

1(a)(i)	AABB AABb AaBB AaBb ; ;																									
1(a)(ii)	long chocolate ;																									
1(b)	A B A b a B a b A B A b a B a b ; <table><tr><td></td><td>AB</td><td>Ab</td><td>aB</td><td>Ab</td></tr><tr><td>AB</td><td>AABB</td><td>AABb</td><td>AaBB</td><td>AaBb</td></tr><tr><td>Ab</td><td>AABb</td><td>AAbb</td><td>AaBb</td><td>Aabb</td></tr><tr><td>aB</td><td>AaBB</td><td>AaBb</td><td>aaBB</td><td>aaBb</td></tr><tr><td>Ab</td><td>AaBb</td><td>Aabb</td><td>aaBb</td><td>aabb ;</td></tr></table> <i>F2 offspring phenotype number ratio:</i> 9 : 3 : 3 : 1 ; short black short chocolate long black long chocolate ; <i>Mp 4 need phenotypes linked to genotypes by colour, symbol or initials</i>		AB	Ab	aB	Ab	AB	AABB	AABb	AaBB	AaBb	Ab	AABb	AAbb	AaBb	Aabb	aB	AaBB	AaBb	aaBB	aaBb	Ab	AaBb	Aabb	aaBb	aabb ;
	AB	Ab	aB	Ab																						
AB	AABB	AABb	AaBB	AaBb																						
Ab	AABb	AAbb	AaBb	Aabb																						
aB	AaBB	AaBb	aaBB	aaBb																						
Ab	AaBb	Aabb	aaBb	aabb ;																						
1(c)	1 structural gene codes for, (named) structural / functional, protein / polypeptide ; 2 regulatory gene codes for, transcription factor / repressor protein or regulatory gene, controls / helps / restricts, expression of (other) genes ;																									
4(a)	1 diploid ; 2 allele ; 3 dominant (allele) ;																									
4(b)	<i>any four from:</i> 1 CDV acts as a selection pressure ; 2 DNA / allele, for black (coat) gives <u>resistance</u> to CDV or DNA / allele, for black (coat), gives (selective) advantage / is selected for, if / when, CDV is common / dogs are common ; <i>in the south (context must be established at least once):</i> 3 more CDV (infection) in <u>wolves</u> ; 4 black wolves, more likely to survive / have selective advantage / are selected <u>for</u> ; ORA greys 5 black wolves more likely to, breed / reproduce ; ORA greys 6 pass on / increase the frequency of, <u>allele</u> for black coat ; ORA grey																									
4(c)	1 positive (linear) correlation / positive relationship / direct relationship / directly proportional or as % with (anti-CDV) antibodies increases the % of black wolvesincreases ; <i>plus any three from:</i> 2 wolves that survive CDV will, later / as a result, have antibodies ; 3 high % of antibodies show population with high level of CDV ; 4 in population with high % antibodies, grey wolves have died / more black wolves are left ; 5 gene / DNA / allele / protein, that gives black coat, helps survival / gives resistance to CDV / defends against CDV ; 6 AVP ;																									

3(a)	<u>dominant</u> ; 3 / daughter, has disease but, 2 / father, does not or 3 / daughter, could not have the disease if allele were recessive ;
3(b)	<i>any three from:</i> 1 founder effect ; 2 allele / variegate porphyria, present in, migrants / settlers / founding population ; 3 higher frequency than in, Dutch / Europeans / original population ; 4 genetic drift has large effect in small, population / gene pool ; 5 inbreeding / migrants married within their own population ; 6 high frequency of allele maintained over, time / generations ; 7 AVP ;
3(c)	<i>any four from:</i> 1 use mRNA (from person's cells) to make, cDNA / ssDNA ; 2 add fluorescent, label / tag / dye / chemical / marker, to (this ss) DNA ; 3 cDNA / ssDNA, hybridises with / binds to / complementary base pairs with, probe(s) / microarray ; 4 fluorescence shows, disease / mutant, gene / allele, expression / transcription ; 5 AVP ;
3(d)	<i>any one from:</i> 1 find out / diagnose, person's disease ; 2 so can, choose / develop, right treatment ; 3 global, research resource / access ;
3(e)	<i>any three from:</i> 1 change from T to C or replacement / substitution, of T , with / by, C or substitution of C for T ; 2 functional / working / correct / normal, enzyme / protein, produced ; 3 <u>gRNA</u> , is specific to / only finds / just alters, CEP / disease / mutant, allele / gene or <u>gRNA</u> does not bind to genes other than CEP ; 4 AVP ;