ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology/Human Biology 6411/6413

Specification A

BYA5 Inheritance, Evolution and Ecosystems

Mark Scheme

2007 examination - June series

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Question 1

(a) (i)

Structure	Animal cell	Plant cell	Prokaryote cell
Mitochondria	✓	✓	×
Cellulose cell wall	×	✓	×
Ribosomes	✓	✓	✓
Large, permanent vacuole	×	✓	×

1 mark per correct column ;;; 3

(ii) (Cell) (surface) membrane / plasma membrane/ chromosome/ gene; 1
Ignore cytoplasm or named molecules
Reject ER/ Golgi/ lysosomes

(b) In sequence:

2 Phylum
3 Class
4 Order
5 Family
6 Genus; 1

Total 5

Question 2

(a) Water → oxygen / O / O_2 ; *Allow 'oxygen atoms'*
→ hydrogen / H / H^+ ; (not H_2)

Light / energy excites electron(s)/ raises electron(s) to higher energy level /releases electron(s) from chlorophyll/ chlorophyll/ photosystem receives e^- (s)/ photosystem;
Ignore PS1

OR 'Breakdown of water using light' = max 1 mark 3

(b) ATP;
Provides energy; *Reject 'provides phosphate'*
Reduced NADP;
Reduces (GP) / adds H (to GP); 4

Total 7

Question 3

(a) Prevents doubling of chromosome no. (at fertilisation) / restores diploid no. (at fertilisation); 1
accept numerical example if clearly n+n→2n/ ½ +½→ whole number

(b) (i) Prophase I; 1

(ii) 9; 1

(c) (i) Crossing over / chromosomes exchanging parts / chromatids exchanging parts / chiasma formation;
Produces new combinations of alleles; 2

(ii) Independent/random AND assortment /segregation/described; 1

Total 6

Question 4

(a) Correct answer: 23 273;; *Allow 23 275* = 2 marks

OR $\frac{125}{4.1}$ and $\frac{125}{13.1}$ but confusion re. 10^n ; = 1 mark 2 max

(b) Saprotrophs / bacteria / fungi / decomposers / microorganisms / detrivores;
Breakdown by enzymes / by digestion / by hydrolysis;
Respiration → CO_2; 3

Total 5

Question 5

(a)

1. Parental genotypes correct: Black female X^bY Barred male X^BX^b ;

2. Gametes correctly derived from candidate's parental genotypes: X^b Y X^B X^b ;

3. Offspring genotypes correctly derived from candidate's suggested gametes – accept Punnett square or line diagram ;

4. Offspring genotypes correct: X^BX^b X^BY X^bX^b X^bY
AND phenotypes correctly assigned: barred male, barred female, black male, black female ;

e.g. Allow max. 2 marks for 2 correct follow-on points (= points 2. + 3.) based on parental genotypes barred male = X^BY and black female = X^bX^b;;

4

(b) Correct cross = Barred female x black male;

Parental genotypes OR gametes correct: X^BY x X^bX^b
/ X^B Y X^b X^b ;

Offspring genotypes correct: X^BX^b X^bY
AND state (white) bars on feathers = male / if black = female; 3

Total 7

Question 6

(a) Equilibrium/ reaches new conditions/ reaches 30^0C;
Allow for expansion / pressure change of air in apparatus/ allow locust to reach respiration rate typical of 30^0C; 2

(b) (i) Oxygen consumed (by locust);
CO_2 given out AND absorbed by KOH;
Reduction in volume / pressure; 3
Ignore 'sucking'

(ii) Correct answer: 0.975 / 0.98 ;; = 2 marks

OR Working shows [Volume changed] x [Correction for 1h] = 1 mark
Mass 2 max

(c) (i) On graph:

Line ruled horizontally starting at (0 , 0.92) ; 1

(ii) RQ = $\frac{CO_2}{O_2}$;

CO_2 out = O_2 in;

No change in volume; 3

(iii) Carbohydrate / glucose / sugar / glycogen; *(Reject starch or sucrose)*
Aerobic / using O_2; 2

(d) Any **two** from:

Active transport/ exocytosis/ endocytosis;
Growth / cell division / reproduction;
Any correct named synthesis – e.g. of glycogen / protein / DNA / RNA / lipid / …etc;
Glycosis; *Ignore respiration*
Movement / muscle contraction / blood circulation / breathing / peristalsis;
As an energy source;
For phosphorylation;
Any other valid suggestion; - e.g. digestion; excretion; nerve impulse; 2 max

Total 15

Question 7

(a) (i) (Ecosystem) Abiotic factors/ environment / habitat and community/ biotic factors/ the living organisms;
Place must be stated or implied by 'environment' / 'habitat' / 'community'

(ii) (Population) All the individuals of one species in an area / habitat / ecosystem / community; 2

(b) (i) Use random numbers from e.g. calculator / computer / tables / phone book / etc;
Allow random number generator
Use of grids/ as coordinates; 2

(ii) (Large number) Need representative / 'typical' / 'reliable' / 'valid' value / anomalies are less significant/more detectable/ chance variations are less significant / allows statistical test;
Reject 'remove' anomalies. Ignore 'accurate' or 'mean'.

(At random) Overcome bias / independent of observer/ is representative; 2
Ignore 'fair'

(iii) Correct answer: 4.24/ 4.2 ;; = 2 marks

OR Understanding of Σn(n-1) + wrong answer/ 4.23; = 1 mark 2 max

(iv) Takes account of number of individuals / of population sizes; 1

(v) 1. Plants change conditions; *Accept suitable example*
examples: add humus to soil
improve water retention
provide shelter
2. Competition/ environment more hostile/harsh/ some species make environment unsuitable for other species;
3. Lack of/competition for named resource – water/ ions/ nutrients [*ignore food*]/ light;
4. Succession occurs;
5. Reduction in number of species; 4 max

(c)	Animal diversity falls because:	OR	Animal diversity increases because:
	Any **two** from:		Any **two** from:
	More exposure to climate / less shelter;		Larger plants → more shelter / are more stable;
	Fewer food types/ less food;		
	Fewer niches / habitats;		→ more niches / (micro)habitats;
	Fewer animal species survive/stay;		More animal species survive/enter; → more food types;

2 max

Total 15

Question 8

(a) Any **five** from:

(i) 1. Parents/*insularia* are $\mathbf{C^iC^t}$ (and $\mathbf{C^iC^i}$); *Accept as gametes in genetic diagram*
2. Can have offspring $\mathbf{C^iC^i}$ / $\mathbf{C^iC^t}$ AND $\mathbf{C^tC^t}$;
3. Both phenotypes correctly assigned to genotypes;
4. *insularia* cannot have $\mathbf{C^C}$ allele;

(ii) 1. Parents/*carbonaria* are $\mathbf{C^CC^t}$ and $\mathbf{C^CC^i}$ (and $\mathbf{C^CC^C}$) ;
2. Can have different offspring with $\mathbf{C^C}$ AND $\mathbf{C^iC^i}$ / $\mathbf{C^iC^t}$ AND $\mathbf{C^tC^t}$;
3. All 3 different phenotypes correctly assigned to genotypes; 5 max
(Accept argument in words / symbols / genetic diagrams)

(b) 1. Variation (in colour) present originally; [*must be explicit, not just implied*]
2. (Variation) due to mutation; [*CONTEXT – not caused by environment*]
3. Appropriate colour → camouflage / inappropriate colour → visability;
4. Camouflaged / better adapted moths survive / not eaten (/ converse for visible)/ dark moths survive / are better adapted in Birmingham (/converse re. Dorset) / have selective advantage;
5. Pass on (relevant) allele / gene to offspring;
6. Increasing frequency of appropriate allele; 5 max

(c) (i) Can interbreed/ can be mated/crossed; 2
Producing fertile offspring/ described; *Ignore viable*

(ii) Mutation occurs;

Correct example of isolating mechanism / 'sympatric'
e.g. temporal – different breeding seasons / feeding times
/ behavioural – different courtship displays / different niches / habitats / feeding areas
/ mechanical – mismatch of reproductive parts
/ gamete incompatibility – sperm killed in female's reproductive tract
/ hybrid inviability / hybrid infertility
/ Geographical isolation / suitable example 'allopatric'; *Allow barrier*

(Eventually) 2 groups can no longer interbreed successfully; 3

Total 15