M1.(a) (i) Unit of energy / mass, per area, per year.

1

(ii) 1. Less light / more shading / more competition for light;
Neutral: references to animals

2. Reduced photosynthesis.
Accept: no photosynthesis

2

(b) 1. Pioneer species;
2. Change in abiotic conditions / less hostile / more habitats / niches;
Accept: named abiotic change or example of change e.g. formation of soil / humus / organic matter / increase in nutrients
Neutral: reference to change in environment unqualified
Neutral: more hospitable / habitable / homes / shelters

3. Increase in number / amount / diversity of species / plants / animals.
Accept: other / new species (colonise)

3

(c) 1. Net productivity = gross productivity minus respiratory loss;
2. Decrease in gross productivity / photosynthesis / increase in respiration.

2

(d) 1. Conserving / protecting habitats / niches;
2. Conserving / protecting (endangered) species / maintains / increases (bio) diversity;
3. Reduces global warming / greenhouse effect / climate change / remove / take up carbon dioxide;
4. Source of medicines / chemicals / wood;
5. Reduces erosion / eutrophication.
Accept: tourism / aesthetics / named recreational activity

1 max

[9]

M2.(a) 1. Geographic(al) isolation;

2. Separate gene pools / no interbreeding / gene flow (between populations);

Accept: reproductive isolation

This mark should only be awarded in context of during the process of speciation. Do not credit if context is after speciation has occurred.

3. Variation due to mutation;
4. Different selection pressures / different abiotic / biotic conditions / environments / habitats;

Neutral: different conditions / climates if not qualified

Accept: named abiotic / biotic conditions

5. Different(ial) reproductive success / selected organisms (survive and) reproduce;

Accept: pass on alleles / genes to next generation as equivalent to reproduce

6. Leads to change / increase in allele frequency.

Accept: increase in proportion / percentage as equivalent to frequency

6

(b) 1. Capture / collect sample, mark and release;
2. Method of marking does not harm lizard / make it more visible to predators;
3. Leave sufficient time for lizards to (randomly) distribute (on island) before collecting a second sample;
4. (Population =) number in first sample × number in second sample divided by number of marked lizards in second sample / number recaptured.

4

(c) 1. High concentration of / increase in carbon dioxide linked with respiration at night / in darkness;
2. No photosynthesis in dark / night / photosynthesis only in light / day;

Neutral: less photosynthesis

3. In light net uptake of carbon dioxide / use more carbon dioxide than produced / (rate of) photosynthesis greater than rate of respiration;
4. Decrease in carbon dioxide concentration with height;

More carbon dioxide absorbed higher up

Accept: less carbon dioxide higher up / more carbon dioxide

lower down

5. (At ground level)
less photosynthesis / less photosynthesising tissue / more respiration / more micro-organisms / micro-organisms produce carbon dioxide.
Neutral: less leaves unqualified or reference to animals

5

[15]

M3.(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]

M4.(a) (i) (Organisms that) can breed together / interbreed **and** produce fertile offspring;
Need both aspects. Reject 'inbreed'
Reject viable offspring

1

(ii) Same number (of organisms) in each region / (organisms) equally spread;
Allow other ways of expressing 'region' or 'equally spread',

eg not clumped together, same number per unit area

1

(b) $P = \frac{AS}{R}$;;

2 marks for correct answer

*1 mark for having **A** on top of equation (recognises that total population related to total area)*

Note:

P = A × S / R or
P = A / R × S

are also correct.

Allow 1 mark for

$\frac{S}{P} = \frac{R}{A}$

2

(c) (i) *In mark–release-recapture (technique)*

Accept converse by considering assumptions of proportional sampling

1. No assumption that organisms are uniformly distributed;

2. Size of total area / size of sampled region not required;

Marking point 1 or marking point 2 do not have to start with the same technique

In this case, allow difference by implication i.e. do not penalise if the two techniques are not compared

2

(ii) Animals are from / all part of the same population;

1

[7]