

- 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)** 1. Chromosome is formed of two chromatids;
2. (Because) DNA replication (has occurred);
3. (Sister) chromatids held together by centromere.

3

- (b) 1. Chromosomes in homologous pair;
2. One of each into daughter cells / haploid number.

2

(c) Separation of (sister) chromatids / division of centromere. 1

(d) 1. Independent segregation (of homologous chromosomes);
Accept random assortment
2. Crossing over / formation of chiasmata. 2

[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

- M4.(a)** Translation. 1
- (b) Transfer RNA / tRNA. 1
- (c) TAC;
UAC. 2
- (d) Have different R group.
Accept in diagram 1
- (e) 1. Substitution would result in CCA / CCC / CCU;
2. (All) code for same amino acid / proline;
3. Deletion would cause frame shift / change in all following codons /
change next codon from UAC to ACC. 3

[8]

- M5.(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*

- (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]