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 <u>tertiary</u> structure / shape;
> *Neutral: alters 3D structure / 3D shape*

5. Change in <u>active site</u>;

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(μg / 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(μg / cm^{-3}), SR strain levels out / off <u>and</u> 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

[7]

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

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]