Mark schemes

1 (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]

2 (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]

3 (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]

4 (a) 4:

1

(b) 2.68(6).

If answer incorrect:
Σn(n-1) = 242 = 1 mark
N(N-1) = 650 = 1 mark

2

(c) 1. Take more samples and find mean;
2. Method for randomised samples described.

Allow larger area = 1 mark

2

[5]

5 (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]

6 (a) 1. Females are (generally) longer / larger / bigger / up to 115(mm) / males are (generally) shorter / smaller / up to 100(mm);

Ignore: tall

Accept: females have a larger / 90 modal / peak / most common value <u>and</u> males have a smaller / 80 modal / peak / most common value

Accept mean length of females greater / mean length of males shorter

Reject: use of mean in relation to 80 mm or 90 mm

Reject: Most of the females are 90 mm long / most of the males are 80 mm long

2. Females show a greater range / variation / males show a narrower range / variation.

Accept: correct use of figures from the graph: the range of males is 50 to 100 <u>and</u> of females is 50 to 115 / the spread is 50 for males <u>and</u> 65 for females

2

(b) (i) **2.6** to **2.7** = 2 marks;

Incorrect answer but evidence of a numerator of **24180 OR 156 × 155** <u>or</u> denominator of **9014** = 1 mark;

2

(ii) (Fewer plant species) − no mark

1. (So) few(er) habitats / niches;

Ignore habitat size

Q Neutral: fewer homes

2. (So) lower diversity of <u>insects</u> / fewer <u>insect</u> species / fewer <u>insect</u> types;

Q Neutral: fewer <u>insects</u>

Accept less variety of <u>insects</u>

3. (So) fewer food source<u>s</u> / less variety of food.

Q Neutral: less food

Ignore references to pesticides, farmers' actions, competition between lizards and evolution

3

[7]

7 **(a)** 1. Recognise / identify / attract same species;

        Ignore: references to letting them produce fertile offspring

    2. Stimulates / synchronises mating / production / release of gametes;

    3. Recognition / attraction of mate / opposite sex;

        Accept finding a mate

        Accept: gender

    4. Indication of (sexual) maturity / fertility / receptivity / readiness to mate;
    5. Formation of a pair bond / bond between two organisms (to have / raise young).

                                                           3 max

(b) 1. Use a (real) male (with intact wings / no wing removed);

        Mark ignoring reference to birds / or other types of animals

        Accept: use a real cricket, since only males sing

    2. Determine (percentage) response (of females compared with **L**).

        *Accept: compare results with **L***

                                                                     2

(c) 1. Lowest / only 30% courtship with no song / K / (or) courtship still occurred when no song played / **K**;

        Note: throughout, for courtship accept response / stimulation / reaction

        Neutral: references to methodology

        Answer must make clear there is no song / version K

    2. Reduced courtship when no ticks / M / there is some courtship when no ticks / M;

    3. Reduced courtship when no chirps / N / there is some courtship when no chirps / N;

        Accept: use of figures from the table <u>in an explanation</u>

    4. (So) courtship must involve a visual stimulus / other factor involved;

    5. Chirps more important as lowest courtship when none / N / ticks less important as similar courtship when changed / M;

        Must make comparison to gain mark

    6. Data only show presence and absence of chirps / 0 and 7 chirps.

        Note: 'courtship still occurred when no sound played so a visual stimulus / other factor / something else (e.g. pheromone?) must be involved'

        = 2 marks

                                                                  4 max

                                                                    [9]

8 **(a)** Aves;

                                                              1

(b)   Gallicolumba kubaryi;

        Must have <u>both</u> words and in <u>this</u> order
        Must be capital G
        If starts with k, award mark as impossible to recognise difference
        Ignore: underlining
        Accept: phonetic spelling
        Accept: G kubaryi (must be a capital / upper case G)

                                                                                    1

(c)   No overlap.

                                                                                    1
                                                                              [3]

9   (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 <u>active site</u>;

        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]

10 (a) (i) 1. Groups within groups;

        *Accept: idea of <u>larger</u> groups at the top **or** smal<u>ler</u> groups at the bottom*

        2. No overlap (between groups);

2

      (ii) **3**;

1

      (iii) Chordata;

        Accept: if phonetically correct eg 'Cordata'

1

(b) (i) 1. (To provide) genetic variation;

Genetic variation must be directly stated and not implied

2. (Allows) different combinations of maternal and paternal chromosomes / alleles;

Accept: any allele of one gene can combine with any allele of another gene

2

(ii) 1. (Zedonk has) 47 / odd / uneven number of chromosomes;

Accept: diploid number would be odd

Reject: if wrong number of chromosomes is given

2. Chromosomes cannot pair / are not homologous / chromosome number cannot be halved / meiosis cannot occur / sex cells / haploid cells are not produced;

Accept: cannot have half a chromosome

Q *Reject: meiosis cannot occur **in** sex cells*

2

[8]

11 (a) 1. Number of (individuals of) each species;

Accept: 'population' for 'number'

2. Total number of individuals / number of species;

Accept: 'species richness'

MP2 allows for other types of diversity index

2

(b) (i) (Shows) results are due to the herbicide / are not due to another factor / (to) compare the effect of using and not using the herbicide / shows the effect of adding the herbicide;

Neutral: allows a comparison

Neutral: ensures results are due to the independent variable

Reject: 'insecticide'

Accept: 'pesticide'

1

(ii) 1. (More) weeds killed **so** more crops / plants survive / higher yield / less competition;

2. High concentrations (of herbicide) harm / damage / kill / are toxic to crops / plants;

Accept: 'pesticide'

Neutral: 'insecticide'

Accept: use of figures (eg 400+)

2

（iii）　1.　Reduced plant diversity / fewer plant species / fewer varieties of plant;

Accept: 'weed' for 'plant'

Neutral: fewer plants

Accept: only one crop species remains

2.　Fewer habitats / niches;

***Q** Neutral: fewer homes / shelters*

3.　Fewer food sources / varieties of food;

Neutral: less food

3

[8]

12　(a)　(i)　(In all organisms / DNA,) the same triplet codes for the same amino acid;

Accept codon / same three bases / nucleotides

Accept plurals if both triplets and amino acids

Reject triplets code for an amino acid

Reject reference to producing amino acid

1

(ii)　64;

1

(b)　Splicing;

Ignore deletion references

Accept RNA splicing

1

(c)　(i)　1.　(Mutation) changes triplets / codons after that point / causes frame shift;

Accept changes splicing site

Ignore changes in sequence of nucleotides / bases

2.　Changes amino acid sequence (after this) / codes for different amino acids (after this);

Accept changes primary structure

Reject changes amino acid formed / one amino acid changed

3.　Affects hydrogen / ionic / sulfur bond (not peptide bond);

4.　Changes tertiary structure of protein (so non-functional);

Neutral 3-D structure

3 max

(ii) 1. Intron non-coding (DNA) / only exons coding;

Context is the __intron__

Do not mix and match from alternatives

Neutral references to introns removed during splicing

1.and 2. Ignore ref. to code degenerate and get same / different amino acid in sequence

2. (So) not translated / no change in mRNA produced / no effect (on protein) / no effect on amino acid sequence;

Accept does not code for amino acids

OR

3. Prevents / changes splicing;

4. (So) faulty mRNA formed;

Accept exons not joined together / introns not removed

5. Get different amino acid sequence;

2 max

[8]

13 (a) (i) Centromere;

Accept: if phonetically correct

Reject: centriole

1

(ii) 1. Holds chromatids together;

2. Attaches (chromatids) to spindle;

3. (Allows) chromatids to be separated / move to (opposite) poles / (centromere) divides / splits at metaphase / anaphase;

*3. **Q** Neutral: chromosomes or chromatids split / halved / divided*

3. Reject: reference to homologous chromosomes being separated

Accept 'chromosomes' instead of 'chromatids'

*Ignore incorrect names for **X***

2 max

(iii) (Homologous chromosomes) carry different alleles;

Accept alternative descriptions for 'alleles' eg different forms of a gene / different base sequences

Neutral: reference to maternal and paternal chromosomes

1

(b) (i) (In **Figure 2**)

1.   Chromatids have separated (during anaphase);

*1. **Q** Neutral: split / halved / divided*

1. Reject: reference to homologous chromosomes being separated

or

2.   Chromatids have not replicated;

1. & 2. Accept 'chromosomes' instead of 'chromatids'

or

3.   Chromosomes formed from only one chromatid;

*Accept converse arguments for **Figure 1***

Ignore references to the cell not dividing as in the question stem

Ignore: named phases

1 max

(ii) 1.   Three chromosomes;

Ignore shading

2.   One from each homologous pair;

Only one mark for three chromosomes shown as pairs of chromatids

2

(iii) Crossing over / alleles exchanged between chromosomes or chromatids / chiasmata formation / genetic recombination;

Accept: description of crossing over eg sections of chromatids break and rejoin

Neutral: random fertilisation

Reject: reference to sister chromatids

***Q** Neutral: genes exchanged*

Neutral: mutation

1

[8]

14 (a) 1. Group of similar organisms / organisms with similar features / organisms with same genes / chromosomes;

1. Accept: same number of chromosomes

1. Accept: smallest taxonomic group

1. Reject: genetically identical. Only allow 1 max if mentioned

*1. **Q** Neutral: similar genes / chromosomes*

2. Reproduce / produce offspring;

2. Accept: breed / mate

3. That are fertile;

3. Neutral: that are 'viable'

'Produce fertile offspring' = 2 marks

2 max

(b) (i) Correct answer of 6.97 to 7 = 2 marks;

One mark for 6320 as numerator or 906 as denominator;

2

(ii) 1. Decrease in variety of plants / fewer plant species;

1. Accept: reference to monoculture or description

1. Neutral: fewer plants

2. Fewer habitats / niches;

2. Neutral: fewer homes / less shelter

3. Decrease in variety of food / fewer food sources;

3. Neutral: less food

3. Accept: less variety of prey

3

[7]