1 **(a) (i)** *accept converse argument*
(more) black moths eaten (by, predators / consumers) **;**

(because) black moths, are not camouflaged / do not 'blend in' / AW **;** [max. 1]

(ii) ***either***
more black moths would be caught **;** **A** numerical answer – see Table 5.1

black moths have better camouflage / AW **;**

accept converse argument

or
less of both varieties recaptured **;**

death due to the pollution **;** [max. 2]

(b) (i) (first heading) phenotype **;**
(second heading) genotype **;** [2]

(ii) (dominant wing colour) pale / speckled **;** **A** white [1]

(explanation)

(pale / speckled) appears when,
the dominant allele / **G**, is present **;**
in, heterozygous / **Gg** (moths) **;**

accept black only appears when, homozygous / **gg** / AW **;** [max. 1]

(c) **1** discontinuous variation **;**
2 (wing colour determined by) a, gene / few genes **;** **A** ref to alleles
3 black is recessive / pale is dominant **;**
4 explanation of inheritance **;** *must include ref. to, terms / genotypes*
(black) inherited when parents are, homozygous recessive / **gg**, or heterozygous
(pale) inherited when only one parent has, dominant allele / **G** / AW **;**
5 ref to, sexual reproduction / meiosis **;** **A** mating / breeding / fertilisation [max. 3]

1 **(d)**

- *accept other letters*
- *ignore any row headings in candidate answers*
- *answer may be given with a Punnett square*
- *gametes may be accepted in the Punnett square even if not labelled as such*
- *gametes do not have to be circled*
- *accept contents of Punnett square as F_1 genotypes*

- *allow ecf if incorrect parental genotypes but only for gametes and F_1 to max 2*
- *allow ecf if no genotype for parent and gametes are wrong – allow F_1 and phenotype to max 2*

genotype of parents Gg x Gg ;

gametes G g ; *lines must be correct for F_1 genotype mark*

F_1 GG Gg gg ;

phenotypes pale pale ;

proportion 0.25 / ¼ / 25% / 1 in 4 ;

put ticks and crosses in a column on right hand side of answer

A 1 black to 3 pale but **(R)** 1 in 3 or 3:1 [5]

(e) **(** mutation ; [1]

(ii) UV light / (ionising) radiation / X rays / (named radioactive) chemical(s) ;
A nuclear fall out [max. 1]

[Total: 17]

Question		Marks	Additional Guidance
2 (a) (i)	reptiles ;	[1]	
(ii)	go to 2 ; go to 3 ; go to 4 ; *Chalcides minutus* B ; go to 5 ; go to 6 ; *Brookesia perarmata* G ; *Calumma parsonii* C ; *Amblyrhynchus cristatus* A ; *Cyclura lewisi* E ; *Abronia graminea* F ; *Varanus komodoensis* **D** ;	[3]	5 / 6 right = 3 3 / 4 right = 2 1 / 2 right = 1 0 right = 0

Question		Marks	Additional Guidance
2 **(b)**	encourages biodiversity ; **ora** prevents extinction ; encourages genetic diversity (within each species) ; maintain food, webs/chains ; food for predators ; increasing research / source of medicine ; AVP ;; e.g. maintain habitats for other organisms / ethical / moral / aesthetic reasons / tourism	max [3]	**A** species diversity **A** an example of feeding
(c) (i)	reduced genetic diversity ; identical offspring ; negative traits passed on ; more competition for local resources ; less chance of survival in a varying environment ; one disease could wipe out total population ; AVP ; e.g. less chance of evolving	max [2]	**A** no genetic diversity **A** unfavourable / bad traits.
(ii)	offspring may not be as well adapted to environment ; slower process / takes longer (than asexual reproduction) ; requires partner / two parents ; less energy efficient / requires more energy / many eggs is wasteful ; AVP ;	max [2]	**A** description e.g. good characteristics are not always passed on.
(d) (i)	reduction division / chromosome number is halved / one set of chromosomes ; diploid to haploid ; for production of gametes ; daughter cells are not genetically identical / genetically different ;	[2]	to each other or parent

Question		Marks	Additional Guidance
2 (ii)	for adaption to, new / changed environment ; causes (genetic) variation ; competition for survival ; best suited reproduce ; allows natural selection ; allows evolution ; AVP ;	max [3]	**ignore** mutations unqualified.
		[Total: 16]	

3 (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]	

3 **(d)**	**1** **2** **3** **4** **5** **6** **7** **8** **9** **10**	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 **;**	**[max 5]**	**A** Survive and reproduce *Idea of* best adapted
			[Total:14]	