

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 </

5(a)	any four from: mark as pairs Name 1 dNTPs / <u>DNA</u> nucleotides ; Explanation 1 to, anneal / bind, to complementary bases ; Name 2 Taq polymerase ; Explanation 2 to make, phosphodiester bonds / the sugar phosphate backbone / double-stranded DNA / a complementary strand of DNA or ref. to functioning at higher temperature / does not denature at the higher temperature / is thermostable ; Name 3 buffer ; Explanation 3 to provide, optimum / suitable / constant, pH for, polymerase / DNA or prevents, denaturation of polymerase / damage to DNA ;
5(b)(i)	any two from: 1 (DNA ladder) compared to (other fragments) ; 2 ref. to (estimate) length of (DNA) fragment / to identify the fragment number ; 3 ref. to show electrophoresis worked correctly ;
5(b)(ii)	any three from: 1 (PCR) amplifies / makes many copies of, DNA (fragments) ; 2 (PCR) ref. to selecting fragments, small enough / less than 1000 bp / not more than 916 bp (for sequencing) ; 3 (electrophoresis) separate the (DNA) fragments ; 4 (electrophoresis) confirms / identifies, fragment lengths / fragment number / PCR worked correctly ;
5(c)	($2^{35} =$) 3.4×10^{10} ;
5(d)	any four from: 1 child may have disease when, neither parent has the disease / no family history ; 2 early, detection / treatment (for gene therapy to work) ; 3 improve, quality of life / life expectancy ; 4 ref. to informs family planning (for future pregnancies) ; 5 idea that it does not involve additional sampling ; 6 (screening is) expensive ; 7 treatment / gene therapy, expensive ; 8 test may not always be accurate ; 9 long-term effect of treatment, unknown / negative ;

2(a)	<i>anaphase: K and M ;</i> <i>cells containing pairs of homologous chromosomes: J and K ;</i> <i>crossing over: J ;</i> <i>haploid cells: L and M and N ;</i>
2(b)	<i>any two from:</i> 1 to prevent self-pollination / to ensure cross-pollination ; 2 so, must cross with / other parent must be / pollen comes from, a, different / selected, plant / parent / individual / variety ; 3 to make plant a female parent ;
2(c)	<i>any four from:</i> <i>stage 1 – inbreeding to get two lines</i> 1 inbreeding / line breeding ; 2 select for, disease resistance / rapid growth / high yield ; 3 select, best / desirable, offspring <u>and</u> cross with each other repeatedly ; 4 (results in) homozygous (loci) ; <i>stage 2 – outcross to get uniform vigorous offspring</i> 5 hybridise / outcross / outbreed, with another, variety / type of maize ; 6 with a different desired trait ; 7 AVP ;

5(a)	<i>any three from:</i> 1 small so can keep, in small space / for low cost / with low maintenance ; 2 can select parents for, mating / cross-breeding / particular crosses ; 3 so get many, offspring / generations, in a short time ; 4 can be used to research, cancer / (named) neurodegenerative diseases ; 5 AVP ;
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5(b)

1 symbols: **A** = grey body **a** = black body
B = long wing **b** = short wing ;

F1 phenotypes: grey long x grey long

2 *F1 genotypes:* **AaBb** x (**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 ;

5 *F2 offspring phenotype number ratio:*
9 : **3** : **3** : **1** ;

6 grey long grey short black long black short ;

5(c)	1 carry out a test cross / cross with a double homozygous recessive fruit fly / cross with fly with black body and short wings ; <i>plus any two from:</i> 2 if some offspring have black body then F2 fly is, heterozygous for the body colour (gene) / Aa ; 3 if all offspring have grey body then F2 fly is, homozygous dominant for body colour (gene) / AA ; 4 if some offspring have short wings then F2 fly is, heterozygous for wing length (gene) / Bb ; 5 if all offspring have long wings then F2 fly is, homozygous dominant for wing length (gene) / BB ;
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