Mark schemes

Q1.

(a)

Classification group
Kingdom
Phylum
Class
Order
Family
Genus
Species

all 4 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks

2

(b) Geospiza fortis

ignore underlining or attempted italics or upper and lower case letters

1

(c) offspring have similar beak depths to parents

ignore same beak depths
ignore positive correlation / described

1

(d) parents of a given beak depth produce offspring with several beak depths

allow spread of results for a given parental beak depth about line of best fit
allow range of phenotypes for a given parental beak depth

1

(e) colonisers of Isabela have a range of beak depths

allow colonisers of Daphne have a range of beak depths

1

due to different combinations of alleles of several genes

or

due to different alleles of one gene

or

due to mutation

1

large range of (sizes / species of) seeds / food (on Isabela)
or
large(r) seeds (on Isabela)

allow small range of (sizes / species of) seeds / food on Daphne

or

allow small(er) seeds on Daphne

1

more competition for seeds / food (on Isabela)

allow less competition for seeds / food on Daphne

ignore competition unqualified

1

birds with larger beaks get enough food to (survive and) reproduce (on Isabela)

allow birds with smaller / medium beak sizes get enough food to (survive and) reproduce on Daphne

1

(survivors) pass on (beneficial) alleles to offspring

allow pass on genes / mutation ignore pass on chromosomes / characteristics

1

(f) Isabela is a large island with more species of plants
or
Isabela is a large island with more variety in seed / food sizes
or
Isabela is a large island with more plants / seeds / food

1

less competition for seeds / food
or
enough seeds / food for both bird species

1

[13]

Q2.

(a) 3.7

1

(b) 2

1

(c) (different combinations of alleles cause) many / 22 values

allow continuous variation

or

in-between values
or
large range of values
or
there are not only two values

allow there are not only 3 values if 3 is given in part (b)

1

(d) different protein made

allow change in shape (of enzyme) or change in 3-D structure
ignore denature

1

active site changed

1

so substrate does not fit / bind

allow description of substrate
allow cannot form E-S complex
ignore lock and key description

1

(e) produces (some) offspring with high-fat milk
or
not all offspring have low-fat milk

ignore reference to alleles

1

(f) takes less time (to obtain results)
or
more offspring at the same time

allow other sensible suggestion – e.g. allows screening or allow cow 7 to continue to produce eggs or avoid injury to cow 7 during mating or giving birth

1

(g) male gametes correct: d (and d)

1

female gametes correct: D and d

1

allow 1 mark if gametes are correct but gender not identified

correct derivation of offspring genotypes from given gametes

allow 2 × 2 or 2 × 1 derivation

1

Dd identified as low-fat and dd identified as high-fat in offspring

if DD offspring are produced, must also identify as low-fat

1

(h) find female with low(est) fat in milk and high(est) milk yield

allow choose from 7, 9, 12, 13 which has the highest yield

1

find male whose female offspring have high(est) milk yield and low(est) fat in milk

allow choose from 16 or 18 whose female offspring has the highest yield

1

or

find female with lowest fat in milk
or cow 13 (1)*

**or*
allow female with high(est) milk yield

find male whose female offspring have high(est) milk yield (1)*

**or*
allow male whose female offspring have lowest fat in milk / male 16

cross the best (for both features) female with the best male

1

select best offspring (for both features) from each generation and repeat for several generations

1

[16]

Q3.

(a)

Classification group	Name
Class	*Mammalia*
Order	*Primates*
Family	*Lemuroidea*
Species	*catta*

all 4 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks

2

(b) Lemur catta

ignore capitalisation / non-capitalisation of initial letters

ignore italics / non-italics
ignore underlining / non-underlining

1

(c) carried by (favourable) currents on masses of vegetation

allow description of currents from Figure 2
ignore swimming

1

(d) isolation of different populations

1

habitat variation between lemur populations

allow examples – biotic (e.g. food / predators) or abiotic (e.g. temperature)

1

genetic variation or mutation (in each population)

1

better adapted survive (reproduce) and pass on (favourable) allele(s) to offspring

allow natural selection or survival of the fittest and pass on (favourable) allele(s) to offspring allow gene(s) / mutation as an alternative to allele(s)

1

(eventually) cannot produce fertile offspring with other populations

allow cannot reproduce 'successfully' with other populations
ignore cannot reproduce unqualified

1

[9]

Q4.

(a) less sweating so less water loss

1

(as) no / little water available in desert

1

(b) (fat store) can be metabolised / respired to water

1

(little urine...) conserve water

1

(hard mouth) not damaged by spines on plants / on food
or
not damaged by hard / dry food

1

(c) dromedary / *C.dromedarius*
and bactrian / *C. bactrianus*

no mark for the names, but must be identified

because
same genus

ignore 'both are Camelus'

1

(d) any two from:

- the fossil record
- oldest fossils in N. America
  or
  newer fossils in S. America / in Asia / in Africa

  allow numbers for ages (45 Mya and 3 Mya / 6 Mya)

- chemical / DNA analysis of living species

  allow radioactive dating of fossils

2

(e) isolation of separate camel populations by sea
or
by mountains

1

habitat variation / described between populations

allow examples – biotic (e.g. food / predators) or abiotic

1

genetic variation / mutation in each population

1

45 million years is sufficient time to accumulate enough mutations

1

natural selection
or
better adapted survive to reproduce

1

pass on favourable allele(s)

allow gene(s)

1

[14]

Q5.

(a) white blood cells have the same DNA / genes / chromosomes
or
have the gene for GH

allow have all the genes

allow all body cells (except RBCs) have all of the genes

1

(b) enzyme has specifically-shaped active site

1

the 2 antibiotic resistance genes have different (sequence of) bases

1

only Tetracycline-resistance gene fits (active site of) enzyme
or
only Tetracycline-resistance gene is complementary to (active site of) enzyme

1

(c)

Ampicillin	Tetracycline
✓	×
×	×
✓ ✓	

1 mark for each correct row
if no other mark, allow 1 mark for one correct column

1
1
1

(d) clone produced by asexual reproduction

allow by 'mitosis'

1

all DNA / all genes are copied

allow GH gene copied
allow plasmid copied

1

every cell receives a copy
or
receives every gene
or
receives GH gene
or
receives plasmid
or
genetically-identical cells

1

[10]

Q6.

(a) any two from:

- so that they do not have specific genetic defects
- to produce docile cats or so they are not aggressive

allow descriptions of aggression such as biting and scratching

- for aesthetic reasons

allow descriptions of suitable aesthetic reasons

2

(b) (cats) are more likely to pass on (recessive) disorders
or
more likely to be susceptible to diseases

1

(c) Level 2 (3–4 marks):
A detailed and coherent explanation is given, which logically links the process of selective breeding with explanations of how this produces cats that do not cause allergic reactions.

Level 1 (1–2 marks):
Simple statements are made relating to process of selective breeding, but no attempt to
link to explanations.

0 marks:

No relevant content.

Indicative content

process:

- parents with the desired characteristic are selected
- the parents are bred together to produce offspring
- offspring with the desired characteristics are selected and bred
- this is repeated over many generations.

explanations:

- parents who produce the least Fel D1 are initially selected
- in their offspring there will be individuals with differing amounts of Fel
- D1 produced
  care is taken to ensure cats are healthy and avoid possible problems associated
  with selective breeding
- over time the population of (selectively bred) cats will produce less Fel D1

4

[7]

Q7.

(a) three billion

1

(b) mutation(s)

1

breed / reproduce

in this order only
allow pass on their genes

1

[3]

Q8.

(a) any two from:

- larger / longer / thicker
  allow examples eg fewer toes or bones fused
- fewer (bones in total)
  allow smaller surface area touching the ground
- fewer bones touching the ground

2

(b) (i) large(r) surface / area in contact with the ground
or
low / less pressure on ground

1

(so) less likely to sink into mud / ground
or
(so) could run fast(er)
allow easy / easier to escape predators

1

(ii) variation (in size / number / arrangement of bones)
allow mutation(s) (in size / number / arrangement of bones)

1

(and) those with large(r) / few(er) bones more suited to running or run faster (on harder / drier ground)

1

these survive and breed
allow ref to offspring for breed

1

(so) genes / DNA (for larger / fewer bones) passed on
allow alleles passed on

1

[8]