Mark schemes

Q1.

(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

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Q2.

(a) 1. Pathogens

Reject toxins

OR

Cells from an organism of a different species;

Accept named examples of pathogens

Accept bacteria/fungi

Ignore viruses

2. Cells from other organisms of the same species;

Ignore B cells/T cells

Accept named appropriate cells from other organisms of the same species

3. Abnormal body cells;

Ignore B cells/T cells

Accept cancer cells

Accept cell infected with virus

4. Antigen-presenting cells;

2 max

(b) As a control (experiment), to show that it is OXA affecting the (immune) response

OR

As a control (experiment), to show that (olive) oil is **not** affecting the (immune) response

OR

To use as a control/standard/reference/starting point, to compare with (after) OXA (exposure);

Reject

'control/controlled variable'

1

(c) 1. Labelled axes correct way round, linear scale and units;

Reject if line graph drawn

Reject if Y-axis does not cover at least half of the grid

Reject if bars not of equal width

Accept a dual bar chart drawn

Reject if bars are touching (except dual bars)

Accept interruption drawn on the y axis

2. Mean points plotted correctly;
Allow all plots to the nearest half cm

3. SD bars correctly plotted above and below the peak of each bar;
Allow all plots to the nearest half cm

3

(d) **Cellular response**

1. Female to female no significant difference in cellular response as SD overlap;

2. Male to male no significant difference in cellular response as SD overlap;

3. Significant **increase** in cellular response in autoimmune male compared with autoimmune female as SD do not overlap

Humoral response

4. Male to male no significant difference in humoral response as SD overlap;

5. Female to female significant **increase** in humoral response as SD do not overlap;

6. Significant **increase** in humoral response in autoimmune female compared with autoimmune male as SD do not overlap

***Max 2** for answers only relating to the cellular response **or** humoral response*

Accept '(ear) thickness' for cellular response, and 'concentration of anti-OXA/antibody' for humoral response

*If **no** other marks awarded, accept **1 principle mark** for the idea that if SD overlap there is no significant difference or the converse*

1, 2 and 4 Accept difference (likely) due to chance for no significant effect

3, 5 and 6 Accept increase not (likely) due to chance for significant increase

Allow 'error bars' for 'SD'

3 max

(e) **Supporting**

1. (Oestrogen) increases the humoral response that produces antibody;

2. More antibodies could increase progression of SLE;

3. (Oestrogen) decreases the cellular response that produces T_C

cells;

4. Fewer T_C cells could decrease/slow progression of RA;

5. Mice and humans are both mammals, so likely to have similar effects in both;

Against

6. Increase in response might mean quicker production of antibody (not more)

OR

Decease in response might mean slower production of T_C cells (not fewer);

7. Decrease in cellular response could (also) mean fewer antigen-presenting cells (and not just T_C cells);

8. (Investigation) done in mice/not humans;

9. **Table 2** does not state which type of autoimmune disease the mice had

OR

Mice might not suffer from SLE/RA;

Max 3 *for reasons supporting or against*

4 max

(f) **No – no mark**

1. Mice with autoimmune disease will be unlikely to reproduce/survive

OR

Mice with autoimmune disease will be selected against;

2. Will not pass on allele (for autoimmune disease)

OR

Allele frequency (for autoimmune disease) will reduce/change;

Yes – no mark

3. As long as the autoimmune disease did not affect the mice's ability to reproduce/survive;

4. The allele frequency will remain constant/not change;

Award as mark points 1 and 2, ***OR*** *3 and 4*

2 max

[14]

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]