

- M1.(a)** Both alleles are expressed / shown (in the phenotype).
Accept: both alleles contribute (to the phenotype)
Neutral: both alleles are dominant

1

- (b) Only possess one allele / Y chromosome does not carry allele / gene / can't be heterozygous.
Accept: only possess one gene (for condition)
Neutral: only 1 X chromosome (unqualified)

1

- (c) 1. $X^G X^B$, $X^B X^B$, $X^G Y$, $X^B Y$;
Accept: equivalent genotypes where the Y chromosome is shown as a dash e.g. $X^G -$, or is omitted e.g. X^G
Reject: GB, BB, GY, BY as this contravenes the rubric
2. Tortoiseshell female, black female, ginger male, black male;
3. (Ratio) 1:1:1:1
2 and 3. Award one mark for following phenotypes tortoiseshell, black, (black) ginger in any order with ratio of 1:2:1 in any order.
Allow one mark for answers in which mark points 1, 2 and 3 are not awarded but show parents with correct genotypes i.e. $X^G X^B$ and $X^B Y$ or gametes as X^G , X^B and X^B , Y
3. Neutral: percentages and fractions
3. Accept: equivalent ratios e.g. for 1:1:1:1 allow 0.25 : 0.25 : 0.25 : 0.25

3

- (d) (i) Correct answer of 0.9 = 2 marks;
 Incorrect answer but shows $q^2 = 0.81$ = one mark.
Note: 0.9% = one mark

2

- (ii) Homozygous dominant increases and homozygous recessive decreases.

1

M2.(a) 1. Cut (DNA) at same (base) sequence / (recognition) sequence;
Accept: cut DNA at same place

2. (So) get (fragments with gene) **R** / required gene.
Accept: 'allele' for 'gene' / same gene

2

(b) 1. Each has / they have a specific base sequence;
 2. That is complementary (to allele r or R).
Accept description of 'complementary'

2

(c) 1. Fragments L from parent rr, because all longer fragments / 195 base pair fragments;
Ignore: references to fragments that move further / less, require identification of longer / shorter or 195 / 135
Accept: (homozygous) recessive

2. Fragments N from parent RR, because all shorter fragments / 135 base pair fragments;
1 and 2 Accept: A3 for 195 and A4 for 135
2. Accept: (homozygous) dominant

3. (M from) offspring heterozygous / Rr / have both 195 and 135 base pair fragments.
Accept: have both bands / strips
Reject: primer longer / shorter

3

(d) 1. (Cells in mitosis) chromosomes visible;
 2. (So) can see which chromosome DNA probe attached to.

2

(e) (i) 1. For comparison with resistant flies / other (two) experiments / groups;
Ignore: compare results / data / no other factors

2. To see death rate (in non-resistant) / to see effect of insecticide in non-resistant / normal flies.

Accept: 'pesticide' as 'insecticide'

Accept to see that insecticide worked / to see effect of enzyme

2

- (ii) (PM must be involved because)

1. Few resistant flies die (without inhibitor);
2. More inhibited flies die than resistant flies;
3. (PM) inhibited flies die faster (than resistant flies);

(Other factors must be involved because)

4. Some resistant flies die;
5. But (with inhibitor) still have greater resistance / die slower than non-resistant flies.

Accept: (with inhibitor) die slower than non-resistant flies

4 max

[15]

M3.(a) (Genes / loci) on same chromosome.

1

- (b)
1. GN and gn linked;
 2. GgNn individual produces mainly GN and gn gametes;
 3. Crossing over produces some / few Gn and gN gametes;
 4. So few(er) Ggnn and ggNn individuals.

4

- (c) (Grey long:grey short:black long:black short) =1:1:1:1

1

- (d)
1. Chi squared test;
 2. Categorical data.

2

[8]

- M4.(a)** (Recessive) allele is always expressed in females / females have one (recessive) allele / males need two recessive alleles / males need to be homozygous recessive / males could have dominant and recessive alleles / be heterozygous / carriers;

*Accept: Y chromosome does not carry a dominant allele.
Other answers must be in context of allele not chromosome or gene.*

1

- (b) (i) 1. 1, (2) and 5;

Accept: for 1 mark that 1 and 2 have slow (feather production) but produce one offspring with rapid (feather production).

Neutral: any reference to 3 being offspring of 1.

2. 1 must possess / pass on the recessive allele / 1 must be a carrier / heterozygous / if slow (feather production) is recessive all offspring of (1 and 2) would be slow (feather production) / if rapid (feather production) was dominant 1 would have rapid (feather production);

Reject: both parents must be carriers / possess the recessive allele.

Reject: one of the parents (i.e. not specified) must be a carrier / heterozygous.

2

- (ii) $5 = X^fY / X^fY^- / f / f^- / fY$;

$7 = X^FX^f$ **and** X^FX^F (either way round) /

or X^fX^F **and** X^FX^F (either way round) /

or X^FX^f , X^fX^F **and** X^FX^F (in any order);

Note: allow $5 = X^fY$, X^fY^- .

Accept: for both 5 and 7 a different letter than F. However, lower case and capital letter must correspond to that shown in the answer. For example accept $7 = X^RX^r$ and X^RX^R .

2

- (iii) X^FX^f **and** X^fY **or** X^fX^F **and** X^fY

or X^FX^f **and** X^fY^- **or** X^fX^F **and** X^fY^- /

or Ff **and** fY /

or Ff **and** fY^- /

or Ff and f- /

or Ff and f;

Accept: a different letter than F. However, lower case and capital letter must correspond to that shown in the answer.

Accept: each alternative either way round.

1

(c) Correct answer of 32 (%) = 3 marks;;;

Accept: 0.32 = 2 marks

If incorrect answer, allow following points

1. $p^2 / q^2 = 4\% / 0.04$ / or $p / q = 0.2$;

2. Shows understanding that $2pq$ = heterozygotes / carriers;

Accept: answer provided attempts to calculate $2pq$. This can be shown mathematically i.e. 2 x two different numbers.

3

[9]