

Variation and Selection

Mark Scheme 3

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Variation and Selection
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 3

Time Allowed: 71 minutes

Score: /59

Percentage: /100

- 1
- (a)(i) 1.
- slows down air movement/reduces wind effect AW;
 - ref. to transpired water vapour trapped inside curled leaf AW;
 - ref. to diffusion gradient reduced/humidity increased inside curled leaf;
 - prevents water loss/less + transpiration/water loss/evaporation;
 - reduces surface area + exposed AW; **max. [2]**
- 2.
- prevents evaporation/loss + of water from leaf; (R) waterproof unqual.
reflects radiant light/reduces heating effect of sun AW; **max. [1]**
- (ii)
- better access AW to + water/mineral salts; (R) goes deeper unqual.
larger surface area for absorption; (R) anchorage **max. [1]**
- 2.
- ref. to storage of water;
 - ref. to small surface area to volume AW;
 - less water loss/less transpiration;
 - ref. to ability to photosynthesise; **max. [2]**
- (b)
- less surface area;
 - less light absorbed;
 - less stomata;
 - less absorption of carbon dioxide;
 - less transpiration;
 - less movement of minerals/water + from roots;
 - less chlorophyll/chloroplasts;
 - less photosynthesis; (A) description **max. [2]**

(c)(i)(ii) MARK COLUMNS INDEPENDENTLY

description of process	name of process	variable that, if increased, would speed up the process
absorption of water from the soil	osmosis; Ⓐ diffusion	concentration of minerals in root hairs/ water in soil/temperature/transpiration (or any factor that increases it)/number of root hairs;;
using water to form glucose	photosynthesis;	light/conc. of carbon dioxide/temperature/water/chlorophyll/ chloroplasts;
movement of water vapour out of leaves	transpiration; Ⓐ diffusion Ⓐ evaporation	temperature/wind speed/ dryness of air/number of size of stomata; Ⓐ ref. to light/heat Ⓔ refs. to humidity

[6]

.....
Total [14]
.....

Question	Answers	Marks	Additional Guidance
2	<p>(a) body divided into/segmented three parts / head, thorax and abdomen (one pair of) antennae / feelers wings three pairs / 6 legs compound eyes</p>	[max 3]	R segmented body unqualified <i>do not accept arthropod features</i>
	(b) <u>arthropod</u> / Arthropoda	[1]	must have arthr so accept arthropod but reject anthropod
	(c) chromosome nucleus mitochondria chloroplast plasmid nucleolus		Note: Apply list rule
	(d) <ol style="list-style-type: none"> 1 two groups: 1 – 6 and 11 & 12 migrate to New Zealand 2 1 – 6, New Caledonia / indirect / migration A 3 11&12, direct (Australia) / migration B 4 correct example of (evolutionary) relationship / DNA similarity, e.g. 13 & 14 most distantly related from others / 9 & 10 most closely related to each other 5 ref to, clade(s) / cladogram 	[max 3]	

2	(e)	<ol style="list-style-type: none"> 1 adapt to environment / conditions in new places are different 2 competition between individuals 3 struggle for existence 4 ref to variation 5 survival of fittest / those that are better adapted 6 survive 7 reproduce, pass on their alleles; A genes I traits 8 mutations / changes in DNA 9 change in the gene pool / AW changes to physical / behaviour (of species), e.g. mating behaviour 	[max 4]	<p>A conditions on different islands are different</p> <p>Mpt 9 R changes of individuals</p>
[Total: 13]				

Question	Answers	Marks	Additional Guidance
3	<p>(a)</p> <p><i>T. castane</i></p> <p>1 wet / AW ;</p> <p>2 any evidence from the table</p> <p>e.g. hot: (A) 100% – (B) warm: (C) 86% – (D) 13% / cold: (E) 29% – (F) 0% ;</p> <p>3 in wet conditions, decreasing survival with decreasing temperature ;</p> <p>4 any suitable two points from the table (i.e. (A) 100% – (C) 86% – (E) 29%) ;</p> <p><i>T. confus</i></p> <p>5 dry / AW ;</p> <p>6 any evidence from the table</p> <p>e.g. hot: (A) 0% – (B) warm: (C) 14% – (D) 87% / cold: (E) 71% – (F) 100% ;</p> <p>7 in wet conditions, increasing survival with decreasing temperature ;</p> <p>8 any suitable two points from the table (i.e. (A) 0% – (C) 14% – (E) 71%) ;</p>	[max 4]	<p>Note: marking points are linked in pairs e.g. MP1 pairs with M</p> <p>Note: at least two data points within species are required as ‘evidence’ ignore ref. to temperature for MP1 and MP2</p> <p>ignore ref to temperature for MP5 and MP6</p>

Question		Answers	Marks	Additional Guidance
3	(b)	competition ; example of competition (food / space) ; one species better adapted / AW ;	[2]	R 'survive better' unqualified A survival of the fittest in context of adaptation
	(c)	<p>1 red-brown black , Aa x aa ;</p> <p>2 A , a + a / a,a ;</p> <p>3 Aa , aa</p> <p>4 red-brown, black ; 1:1 / AW ;</p>	[4]	<p>Note: marking points 1, 2, 3 are free-standing. MP 4 is linked to MP 3.</p> <p>allow ECF from MP1 to MP2</p> <p>allow ECF from MP2 to MP3</p> <p>allow ECF from MP3 to MP4</p>
	(d)	<p>mutation ; mutation, rare event ;</p> <p>(white) <u>allele</u> is recessive / ora ; only expressed in homozygote recessive ;</p> <p>selection ; disadvantage / AW ;</p>	[max 2]	<p>R gene A correct ref to parents – both must be heterozygous / homozygous / one of each</p> <p>A reason for being so</p>
	(e)	<p>decomposition ; bacteria / fungi, release enzymes / digest ; breakdown protein (in faeces) → amino acids ; deamination ; amino acids → ammonia ; breakdown urea → ammonia (+ carbon dioxide) ; (undigested) carbohydrate (in faeces) respired ;</p>	[max 4]	<p>A bacteria / fungi are decomposers A feed saprophytically</p>
			[Total: 16]	

4 (a) (length of) DNA / part of chromosome / on a chromosome ,
that codes for a protein or polypeptide or enzyme / controls a characteristic ; [1]

(b) $H^N H^S \times H^N H^S$; accept *N and S*

$H^N, H^S + H^N, H^S$; gametes must be clear *accept on dotted line or in Punnett square*

$H^S H^S$; *ecf from correct gametes if wrong parental genotype* [3]

(c) check <http://www.sicklecellociety.org/education/healthpr.htm> for AVPs

- 1 red (blood) cells become, sickle shaped / distorted / AW ; **R** abnormal unqualified
- 2 in areas of low oxygen concentrations / in tissues ;
- 3 fewer / less elastic / less flexible / short-lived, red blood cells ; *ora*
- 4 less haemoglobin ;
- 5 blood / haemoglobin, less efficient at transporting oxygen ; **R** no oxygen
- 6 less respiration ; **R** no respiration
- 7 less energy / fatigued / exhaustion / less active / feeling faint or tired / breathless ;
- 8 capillaries are blocked ;
- 9 pain ;
- 10 death of tissues linked to blood supply ;
- 11 'sickle cell crisis' ; **A** 'attacks needing oxygen'
- 12 slow / poor, growth ;
- 13 susceptible to infections ;
- 14 reduced life span ;
- 15 AVP ;
- 16 AVP ;

[4 max]

- 4 (d) 1 *idea that* areas with high percentage of sickle cell (allele) are places with malaria ;
- 2 $H^S H^S$ / homozygous recessive, reduced life span because of sickle cell anaemia ;
- 3 $H^N H^N$ / homozygous dominant / without H^S , susceptible to malaria / AW ;
- 4 $H^N H^S$ / heterozygous / carrier/ with H^S , resistant / not affected / less susceptible ;
- A** $H^S H^S$ **R** immune / immunity
- 5 $H^N H^S$ (carrier) survive and have children / $H^N H^N$ or $H^S H^S$ do not ;
- 6 $H^N H^S$ / carrier, pass on the allele / H^S ;
- 7 (if $H^N H^S$ x $H^N H^S$) 1 in 4 chance of, $H^S H^S$ / homozygous recessive ;
- 8 2 in 4 / 50% / $\frac{1}{2}$, have advantage of resistance to malaria ;

[5 max]

- (e) 1 *idea that* distinct groups / categories ; ref to bar chart
- 2 *either* sickle cell anaemia ($H^S H^S$), sickle cell trait ($H^N H^S$), normal ($H^N H^N$) / or normal, anaemic ; **A** 'some people have disease, some do not'
- A** 'some people have the allele, some do not'
- 3 no intermediates / no continuous scale of anaemia / AW ;
- 4 genetic condition / environment has no effect (or its expression) ;
- A** ref to small number of, genes / alleles, involved

[3 max]

[Total: 16]