

M1.(a) (i) any **two** from:

- (dead) animal buried in sediment
allow imprint in mud
- hard parts / bones do not decay **or** soft parts do decay
allow (one of) the conditions for decay is missing – accept example, eg oxygen / water / correct temperature / bacteria
- mineralisation (of hard parts / bones)
allow replacement by other materials

2

(ii) any **two** from:

- conditions not right for fossilisation
ignore references to soft-bodied
- geological activity has destroyed fossils / has destroyed evidence
allow a named / described example – eg vulcanism / earth movements / erosion
- fossils not yet found
allow description of why not yet found

2

(b) any **four** from:

- separation / isolation (of different populations)
- different environmental conditions (between locations)
- mutation(s) occur **or** genetic variation (within each population)
- better adapted survive **or** natural selection occurs
allow 'survival of the fittest'
ignore animals adapt to their environment
ignore reference to stronger survive
- favourable alleles passed on (in each population)
allow genes for alleles
- eventually different populations unable to breed successfully with each other
allow unable to produce fertile offspring

4

[8]

M2.(a) (i) 3.15 : 1

accept 3.147:1 or 3.1 : 1 or 3 : 1
do **not** accept 3.14 : 1
Ignore 705:224

1

(ii) any **two** from:

- fertilisation is random **or** ref. to chance combinations (of alleles / genes / chromosomes)
- more likely to get theoretical ratios **or** see (correct) pattern **or** get valid results if large number
allow ref. to more representative / reliable
*do **not** allow more accurate **or** precise*
ignore fair / repeatable
- anomalies have limited effect / anomalies can be identified
accept example of an anomaly

2

(b) (i) in sequence:

Homozygous
Homozygous
Heterozygous

All 3 correct = 2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks

2

(ii) genetic diagram including:

Parental genotypes: **Nn** and **Nn**

allow other characters / symbols only if clearly defined

1

or

Gametes: **N** and **n** + **N** and **n** derivation of offspring genotypes:

NN Nn Nn nn

allow genotypes correctly derived from candidate's P gametes

1

identification: **NN** and **Nn** as purple **and nn** as white
*allow correct identification of candidate's offspring genotypes
but only if some F₂ are purple and some are white*

1

(c) any **two** from:

- did not know about chromosomes / genes / DNA
or did not know chromosomes occurred in pairs
ignore genetics
- had pre-conceived theories
*eg blending of inherited characters
ignore religious ideas unless qualified*
- Mendel's (mathematical) approach was novel concept
*allow his work was not understood or no other scientist had
similar ideas*
- Mendel was not part of academic establishment
*allow he was not considered to be a scientist / not well
known / he was only a monk*
- work published in obscure journal / work lost for many years
- peas gave unusual results of other species
allow he only worked on pea plants
- Mendel's results were not corroborated until later / 1900

2

[10]

M3.(a) (i) variation (in population) / mutation

1

longer nosed individuals get more food / leaves
allow longer nosed individuals more likely to survive

1

(these) survivors breed (more)

1

pass on genes / alleles / DNA (for long nose)
allow pass on mutation

1

- (ii) Phiomia / ancestor stretched its nose (during its lifetime) to reach food / leaves

1

passed on (stretched nose) to offspring
allow offspring inherit (stretched nose)
do not allow ref to genes

1

- (b) (i) insufficient evidence / no proof
ignore other theories, eg religion
do not allow no evidence

1

mechanism of inheritance not known
allow genes / DNA not discovered

1

- (ii) God made all living things / them
allow creationism
ignore religion

1

[9]

- M4.(a)** lack of fossils / fossils destroyed
allow lack of evidence

1

(due to soft parts) decaying / geological activity
allow an example – eg vulcanism or earth movements or erosion
allow converse points re skeletons, shells, hard parts

- 1
- (b) (i) **A** and **B** did not mate successfully
'A and B did not mate' insufficient
allow did not produce fertile offspring
- 1
- (ii) any **two** from:
- may not be mating season
 - **A** and **B** may not find each other attractive
 - this is just a one-off attempt / an anomaly / need repeats
 - may be juvenile / immature
 - may be the same sex
- allow other sensible suggestion eg were put in unfavourable environment or one / both could be infertile*
- 2
- (c) 1. (two ancestral populations) separated (by geographical barrier / by land) / were isolated
- 1
2. genetic variation (in each population) **or** different / new alleles **or** mutations occur
- 1
3. different environment / conditions
allow abiotic or biotic example
- 1
4. natural selection occurs **or** some phenotypes survived **or** some genotypes survived
- 1
5. (favourable) alleles / genes / mutations passed on (in each population)
- 1
6. eventually two types cannot interbreed successfully
allow eventually cannot produce fertile offspring
- 1

[11]

M5.(a) variation (between organisms within species)

allow described example
*allow mutation – but **not** if caused by change in conditions*

1

those most suited / fittest survive

1

genes / alleles passed on (to offspring / next generation)
allow mutation passed on

1

(b) (i) any **two** from:

allow converse

- increase in latitude reduces number of (living) species
ignore references to severity of conditions
- increase in latitude reduces time for evolution (of new species)
- the less the time to evolve the fewer the number of (living) species

2

(ii) any **two** from:

*do **not** accept intention or need to evolve*

- (increase in latitude reduces number of (living) species because) less food / habitats / more competition at high latitude
allow only extremophiles / well-adapted species can survive
- (increase in latitude reduces time for evolution (of new species) because) severe conditions act more quickly / to a greater extent on the weakest
- (the less the time to evolve the fewer the number of (living) species because) species that evolve slowly don't survive

2

[7]

M6.(a) organisms that can breed together

accept converse points re. 2 different species

1

successfully

accept produces fertile offspring

1

(b) any **two** from:
(live at)

- different pH of soil
- different height above sea level
- different flowering times

2

AND

genetic variation / mutation / different alleles (produced in isolated populations)

1

natural selection acts differently on the two populations

or different characteristics in the two populations survive

or different alleles passed on in the two groups

1

eventually resulting in interbreeding no longer possible

1

[7]

M7.(a) wing pattern similar to *Amauris*

allow looks similar to Amauris

1

birds assume it will have an unpleasant taste

1

- (b) mutation / variation produced wing pattern similar to *Amauris*
do not accept breeds with Amauris
do not accept idea of intentional adaptation

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]