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 **o**r 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 <u>active site</u>

1

the 2 antibiotic resistance genes have different (sequence of) <u>bases</u>

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]