Mark schemes

Q1.

(a) 1. Mutations/genotype/alleles;

2. Environment/habitat

OR

(Natural) selection;

Accept named different habitats, e.g. 'walls' and 'trees/trunks.

Accept selection pressure e.g. predation.

3. Epigenetics;

4. Crossing over;

Accept recombination.

5. Independent segregation/assortment (of homologous chromosomes);

Accept 'Random assortment'.

6. Random fusion of gametes

OR

Random fertilisation;

2 max

(b) 1. Provides camouflage;

Accept description of camouflage.

2. (So) not seen by predators/prey

OR

Less predation

OR

Obtain/catch (more) prey;

Accept 'stops predation'.

Accept descriptions of reduced predation e.g. 'fewer are eaten'.

2

(c) **Mark point 1 required for max marks**

1. (Geckos in) same habitat/environment/area

OR

No geographical isolation/separation (between geckos);

2. (Possibly) allopatric speciation as different (areas of same) habitat(s)/environment/area

OR

(Possibly) geographical isolation/separation as different (areas of same) habitat(s);

Accept 'walls' and 'trees/trunks' as different habitats.

3. (Could lead to) separate gene pools

OR

Reproductive isolation;

Accept 'can't interbreed' in correct context, i.e., not when describing a species.

Accept 'no gene flow'.

4. Mutation(s);

Reject mutation(s) if context incorrect e.g., 'mutate to adapt', 'mutation caused by selection'.

5. Selection for (both) extremes/colours

OR

Disruptive selection (occurs) as two extremes/ colours;

Accept description of selection e.g. 'favoured'.

Accept selection against 'middle'

6. (Analysis shows that) diurnal geckos are a distinct (genetic) group;

Accept 'nocturnal' for 'diurnal'.

7. (Genomes/DNA indicates geckos are) same species;

5 max

(d) 1. Compare <u>DNA</u> base/nucleotide sequence

OR

Compare banding/position of DNA fragments;

Idea of 'comparison' must be conveyed.

Accept alleles/VNTRs for 'DNA fragments'.

Accept genes for 'DNA fragments' in 1 but reject genes in mark point 2.

Ignore 'gene machine'.

2. A distinct (group) will have different alleles/DNA/banding (from other group/s)

OR

If **not** distinct (group) will have similar alleles/DNA/banding (to other group/s)

Accept genes for 'DNA fragments' in 1 but reject genes in mark point 2.

Accept in context of either nocturnal or diurnal group being the distinct group.

Accept not 'closely related' for 'distinct (group)' and 'closely related' for 'not distinct (group)'.

Reject 'species' for 'group'.

3. DNA sequencing is automated/computerised

OR

Genetic/DNA fingerprinting is automated/ computerised

OR

PCR amplifies DNA/genes

OR

Genetic fingerprinting/electrophoresis separates fragments/genes/alleles

OR

Use of DNA probes/hybridisation to identify genes/alleles;

Ignore 'gene machine'.

(e) 1. Marking not toxic **so** does not affect survival

OR

Marking not visible to predators

OR

Marking does not wash/rub off **so** recaptured (geckos) identified;

Ignore births, deaths, reproduction, immigration, emigration.

Accept 'does not cause harm/death' for 'does not affect survival'.

Idea of marking affecting visibility required in relation to predators.

2. Time/delay after release **so** (geckos) spread (in the population)

OR

Time/delay before recapture **so** (geckos) spread (in the population);

Accept 'after marking' for 'after release'

3. (Population =) (number in) first sample × (number in) second sample divided by (number) marked in second sample / number recaptured;

Accept the correct equation/formula.

3

[15]

Q2.

(a) **Mark as pairs: 1 and 2 OR 3 and 4**

1. Deletion/translocation;

2. Could mean triplet(s)/codon(s) missing

OR

Could mean amino acid(s) missing (from the polypeptide/SURF1);

Reject could mean an amino acid is not produced

3. Substitution/inversion/addition/duplication/ deletion/translocation;

4. Could result in a (premature) stop triplet/codon;

2 max

(b) Correct answer of 3 (people) = **3 marks**;;;

3.462564706/3.48/3.45 (or any correct rounding down to 1dp) = **2 marks** (answer not to the nearest whole number)

23 = **2 marks** (number of Faroe Islanders with nuclear mutations)

4 = **2 marks** (not factored in that only 80% of mutations are in nuclear DNA)

29 = **1 mark** (number of Faroe Islanders with LS)

3

(c) **Mark as pairs: 1 and 2 OR 3 and 4**

1. Genetic drift;

2. Frequency is higher by chance

OR

High frequency is not due to natural selection;

3. (Only) inbreeding/interbreeding (within a population)

OR

No (inter)breeding with other populations

OR

(Inherited from) common ancestor;

*Accept descriptions of inbreeding **OR** no interbreeding*

Accept reproductively isolated

*Accept genetic bottleneck **OR** founder effect*

4. Low genetic diversity

OR

Small gene pool

OR

Little gene flow
OR

Higher chance of inheriting allele
OR

Frequency of allele higher (in offspring);

2 max

(d) **2 max for mark point 1 to 4 OR 5 to 7**

Yes (no mark)

1. Some people could be heterozygous/carriers;

2. Could prevent (human) suffering/death
OR

Could allow for (informed) decisions about having children;

3. (But only) in families/people with a history of LS
OR

(only) in families/people in the Faroe Islands (where high frequency/1: 1700);

4. Cost of screening might be cheaper than cost of treating LS;

No (no mark)

5. It is rare (globally)
OR

(Only) 1 in 40 000 (globally);

6. Caused by (too) many genes/one of 75 genes
OR

Would need (too) many probes/75 probes;

7. (Too) expensive to produce tests/probes (for more than 75 different genes)

OR

(Too) expensive to screen **all**;

3 max

[10]

Q3.

(a) 1. (Colour vision involves) cones;

*1, 2 and 3 Reject 'red cones/photoreceptors' and 'green cones/photoreceptors' only **once**.*

*1 and 2 Each cone has a different pigment or absorbs particular wavelengths = **two** marks.*

*1 and 3 Greater absorption by 'red sensitive' than 'green sensitive' cones = **two** marks.*

2. (Each type of) photoreceptor has a different pigment

OR

(Each type of) photoreceptor absorbs particular/different (range of) wavelength(s)

OR

(Each type of) photoreceptor stimulated by particular/different (range of) wavelength(s);

3. Greater absorption by 'red sensitive' than 'green sensitive' (cells/photoreceptors/cones)

OR

Provides percentage values which indicate difference in light absorption (at 600nm)

OR

More impulses to brain from 'red sensitive' than 'green sensitive' (photoreceptors/cones)

OR

More impulses along optic nerve from 'red sensitive' than 'green sensitive' (photoreceptors/cones);

Allow approximately correct percentage values.

Accept suitable alternatives for 'sensitive' e.g. detecting/absorbing.

Accept action potentials for impulses.

*Do **not** credit 'signals', 'messages' for third or fourth options for mark point 3.*

3

(b) Box 3 correct - Several photoreceptors connecting to one neurone and spatial summation

1

(c) 1. Geographical isolation/separation due to elevation/altitude;

2. Allopatric speciation due to isolation/separation;

3. Different selection pressures

OR

Different environment(s);

Accept selection (due to) flower colour.

Accept different 'abiotic conditions/factors' for 'different environment(s)' or different named factor e.g. temperature, humidity but 'different altitudes' on its own is not enough.

4. (However) some overlap in distribution

OR

(Both) plants found in same area/habitat/altitude;

5. So (possibly) sympatric speciation;

Only awarded if mark point 4 is credited.

6. (Variation due to) mutation(s);

Reject mutation(s) if context incorrect e.g. 'mutate to adapt'.

7. Reproductive isolation/separation due to different pollinators/distributions/altitudes

OR

Separate gene pools due to different pollinators/distributions/altitudes;

Accept 'no gene flow' for separate gene pools.

8. Change in allele frequency (in each population)

OR

Different allele frequency (in each population);

Accept 'increase' or 'decrease' for 'change'.

9. Different species) can no longer (interbreed to) produce fertile offspring;

5 max

[9]

Q4.

(a) 1. *E. rufus* in north (west)
OR
E. rufus in the west
OR
E. rufus above river;

2. *E. rufifrons* in south
OR
E. rufifrons in west **and** east
OR
E. rufifrons below river;

1 and 2. Accept equivalent valid statements e.g., for 1, no E. rufus in south.

*1 and 2. If neither mark is awarded, accept, for one mark, 'they are separated by the river' **OR** 'there is no overlap in their distribution/ranges'.*

1 and 2. Accept converse.

1 and 2. Do not penalise 'prefer'.

3. (Actual) distribution similar to expected (distribution)
OR
(Actual) distribution similar to environmental needs
OR
(Actual) distribution (slightly) less than expected distribution;

Accept for one or both species.

3

(b) 1. Geographical isolation;
OR
Allopatric speciation;

Ignore descriptions of geographical isolation.

Reject sympatric.

Ignore reference to two species at start.

2. Reproductive separation/isolation
OR
No gene flow
OR
Gene pools separate;

Reproductive isolation must be at beginning of process.

Accept no interbreeding but must be a separate idea from mp 6 which relates to definition of a species.

Reject no inbreeding.

3. Different selection pressures;
OR
Different environmental/abiotic conditions/factors;

4. (Variation due to) mutation(s) (in different populations);

5. (Different/advantageous) allele/s passed on/selected
OR
Change in frequency of allele/s;

6. (Eventually different species) cannot (inter)breed to produce fertile offspring;

5 max

(c) (Marking) does not affect survival/predation/recapture;

Accept. Mark does not rub/wash off/is non-toxic.

Ignore 'does not harm' on its own unless it relates to survival/predation/recapture.

1

(d) 3;

Ignore any wording provided e.g. lemurs.

1

[10]