

- 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:

$$P = A \times S / R \text{ or}$$

$$P = A / R \times S$$

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]