

Question number	Answer	Additional guidance	Mark
4(a)	<ul style="list-style-type: none"> • (India) 71.76 (million) (1) • (Malaysia) 3.2 (1) 		(2)

Question number	Answer	Additional guidance	Mark
4(b)(i)	<ul style="list-style-type: none"> • {16.75 / 16.8 / 17} : 1 (1) 		(1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	<p>An explanation that includes the following points:</p> <ul style="list-style-type: none"> • because colour blindness is {sex-linked / sex-linkage} (1) • which means the {gene for colour vision / colour blind gene} is located on the X chromosome (1) • therefore males with {faulty / recessive / colour blind} allele will be colour blind (1) • whereas females need to {be homozygous recessive / have two faulty alleles} to be colour blind (1) 	<p>ACCEPT X-linked</p> <p>ACCEPT {genetic information / allele} for {colour vision / this disorder}</p> <p>if dominant and recessive alleles shown on X chromosomes in a diagram</p>	(4)

Question number	Answer	Additional guidance	Mark
8(a)(i)	<p>A description that includes the following points:</p> <ul style="list-style-type: none"> gene is the {length of DNA / sequence of bases} coding for a (poly)peptide (1) allele is the (different) {version / form / variation} of the gene (1) gene for feather colour <u>and</u> allele for {white / black} feathers (1) 	<p>ACCEPT protein / sequence of amino acids</p> <p>NB piece together DO NOT ACCEPT speckled feathers</p>	(3)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	<p>A description that includes the following points:</p> <ul style="list-style-type: none"> genotype is the combination of alleles (1) phenotype is the {(observable) characteristics / appearance / traits} (1) phenotype is the colour of the feathers <u>and</u> genotype is the presence of white and or black alleles (1) 	<p>ACCEPT mixture of alleles / the alleles present DO NOT ACCEPT genes ACCEPT feature / ref to colour of feathers IGNORE ref to environment</p> <p>ACCEPT phenotype is {white / black / speckled / mixture of black and white} (feathers) genotype is {WW / BB / WB} or any other letters used NB piece together</p>	(3)

Question number	Answer	Additional guidance	Mark
8(b)	<p>An answer that includes the following points:</p> <ul style="list-style-type: none"> parent's genotypes shown as BB and BW (1) offspring's genotypes shown as BB and BW (1) number of speckled chicks given as 12 or 13 (1) 	<p>ACCEPT other letters, including B and b DO NOT ACCEPT X and Y B for white and W for black ACCEPT other letters, including B and b</p> <p>CE from 1</p> <p>CE from 2 provided whole number</p> <p>NB Bald answer = 1 mark</p>	(3)

Question number	Answer	Additional guidance	Mark
8(c)(i)	Chi squared (1)	<p>ACCEPT Chi square / X squared / x squared / X^2 / x^2 / χ^2 / chi² distribution (test) / chi (test) / closeness of fit / goodness of fit</p> <p>phonetic spellings e.g kai / cai / khi</p>	(1)

Question number	Answer	Additional guidance	Mark																															
8(c)(ii)	An answer that includes the following points: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th rowspan="2">Steps in the calculation for the statistics test</th> <th colspan="3">Colour of feathers of chicks</th> </tr> <tr> <th>Speckled</th> <th>White</th> <th>Black</th> </tr> </thead> <tbody> <tr> <td>Observed number (O)</td> <td>243</td> <td>125</td> <td>112</td> </tr> <tr> <td>Expected number (E)</td> <td>240</td> <td>120</td> <td>120</td> </tr> <tr> <td>(O-E)</td> <td>3</td> <td>5</td> <td>-8</td> </tr> <tr> <td>$(O-E)^2$</td> <td>0.0375</td> <td>0.2083</td> <td>0.5333</td> </tr> <tr> <td>E</td> <td>9/240</td> <td>25/120</td> <td>64/120</td> </tr> <tr> <td></td> <td>3/80</td> <td>5/24</td> <td>8/15</td> </tr> </tbody> </table>	Steps in the calculation for the statistics test	Colour of feathers of chicks			Speckled	White	Black	Observed number (O)	243	125	112	Expected number (E)	240	120	120	(O-E)	3	5	-8	$(O-E)^2$	0.0375	0.2083	0.5333	E	9/240	25/120	64/120		3/80	5/24	8/15	All correct = 2 marks One row correct = 1 mark ACCEPT 8 DO NOT ACCEPT -3 / -5 ACCEPT 2 or 3 or 4 dps but not necessarily consistently the same number. DO NOT ACCEPT recurring	(2)
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8(c)(iii)	0.8 / 0.78 / 0.779 / 0.7791 (1)	CE / rounding effect from (c)(ii) DO NOT ACCEPT 0 NB $187/240 = 0.7792$	(1)

Question number	Answer	Additional guidance	Mark
8(c)(iv)	An explanation that includes two of the following points: <ul style="list-style-type: none"> • {calculate / use} the number of degrees of freedom • use (a probability) value of (up to or equal to) 5%/0.05 (1) • compare (calculated) {value / result} to (critical) value (1) • if the (calculated) {value / result} is greater than (critical) value then null hypothesis is rejected (1) 	ACCEPT description of how to work out degrees of freedom NB mp 4 alone = 2 marks ACCEPT the converse argument any quoted figures for the calculated value	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	<ol style="list-style-type: none"> 1. temperature; 2. light intensity; 3. soil moisture concentration; 4. (soil) pH; 5. mineral ion concentration; 6. age of plant; 	<p>2. ACCEPT wavelength of light</p> <p>3. ACCEPT water availability / humidity</p> <p>5. ACCEPT named mineral ion availability</p> <p>6. IGNORE species of plant</p>	(2)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	<p>The correct answer is A P which is the cerebral cortex</p> <p>B is not correct because Q is the cerebellum</p> <p>C is not correct because R is the medulla oblongata</p> <p>D is not correct because S is the hypothalamus</p>		(1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	<p>A description that includes the following points:</p> <ul style="list-style-type: none"> • genotype is the combination of alleles + {TT / tt / Tt} (1) • phenotype is the {expressed / observable} {characteristic / trait / feature} + {taster / non-taster} 	<p>ACCEPT any pair of letters</p> <p>ACCEPT characteristic that can be measured (tasting / not tasting) (receptor)</p> <p>NB Two correct definitions but no examples = 1 mark</p>	(2)

Question number	Answer	Additional guidance	Mark
4(c)	<p>An explanation that includes the following points:</p> <ul style="list-style-type: none"> • dominant allele is (having a receptor that) can taste bitter taste (1) • because individuals 1 and 2 were tasters who had children of both phenotypes (1) 	<p>ACCEPT children who could taste and children who could not taste</p>	(2)

Question number	Answer	Additional guidance	Mark
4(d)	<p>An explanation that includes the following points:</p> <ul style="list-style-type: none"> • because individual 6 was a female non-taster (1) • and her father was a taster (1) 		(2)