

M1.(a) part of a chromosome

allow piece of DNA

allow parts of chromosomes

1

controls a characteristic

allow controls characteristics

allow codes for (or controls production of) protein / enzyme

ignore examples of characteristics

1

(b) (iPS method)

max 3 similarities or differences

allow converse if clearly referring to adult cell cloning

similarities

- (both) use of skin / body cell
- (both) ref to (formation of) embryo
- (both) transfer (embryo) into womb / uterus
- (both) use surrogate mothers

differences

- (iPS) uses sexual reproduction
*allow ref to egg **and** sperm **or** gametes **or** fertilisation*
- (iPS) surrogate mother is different species
- (iPS) no nucleus transfer / removal
- (iPS) offspring genetically different from parent
allow not a clone
- (iPS) no electric shock

4

(c) any **one** from:

- idea of retaining biodiversity
- may be (economically) useful (in the future)
- idea of maintaining food chain / ecosystem

1

[7]

M2.(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]

- M3.(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

- 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]

M4.(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]

M5.(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]

M6.(a) (use of) enzymes

1

(b) asexual reproduction / no gametes / no fusion / only one parent

ignore clones

1

cells all contain same genetic information / same genes (as parent) / same DNA

1

- (c) can spray crop with herbicide – only weeds killed
crop survives herbicide insufficient

1

- (d) any **one** from:

allow 'think that GM food is bad for health'

- fears / lack of knowledge about effects of GM food on health
ignore not natural or against religion
- crop plants may pass on gene to wild plants
- encourages use of herbicides

1

[5]

M7.(a) Lamarck

ignore any first name(s)

1

- (b) (i) variation / range of sword lengths (in ancestors)
accept mutation produced longer sword

1

those with long swords get more food
accept those with short swords get less food

1

swordfish (with long swords) survive **and** breed

allow have offspring for breed

1

(survivors) pass on gene(s) / allele(s) (for long sword)

allow mutation for gene(s) / allele(s)

1

(ii) any **one** from:

- more evidence (now)
accept examples of evidence, e.g. more fossils
- DNA / genes / mechanism of inheritance discovered
allow Lamarck's theory has been disproved
ignore religious arguments
ignore proof

1

[6]

M8.(a) (i) DNA replication / copies of genetic material were made

'it' = a chromosome

allow chromosomes replicate / duplicate / are copied

ignore chromosomes divide / split / double

1

(ii) one copy of each (chromosome / chromatid / strand) to each offspring cell

ignore ref. to gametes and fertilisation

1

each offspring cell receives a complete set of / the same genetic material

allow 'so offspring (cells) are identical'

1

(b) (i) meiosis

allow meiosis as the only alternative spelling

1

(ii) Species A = 4 **and** Species B = 8

1

(iii) sum of A + B from (b)(ii) e.g. 12

1

(c) (i) similarities between chromosomes **or** similarities between flowers described

e.g. shape of petals / pattern on petals / colour / stamens

1

can breed / can sexually reproduce

allow can reproduce with each other / they can produce offspring

1

(ii) any **two** from:

- offspring contain 3 copies of each gene / of each chromosome / odd number of each of the chromosomes
- some chromosomes unable to pair (in meiosis)
- (viable) gametes not formed / some gametes with extra / too many genes / chromosomes

or some gametes with missing genes / chromosomes

2

[10]