

Variation and Selection

Mark Scheme 1

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Variation and Selection
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 1

Time Allowed: 69 minutes

Score: /57

Percentage: /100

Question		Mark	Additional Guidance
1 (a)	guard (cells) ;	[1]	
(b) (i)	oxygen is a (waste/by) product of photosynthesis ; more oxygen is produced than used in respiration ; concentration inside the leaf is greater than outside ; ref to air spaces inside the leaf ; oxygen moves down its concentration gradient ; by <u>diffusion</u> ; <i>idea that</i> the rate of photosynthesis is greater than the rate of respiration ;	max [3]	A word equation / symbol equation
(ii)	passes through air spaces ; carbon dioxide dissolves in water (in cell wall) ; (spongy / palisade) mesophyll ; passes / diffuses, through, cell wall / cell membrane ; passes / diffuses, into / through, cytoplasm ; enters chloroplast / used in chloroplast ; reacts with water (to form glucose) ;	max [3]	A palisade cells ignore spongy cells A correct equation

Question		Mark	Additional Guidance
(c) (i)	<p>stomata on, both sides of the leaf/both upper and lower epidermis ; fewer stomata overall (however expressed) ; fewer stomata on upper epidermis than water lily/ ora ; fewer stomata on lower epidermis than myrtle/ ora ; more stomata on lower epidermis than water lily/ ora ; more stomata on upper epidermis than myrtle/ ora ; <i>idea that</i> about the same number on each surface whereas the numbers are very different on the surfaces of the other plants ;</p>	max [2]	<p>A use of numbers to make comparisons with units used at least once in the answer</p> <p>mp7 also gains mp1</p>
(ii)	<p><i>white water lily</i> (all) stomata (on upper surface) in contact with air/ AW ; for absorption of, carbon dioxide/ oxygen ; no stomata (on lower epidermis) in contact with water ; <u>diffusion</u> (much) faster in air (than in water) ; (large number of stomata as) plant does not need to restrict, transpiration/ water loss/ AW ;</p> <p><i>common myrtle</i> (all) stomata (on lower surface), in the shade/ away from the sun/ out of the heat/ in a cooler place ; ora reduces/ restricts/ less, <u>transpiration/ evaporation</u> ; ora so, less water is lost/ water is conserved ;</p>	max [5]	<p>A gas exchange / diffusion of gases</p> <p>ignore if explained in terms of waxy cuticle only R 'prevents'</p>
		[Total: 14]	

2 (a) (i)	pollen / male gamete ;	[1]	R gamete unqualified
(ii)	chromosome number halved / becomes haploid ; genetic / DNA variation ; new combinations of alleles ; fertilisation restores diploid number in zygote / ensures number of chromosome remains constant in next generation ;	[max 2]	
(b) (i)	pollen from anther to stigma ; between different plants of same species ;	[2]	
(ii)	large petals ; pattern / guide lines on petals ;	[ma 1]	
(c) (i)	temperature / warmth ; light ; water availability ; wind ; pollinator life-cycle timings ; CO ₂ concentration ; pressure ;	[ma 1]	
(ii)	influence by genes and environment ; range of phenotypes / flowering times results ; (flowering time) is measurable ;	[ma 2]	

<p>2 (d)</p>	<p>1 2 3 4 5 6 7 8 9 10</p>	<p>different environments have different selection / competition pressures ; variation occurs (at fertilization / meiosis) ; ref to mutation ; best adapted organisms most likely to survive ; (those that survive) pass on their alleles / genes ; competition for survival ; cross pollination ensures more variation (than self-pollination) ; reproductive isolation (by different flowering times) ; changes enhanced over generations ; no cross-pollination between low and high altitude plants ;</p>	<p>[max 5]</p>	<p>A Survive and reproduce <i>Idea of best adapted</i></p>
		<p>[Total:14]</p>		

Question	E answers	Mark	Additional Guidance
3 (a)	<p>there are different forms of one, feature / characteristic ;</p> <p>example of a feature shown by Soay sheep ;</p> <p>coat / fur, colours patterns of coat / AW with and without horns lengths of horns ear, length / width / size / shape face, length / width / size / shape body mass body shape / body size / AW</p>	[2]	<p>look for a general explanation of 'variation in their phenotype' and an example</p> <p>the example chosen does not have to be visible in Fig. 6.1</p>
(b) (i)	<p><i>in years with high populations of sheep</i></p> <p>1 more deaths in total ; A low survival rate</p> <p><i>for all sizes of lambs</i></p> <p>2 more lambs died than survived ;</p> <p>3 any comparative data quote using same body mass in high and low population years – units (kg) are not necessary A tolerance given in table for bars between gridlines</p>	[max 2]	<p><i>looking at sum total of the bars in each graph</i></p> <p><i>looking at bars for each body mass</i></p> <p>e.g. lambs 13-14 (kg), 106 died in hi population year against 12 that died in low population year</p> <p>see page 18 for table of data</p>

Question	E answers	Mark	Additional Guidance
<p>3 (ii)</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p>	<p><i>in high population – ora for low population</i> <i>one mark for competition and two marks for marking points 2-11</i></p> <p>competition for, shelter / food / grass / resources ;</p> <p>as a result of competition there is shortage of food for each lamb ;</p> <p><i>as a result of competition for food</i></p> <p>lambs do not store enough fat ;</p> <p>ref insulation ;</p> <p>cannot survive the winter ;</p> <p>ewes / females, produce less milk ;</p> <p>ref to number of lambs per female ;</p> <p>ref to, more likely to die of disease / AW ;</p> <p>A disease more likely to spread</p> <p>more small lambs die ;</p> <p>(pregnant) ewes / females, are short of food</p>	<p>[1]</p> <p>[max 2]</p>	<p>ignore explanations about why the population is high in some years and low in others – not relevant</p> <p>R competition for mates</p>

Question	Expected answers	Mark	Additional Guidance
<p>3 (c)</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>8</p>	<p><i>note that this is not a question about artificial selection</i></p> <p>variation / AW, among the sheep in the population ;</p> <p>some are better, adapted / suited / AW, than others ; A 'best adapted'</p> <p>any example of an adaptive feature for survival in the extreme conditions ;</p> <p>any example of an appropriate selective agent ; ignore 'extreme conditions / weather'</p> <p>survive and, breed / have offspring ; A ora</p> <p>pass on their <u>alleles</u> ;</p> <p><i>idea that</i> over time better adapted, features / traits, become more common ;</p>	<p>[max 4]</p>	<p><i>points need to be in correct sequence and in the context of selection</i></p> <p>R better animals survive unqualified by adaptation or some example</p> <p>'some sheep have thicker coats' = MP1 and MP3</p> <p>MP3 must be a feature related to survival in extreme conditions, not 'strength', 'fitness' 'healthiness' etc</p> <p>to survive the cold = MP4</p>

4 (a)	stage	Pr		
	P	nitrogen fixation ;		
	Q	protein synthesis ;		
	R	feeding / digestion ;		
	S	deamination		
	T	nitrification ;		
	U	denitrification ;		

Question	Expected Answers	Marks	Additional Guidance
4 (b) 1 2 3 4	1 plants from irradiated seeds had more nodules ; 2 plants from irradiated seeds had nodules with more mass ; 3 comparative data quote for number ; 4 comparative data quote for dry mass of nodules ;	[max 3]	Units are required at least once.
(c)	mutation ; change in, gene(s) / DNA ;	[2]	
(d) 1 2 3 4 5 6 7	1 choose plants with desired feature(s) ; 2 cross / breed plants ; 3 any detail ; e.g. bagging flowers, transfer of pollen with paintbrush 4 collect seeds ; 5 grow seeds and check plants for features ; 6 cross plants showing features with original variety ; 7 keep crossing and selecting ;	[max 4]	
(e) 1 2 3 4	1 <u>genetic engineering</u> / <u>genetic modification</u> ; 2 introduced a gene from a different species ; 3 results, after one generation ; 4 any detail of method involved e.g. use of vector / plasmid ;	[max 2]	
(f) 1 2 3 4	1 fix nitrogen ; 2 products of fixation / nitrates provide a source of protein ; 3 increases nitrogen in soil when beans decay ; 4 maintain / higher, yields (of maize) ;	[max 2]	
		[Total: 18]	