixing bacteria;
5 Organic material/leaves from plants (fall onto soil)/animal droppings/dead animals;
6 Broken down by saprotrophs/decomposition;
7 Release of ammonia/ammonium ions (from organic matter/from decay);
8 Ammonia/ammonium converted to nitrite;
9 Nitrite converted to nitrate; [*Accept: Ammonium → nitrate for 1 mark*]
10 By nitrifying bacteria/correct named example; max 5

[*Note: Formulae, if used on their own, must be correct*]

Total 15 marks