Mark scheme
January 2002

GCE

Biology A / Human Biology

Unit BYA5

Question 1

(a) (i) Prokaryotae / Prokaryotes; 1

(ii) Fungi; 1

(iii) Animalia / Animals; 1

(b) (i) Order; 1

(ii) Correct sequence:

Sequence
1
6
2
3
4
5

1

Total 5

Question 2

(a) Energy losses due to radiation / evaporation / transpiration / in photosynthesis / energy of wrong wavelength / some of energy is heat; 1
Extras: cancel

(b) 2920; 1

(b) (Ammonium) → nitrite;
Nitrite → nitrate;

OR

Ammonium → nitrate; *(1 mark only)*

If symbols: underline correct symbols
e.g. ammonium → nitrate (NO_3) = NO MARKS

By nitrifying bacteria / *Nitrosomonas* / *Nitrobacter* / nitrification;
By oxidation / using oxygen / aerobic; 3 max

Total 5

Question 3

(a)		Anaphase I; Chromo<u>somes</u> / chromatid pairs / bivalents are separating; *Allow: "they" are separating*	2
(b)		8;	1
(c)		2;	1
(c)		So fertilisation / described can restore (diploid) number / prevent chromosome doubling at fertilisation / described; *Ignore references to "variation"*	1

Total   5

Question 4

(a)	(i)	3;	
	(ii)	Reduced NADP: to reduce <u>GP</u> / add H (to GP); *NOT just 'convert GP to TP'* ATP: supply energy; *NOT 'to supply phosphate' / to phosphorylate / produce energy / make energy*	2
(b)	(i)	(Radioactivity in) GP <u>before</u> in TP; *'It' / 'that' = ambiguous, unless qualified*	1
	(ii)	<u>RuBP</u> becomes radioactive / RuBP is formed; *20s line copied from table = no marks* *20s line with arrows '→ RuBP' ≡ RuBP = one mark* *Time comparison e.g. 15-20s re RuBP = one mark*	1

Total   5

Question 5

(a)		Soil erosion / mud slides / flooding / leaching of minerals – trees no longer protect soil from rain / from wind / roots no longer hold soil; Increased CO_2 (in air) OR "greenhouse effect" – trees remove CO_2 / trees photosynthesise / burning releases CO_2; Less diversity / loss of (forest) species / fewer individuals – loss of food / loss of habitat / niches / ecosystem; Changed rainfall patterns / drought – less transpiration from trees;	2 max
(b)	1. 2. 3.	Suitable habitat / food nearby for displaced animals; Later recolonisation possible from adjacent areas; Reference to sufficient time for recovery (e.g. not felled again for 280 years);	3 max

Total   5

Question 6

(a) Parental genotypes and gametes correct:
X^GY X^BX^B X^BY X^GX^G ;

X^G Y X^B X^B Y X^G ;

Offspring genotypes and phenotypes correct:
X^BX^G X^BY X^BX^G X^GY ;

*ONLY these. BUT if error, then award phenotypes if
correct re. candidate's genotypes*

tortoiseshell   black   tortoiseshell   ginger
female   male   female   male   ;   4
Must relate to stated genotypes

(b) Male has Y with no gene / allele for colour / must have <u>both</u>
B and G to be tortoiseshell / male cannot have B <u>and</u> G /
2 colour alleles / male can only have B <u>or</u> G / only 1 colour
allele;   1

                                                              Total   5

Question 7

(a) (i) All the organisms present in an area / all populations in an
           area / populations of all species in an area / in an ecosystem;
           NOT "all the species in an area"

     (ii) Habitat + community / environment + organisms / all biotic
            and abiotic factors of an area;   2

(b) (i) <u>EITHER:</u>   Correct answer: 4.26 / 4.3 (2 marks);;
          <u>OR:</u>   Understanding of $\sum n\ (n-1)$ + wrong answer (1 mark);   2 max

     (ii) Takes account of number of individuals / of population sizes (as
            well as number of species);   1

     (iii) <u>EITHER:</u>   More light;
                            More photosynthesis / fewer spp. adapted to lower light;
           <u>OR:</u>   Warmer;
                            Faster metabolism / named aspect;   2 max

     (iv) 'It' / south-facing is less hostile environment / conditions better /
            favourable for plants;
            Has higher (index of) diversity / more species present;
            Provides more niches / described / more complex interactions
            between species;
            Changes in abiotic factors / named example have less influence;
            Loss of one species will have less effect on food web / on the system;   3 max

	(v)	Greater variety of habitats / described – e.g. re. nesting sites / humidity / temperature / more food / more variety of food types / less competition for food / more niches;	1
(c)	(i)	EITHER: Correct answer: 280 (2 marks) ;; OR: Correct use of data but wrong answer/ $P = (40 \times 42) \div 6$ / correct formula (1 mark) ;	2 max
	(ii)	Sample too small / too few traps / too short a time to mix evenly; Uneven distribution of animals / great variation trap to trap; Birth / death of some woodlice; Immigration / emigration; Marking method affected woodlouse behaviour;	2 max

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Total   15

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Question 8

(a)	(i)	Allow for expansion / contraction / pressure changes of air in apparatus; Allow <u>animals</u> to equilibrate / reach respiration rate typical of 20°C	2
	(ii)	1st experiment (*any **two** from):* Oxygen <u>consumed</u> by animals; CO_2 <u>given out</u> / CO_2 <u>released</u> but absorbed by NaOH; Reduction in volume / pressure; 2nd experiment: (Volume) O_2 consumed = (volume) CO_2 produced / because RQ = 1.0;	3 max
	(iii)	Same apparatus but no larvae / dead larvae / glass beads / eq. ; To show effect is due to larvae / to a living organism;	2
	(iv)	EITHER: Correct answer: 1440 (2 marks);; OR: Use of <u>12 per min</u> / 60 per 5 min but wrong answer (1 mark); *NOT use of '12x5min = 1h'*	2 max
(b)	(i)	<u>Volume CO_2 produced</u> Volume O_2 consumed / <u>No. molecules CO_2 produced</u> No. molecules O_2 consumed / <u>CO_2 out</u> O_2 in ;	1
	(ii)	Volume CO_2 (produced) = Volume O_2 (consumed) / $CO_2 = O_2$;	1
	(iii)	Carbohydrate / glucose / glycogen / sugar / correctly named sugar; *NOT starch / cellulose*	1

(c)   Fat / lipid being used;   1
       NOT protein

(d)   EITHER   **For process**:
                 CO_2 production / decarboxylation;
                 No O_2 consumption;
       OR   **For person**:
                 More CO_2 production;
                 O_2 consumption unchanged;   2 max

                                    Total   15

Question 9

The answer to this question requires continuous prose. Quality of language should be considered in crediting points in the mark scheme. In order to gain credit, answers must be expressed logically in clear scientific terms.

(a)   1   Feature / beak size due to effect of more than one gene;
            NOT ref. 'multiple alleles'

       2   Different alleles of each gene present in the population;

       3   Meiosis gives new combinations of alleles / of genes / of DNA;

       4   By crossing-over / described;

       5   By independent assortment of chromosomes / in meiosis I;

       6   By independent assortment of chromatids / in meiosis II;
            *'Independent assortment' (unspecified) = 1 mark alternative
            to point 5 or 6*

       7   Meiosis gives new combinations of chromosomes;

       8   Several / large number of combinations (of alleles /
            chromosomes) possible;   5 max

(b)   1   <u>Variation</u> (in beak size) already present in population;

        2   (Variation) due to inheritance / due to mutation;

        3   Beak size relates to food size;

(On Albermarle):
        4   Competition between birds of similar beak size /
                birds with more extreme beak sizes get enough food /
                reduce competition;

        5   OR converse → best adapted survive / selected for / larger beak
                sizes (in *G. fortis*) survive / larger beak an advantage;

(On 2nd island):
        6   *G. fortis* has smaller seeds available (since no competition);

        7   *G. fortis* does not need large beak to survive / to feed;

        8   (Survivors) reproduce;

        9   Pass on (relevant) <u>allele</u>(s) / <u>gene</u>(s) to offspring;
                Worth 2 marks, because subsumes 'survivors reproduce' marking point

        10   Increasing frequency of appropriate <u>allele</u>(s) /
                <u>gene</u>(s) (in population);   7 max

(c)   (i)   Allopatric – new spp. arise in separated areas <u>AND</u>
            sympatric in <u>same</u> area / no geographical barrier;   1

        (ii)   Allopatric – separation by sea / on separate islands / by mountains;

            Sympatric:
                Temporal – different breeding seasons / feeding times /

                Behavioural – different courtship displays / different niches /
                habitats / feeding areas /

                Mechanical – mismatch in reproductive parts /

                Gamete incompatibility – sperm killed in female's
                reproductive tract /

                Hybrid inviability / hybrid infertility;   2

                                            Total   15