Mark schemes

Q1.

(a) 1. Cross with homozygous recessive (fly)

OR

Cross with a black (fly)

OR

Cross with gg (fly);

Accept cross with heterozygous (fly)

2. Black offspring/flies then is heterozygous/Gg

OR

Black and grey offspring/flies then is Heterozygous/Gg

OR

No black offspring/flies then is homozygous/GG

OR

All grey offspring/flies then is homozygous/GG;

Alternative mark scheme, if cross not used.

Mark as pairs 3 with 4, and 5 with 6.

3. DNA base sequencing;

4. Compare base sequence with known alleles;

5. Separate alleles using electrophoresis;

6. Use gene/DNA probes to identify alleles

OR

Compare position/banding with known alleles

OR

Homozygous forms one band, heterozygous forms two bands;

2

(b) (If sex-linked) grey/male fly would only have / pass on grey/dominant allele

OR

(If sex-linked) females would receive the grey/dominant allele

OR

(If sex-linked) grey/male fly would **not** have / pass on black/recessive allele

OR

(If sex-linked) female (offspring) would be grey

OR

(If sex-linked) no female (offspring) would be black

OR

(If sex-linked) male (parent) could **not** have been heterozygous;

OR

(If sex-linked) only black male (parent) could produce a black bodied female;

Accept G for dominant allele and g for recessive allele.

1

(c) 1. Correct answer of 18 (%) = **2 marks**;;

*Accept 0.18 for **one mark**.*

2. Incorrect answer but shows understanding that 2pq = heterozygous/carriers = **1 mark**

OR

Incorrect answer but shows understanding that $1 – (p^2 + q^2)$ = heterozygous/carriers = **1 mark**;

Accept understanding of 2pq by using a calculation involving 2 × two different numbers.

2

(d) 1. RrGG and Rrgg;

2. RrGg, (×2), rrGg, (and RRGg);

Accept the alleles in any order e.g. RGrG and accept if not shown on answer lines.

Accept if different letters than shown are used for the alleles.

3. Curly(-winged), grey(-bodied) and Normal(-winged), grey(-bodied) **and** ratio 2 : 1;

Accept ratios equivalent to 2 : 1.

*Note: If no mark awarded allow **one** (principle) **mark** when parental genotypes are incorrect but correct dihybrid genotypes shown for offspring from this cross.*

3

[8]

Q2.

(a) Epistasis

OR

Epistatic;

Ignore any words before or after epistasis e.g. dominant'.

Accept phonetic spellings.

1

(b) Tortoiseshell female;

Accept 'female tortoiseshell'.

Accept 'ginger & black female'.

1

(c) 1. (Gametes) X^GF, X^Gf, X^Bf **and** Yf;

*Allow **one mark** for correct dihybrid genotypes of offspring from incorrect parental gametes.*

1 and 2 Accept if g and b are used throughout for G and B.

1 and 2 Accept in Punnet square.

2. X^GX^BFf, X^GX^Bff, X^GYFf **and** X^GYff;

Accept the alleles within a genotype in any order.

2 and 3 Accept any order of genotypes and phenotypes and accept if on incorrect answer lines.

3. White female, Tortoiseshell female, White male, Ginger male, **and** ratio 1 : 1 : 1 : 1;

Accept sequence of phenotypes does not need to mirror genotypes but must be correct.

Accept equivalent ratios e.g. 4:4:4:4.

Accept 'Ginger and black' for tortoiseshell and accept 'no pigment' for white.

3

(d) Correct answer of 0.8 = **2 marks**;;

Incorrect answer but shows $ff/q^2 = 0.64$ = **1 mark**

OR

Incorrect answer but shows $ff/q^2 = 64\%$ = **1 mark;**

*Accept answer of 80% for **2 marks.***

2

[7]

Q3.

(a) (1) I^AI^O **and** (2) I^AI^B;

*Accept I^OI^A for (1) **and** I^BI^A for (2).*

*Accept AO or OA for (1) **and** AB or BA for (2).*

Accept lower case for A, B and O.

1

(b) 1. Rhesus positive parents produce 7/Rhesus negative child
OR
3 and 4 produce 7/Rhesus negative child
OR
Two Rhesus positive produce 7/Rhesus negative child;;

Reject if incorrect evidence and correct evidence provided.

Accept Rhesus positive parents produce Rhesus positive and Rhesus negative child.

Accept 'affected' for Rhesus positive and 'unaffected' for Rhesus negative.

2. Both Rhesus positive/3 and 4 carry recessive <u>allele</u>
OR
Both Rhesus positive/3 and 4 are heterozygous/carriers
OR
If Rhesus positive was recessive, all children (of 3 and 4) would be Rhesus positive / have recessive (phenotype);

Reject if incorrect explanation and correct explanation provided.

Accept 'affected' for Rhesus positive and 'unaffected' for Rhesus negative.

2

(c) Correct answer of 0.125 / $^1/_8$ / 12.5% = **2 marks**;;

Incorrect answer of 0.25 / $^1/_4$ / 25% = **1 mark**;

Accept 1 in 8 for 2 marks or accept 1 in 4 for 1 mark.

Accept equivalent raw fractions e.g., $^2/_{16}$ for 2 marks or $^4/_{16}$ for 1 mark.

Accept 12.5 for 1 mark.

2

(d) 0.2
OR
0.20;

1

(e) 1. Chi-squared;

2. 3;

Accept χ^2 or Chi^2

2

(f) 1. Selection (against/for a blood group/phenotype/allele);

2. (High rate of) mutation;

3. Immigration/emigration;
Accept 'migration' or population is not isolated.

4. No random mating.
Ignore no 'random fertilisation'.

Reject converse statements as context would be incorrect
Ignore births/deaths.

2 max

[10]