

- M1.(a)**
1. Change / mutation in base / nucleotide sequence (of DNA / gene);
Q.
Ignore: references to changing base-pairing
Accept: affect for change, if in correct context
Accept: changes triplets / codons
 2. Change in amino acid sequence / primary structure (of enzyme);
Accept: different amino acid(s) coded for
Q Reject: different amino acids produced / formed / made
 3. Change in hydrogen / ionic / disulfide bonds;
Accept: references to sulfur bonds
 4. Change in the tertiary structure / shape;
Neutral: alters 3D structure / 3D shape
 5. Change in active site;
 6. Substrate not complementary / cannot bind (to enzyme / active site) / no enzyme-substrate complexes form.
Accept: no E S complexes form

6

- (b)
1. Non-SR strain falls more / SR strain falls less / up to $10(\mu\text{g} / \text{cm}^{-3})$;
Must include 10 but only required once in either MP1 or MP2
Ignore: units or absence of
This must be a comparative statement
 2. Above $10(\mu\text{g} / \text{cm}^{-3})$, SR strain levels out / off and non-SR strain continues to decrease;
 3. Greater difference between strains with increasing concentration of antibiotic.
This must be a comparative statement

2 max

- (c)
1. Division stopped (of both strains by scientist);
Reject: references to mitosis stopping
 2. SR strain still more resistant / fewer die / none die (at higher concentrations of antibiotic).
Accept: SR strain and non-SR strain would be similar if

*resistance is due to only stopping division
Need some comparison with non-SR*

2

- (d) 1. Make a competitive / non-competitive inhibitor;
*Mark in pairs
either MP1 and MP2 OR MP3 and MP4*
2. Competitive competes with / blocks active site / non-competitive inhibitor affects / changes active site;
Do not mix and match
- OR
3. (Make a drug) that inhibits / denatures / destroys enzyme / stringent response;
Accept: drug that 'knocks out' / destroys enzyme
4. Give at the same time as / before an antibiotic.

2 max

- (e) (SR strain)
1. Fewer free radicals (than non-SR);
Note: has to be comparative statement
2. Produces more catalase (than non-SR);
Accept converse statements for non-SR.
3. Catalase (might be) linked to production of fewer free radicals / breaking down / removing free radicals.
Accept: hydrolysis of radicals by catalase.

3

[15]

- M2.(a)** (No – no mark)
Graph / bar chart only shows number of species, not the name of the species.

1

- (b) (No – no mark)
1. Mutations are spontaneous / random;
 2. Only the rate of mutation is affected by environment;
 3. Different species do not interbreed / do not produce fertile offspring;

4. So mutation / gene / allele cannot be passed from one species to another.

Ignore references to correlation does not prove causation

4

- (c) 1. Initially one / few insects with favourable mutation / allele;
 2. Individuals with (favourable) mutation / allele will have more offspring;
 3. Takes many generations for (favourable) mutation / allele to become the most common allele (of this gene).

3

[8]

M3.(a) PKNJ.

1

(b) *Lutra lutra*.

1

(c) Bone / skin / preserved remains / museums.

1

(d) 1. (Hunting) reduced population size(s), so (much) only few alleles left;
Accept bottleneck

2. Otters today from one / few surviving population(s);
Accept founder effect

3. Inbreeding.
Allow any two

2 max

(e) 1. Population might have been very small / genetic bottleneck;
 2. Population might have started with small number of individuals / by one pregnant female / founder effect;
 3. Inbreeding.

Allow any two

2 max

[7]

M4.(a) 0.32.

*Correct answer = 2 marks**Accept 32% for 1 mark max**Incorrect answer but identifying 2pq as heterozygous = 1 mark*

2

- (b) 1. Mutation produced *KDR minus* / resistance allele;
 2. DDT use provides selection pressure;
 3. Mosquitoes with *KDR minus* allele more likely (to survive) to reproduce;
 4. Leading to increase in *KDR minus* allele in population.

4

- (c) 1. Neurones remain depolarised;
 2. So no action potentials / no impulse transmission.

2

- (d) 1. (Mutation) changes shape of sodium ion channel (protein) / of receptor (protein);
 2. DDT no longer complementary / no longer able to bind.

2

[10]

- M5.(a) 1. Kingdom, Phylum, Class, Order, Family;
 2. *Luscinia svecica*.

*1 mark for each correct column**Allow Genus and Species if both placed in box for species but not if both placed in genus box*

2

- (b) Number of different alleles of each gene.

Accept number of different base sequences (found) in each gene

1

- (c) 1. Has greater proportion of genes / percentage of genes showing diversity;
2. Percentage is 35% compared with 28% / proportion is 0.35 compared with 0.28.

Allow correct figures that are not rounded up, i.e., 34.9% / 0.349 and 27.8% / 0.278

2

[5]