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

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## 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) 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]**