

Question number	Answer	Marks	Guidance
1 (a) (i)	(dominant) epistasis; B epistatic A hypostatic; prevents transcription of A; product of B binds to, promoter / AW, of A; prevents translation of A mRNA; product of B binds to, mRNA / ribosome; product of B inhibits enzyme encoded by A / B codes for enzyme which breaks down pigment;	3 max	
1 (a) (ii)	<i>Parental phenotypes</i> (AABB) white (aabb) white; (genotypes given in question) <i>gametes</i> AB ab; <i>F<sub>1</sub> genotype and phenotype</i> all AaBb white; <i>F<sub>1</sub> gametes</i> AB Ab aB ab; A from P. square <i>F<sub>2</sub> genotypes</i> all correct;; delete 1 for each of first two mistakes <i>F<sub>2</sub> phenotypes</i> correctly related to genotypes; A key <i>F<sub>2</sub> ratio</i> 13 white : 3 red; (see Punnett square)	8	
1 (b) (i)	Genes linked / AW; ref. locus involved in production of toxin; resistance inherited with, allele A / allele b; close together (on same chromosome / in same linkage group); few without resistance from crossing over;	2 max	
1 (b) (ii)	Crossing over has occurred; in, meiosis I / prophase I; exchange of (part of) non-sister chromatids; diagram; mutation;	2 max	
2 (a) (i)	Green-based is dominant (to uniform colour) / G is dominant to g / ora <u>re</u> recessive;	1	
2 (a) (ii)	Red (fruit) is dominant to orange (fruit) / R is dominant to r / ora <u>re</u> recessive;	1	
2 (b)	ggrr / rrgg;	1	
2 (c)	<i>Parental phenotypes</i> green-based red x uniform orange; <i>parental genotypes</i> GgRr ggrr; <i>gametes</i> GR Gr gR gr gr; <i>offspring genotypes and phenotypes</i> GgRr green-based red Ggrr green-based orange ggRr uniform red ggrr uniform orange;;	4 max	
2 (d) (i)	3;	1	
2 (d) (ii)	> 0.1/ greater than 0.1;	1	
2 (d) (iii)	Difference from expectation is not significant/statistically different; above (critical) value (0.05) / AW; result due to chance; prediction correct / null hypothesis should be accepted;	3 max	

	loci (apparently), assort independently / not linked;		
2 (e)	Loci (too) far apart (for linkage to be detected); ref. recombinants; crossing over has occurred; detail crossing over; <i>[in prophase I of meiosis / exchange of (part of) non-sister chromatids]</i> ignore chiasmata has occurred, twice / even number of times; (therefore) restoring loci to parental combinations; diagram;	3 max	
3 (a) (i)	cross 1 7, 7; cross 2 14, 7;	2	
3 (a) (ii)	Chromosome number has doubled; ref. polyploidy; nuclear division but no cell division; failure of spindle in mitosis; non-disjunction;	2 max	
3 (b)	Different numbers (42 & 14) of chromosomes; different numbers (21 & 7) of chromosomes in gametes; chromosomes cannot pair; ref., synapsis / homologous pairs, in meiosis; meiosis fails; [R 'cannot occur'] hybrid/new plant sterile; R not viable	2 max	
3 (c)	Act as gene banks; source of genetic diversity; (a) maintain genetic diversity store of alleles; for future use; in selective breeding of wheat; to restore alleles lost in selective breeding/ counter effect of inbreeding/genetic erosion; in case different traits needed/ changed consumer demand; in case climate change; e.g. global warming / temperature rise; e.g. drier conditions; not environmental change in case new, pathogen / disease; in case new pest; may have as yet unrecognized trait; AVP; e.g. detail / i.e. disease resistance to new disease AVP; e.g. genetic engineering	8 max	