Mark schemes

1

(a) 1. Same genus;

2. Same evolutionary origin / common ancestor.

2

(b)

Taxon	Name of Taxon
Domain	Eukarya
Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Rodentia
Family	Muridae

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

2

(c) 1. (No) SDs of means of body sizes / sizes of parts of bodies overlap;

2. Calculation of correct head and body: tail ratios;

3. Almost identical, so same body shape / proportions;

3

(d) 1. Breed the two mice together;

2. (Same species) produce fertile offspring.

2

[9]

2

(a) 1. Kingdom, Phylum, Class, Order, Family;

2. *Luscinia svecica.*

1 mark for each correct column

Allow Genus and Species if both placed in box for species but not if both placed in genus box

2

(b) Number of different alleles of each gene.

Accept number of different base sequences (found) in each gene

1

(c) 1. Has greater proportion of genes / percentage of genes showing diversity;2. Percentage is 35% compared with 28% / proportion is 0.35 compared with 0.28.

Allow correct figures that are not rounded up, i.e., 34.9% / 0.349 and 27.8% / 0.278

2 [5]

(a) PKNJ.

3 **1**

(b) *Lutra lutra.*

1

(c) Bone / skin / preserved remains / museums.

1

(d) 1. (Hunting) reduced population size(s), so (much) only few alleles left;*Accept bottleneck*

2. Otters today from one / few surviving population(s);*Accept founder effect*

3. Inbreeding.*Allow any **two***

2 max

(e) 1. Population might have been very small / genetic bottleneck;
2. Population might have started with small number of individuals / by one pregnant female / founder effect; 3. Inbreeding. *Allow any **two***

2 max

[7]

(b) 1. (So) age not a factor in female choice;

4

2. (So) will attract a mate;

3. (So similar) sexual maturity;

4. (So) have the correct feathers;

4. Accept 'have blue feathers'

2 max

(c) Number the birds, then numbers out of hat / random numbergenerator;

Both aspects needed for mark

1

(d) 1. That movement was not related to some other factor (than themale);

2. That movement (towards the male) indicated matingbehaviour;

3. (Females) only respond to throat feathers (of the male) / donot respond to other visual display / sounds / calls (by the male);

2 max

(e) 1. Change in sequence of bases / nucleotides;

2. (As a result of a) deletion / substitution;

3. Change in amino acid sequence / primary structure;

4. Change in tertiary structure of protein;

1. Do not accept 'change in the DNA sequence'

2. Accept e.g. addition / inversion / duplication / translocation

3

(f) **Yes**

1. (From resource A) birds can detect UV light;

2. (From resource B) difference between UVR and NR significant/ not due to chance;

3. As error bars do not overlap;

*1. max if only **No** marks awarded*

2. Reject idea that 'results' in resource B are significant / not due to chance, must include idea of 'difference' 3. Reject 'as standard deviations do not overlap'

No

4. UV light may not be involved in mating / other factors may beinvolved in mating;

5. Some birds in UVR group were attractive to females;

6. (Experiment in resource B) carried out in artificial conditions /only 40 birds used / small sample size;

6. Neutral: idea that this is only one study / that there are no repeats

4 max

[12] (a) 1. Recognise / identify / attract same species;

5

Ignore: references to letting them produce fertile offspring

2. Stimulates / synchronises mating / production / release of gametes;

3. Recognition / attraction of mate / opposite sex;

Accept finding a mate

Accept: gender

4. Indication of (sexual) maturity / fertility / receptivity / readiness to mate;
5. Formation of a pair bond / bond between two organisms (to have / raise young).

3 max

(b) 1. Use a (real) male (with intact wings / no wing removed);

Mark ignoring reference to birds / or other types of animals

Accept: use a real cricket, since only males sing

2. Determine (percentage) response (of females compared with **L**).

*Accept: compare results with **L***

2

(c) 1. Lowest / only 30% courtship with no song / K / (or) courtship still occurred whenno song played / **K**;

Note: throughout, for courtship accept response / stimulation / reaction

Neutral: references to methodology

Answer must make clear there is no song / version K

2. Reduced courtship when no ticks / M / there is some courtship when no ticks /M;

3. Reduced courtship when no chirps / N / there is some courtship when no chirps / N;

Accept: use of figures from the table <u>in an explanation</u>

4. (So) courtship must involve a visual stimulus / other factor involved;

5. Chirps more important as lowest courtship when none / N / ticks less importantas similar courtship when changed / M;

Must make comparison to gain mark

6. Data only show presence and absence of chirps / 0 and 7 chirps.

Note: 'courtship still occurred when no sound played so a visual stimulus / other factor / something else (e.g. pheromone?) must be involved'

= 2 marks

4 max

[9]

6 (a) (i) (Grouped according to) evolutionary links/history/relationships / common ancestry;

Ignore: closely related, factors, characteristics

Ignore: genetically similar

1

(ii) 1. Able to reproduce;

Accept: smallest taxonomic group/groups of organisms with same genes/ chromosomes/same number of chromosomes

Accept: breed for 'reproduce'

Ignore: mate

Reject: genetically identical

Ignore: similar genes/chromosomes

2. To produce fertile offspring;

Ignore: that are 'viable'

2

(b) Phylum
Class
Family
Genus;

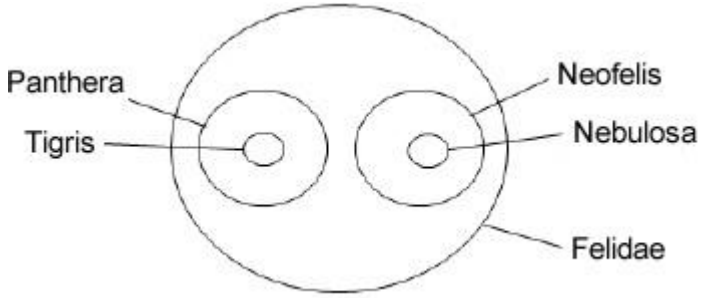
Accept: pleural answers phyla / genera / families

Accept phonetic answers phyllem/phylem/fylum/fyla/phylae/phyli /jenus/ jenera/familys

All 4 in correct order for 1 mark

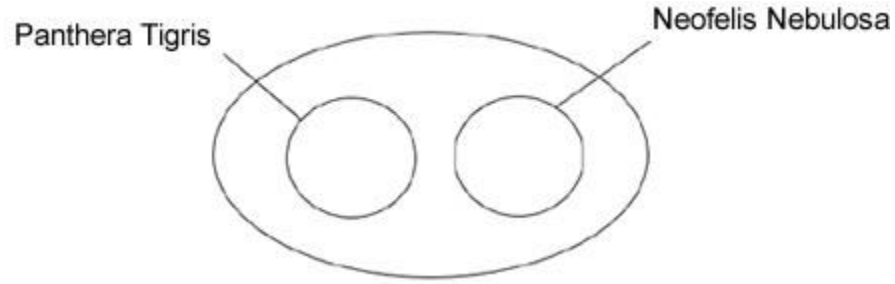
1

(c) 1. Two circles/with two inner circles with no overlap;



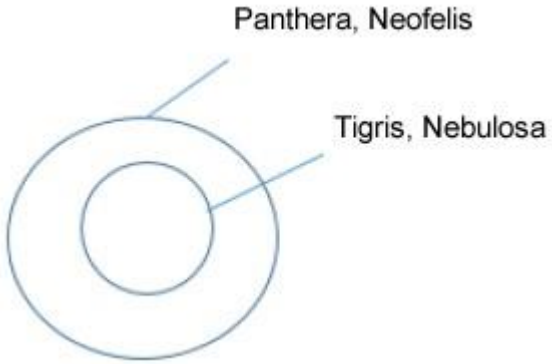
= 2 marks

OR



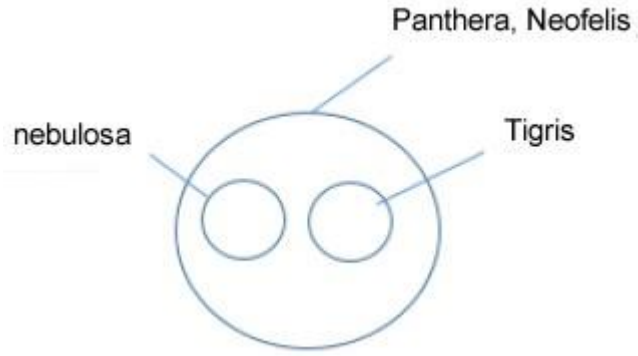
= 2 marks

OR



= 1 mark

OR



= 1 mark

2. Labels correct;

Ignore underlining / capitals

Accept: P tigris/ N nebulosa

Accept phonetic spelling

2

(d) 1. South China and Sumatran tigers share a more recentcommon ancestor;

Accept: more closely related (statement must be comparative)

Accept: a labelled hierarchy

2. (because) identical/same/matching (nucleotide) sequences;

Accept: converse for Siberian tiger eg Siberian is less closely related to South China AND Sumatran tigers

2

[8]

7

(a) Aves;

1

(b) Gallicolumba kubaryi;

Must have <u>both</u> words and in <u>this</u> order

Must be capital G

If starts with k, award mark as impossible to recognise difference

Ignore: underlining

Accept: phonetic spelling

Accept: G kubaryi (must be a capital / upper case G)

1

(c) No overlap.

1

[3]

(a) (i) 1. Groups within groups;

8

*Accept: idea of larger groups at the top **or** smaller groups at the bottom*

2. No overlap (between groups);

2

(ii) **3**;

1

(iii) Chordata;

Accept: if phonetically correct eg 'Cordata'

1

(b) (i) 1. (To provide) genetic variation;

Genetic variation must be directly stated and not implied

2. (Allows) different combinations of maternal and paternal chromosomes / alleles;

Accept: any allele of one gene can combine with any allele of another gene

2

(ii) 1. (Zedonk has) 47 / odd / uneven number of chromosomes;

Accept: diploid number would be odd

Reject: if wrong number of chromosomes is given

2. Chromosomes cannot pair / are not homologous / chromosome number cannot be halved / meiosis cannot occur / sex cells / haploid cells are not produced;

Accept: cannot have half a chromosome

***Q** Reject: meiosis cannot occur **in** sex cells*

2

[8

] (a) 1. Group of similar organisms / organisms with similar features / organisms with same

9

genes / chromosomes;

1. Accept: same number of chromosomes

1. Accept: smallest taxonomic group

1. Reject: genetically identical. Only allow 1 max if mentioned

1. ***Q** Neutral: similar genes / chromosomes*

2. Reproduce / produce offspring;

2. Accept: breed / mate

3. That are fertile;

3. Neutral: that are 'viable'

'Produce fertile offspring' = 2 marks

2 max

(b) (i) Correct answer of 6.97 to 7 = 2 marks;

One mark for 6320 as numerator or 906 as denominator;

2

(ii) 1. Decrease in variety of plants / fewer plant species;

1. Accept: reference to monoculture or description

1. Neutral: fewer plants

2. Fewer habitats / niches;

2. Neutral: fewer homes / less shelter

3. Decrease in variety of food / fewer food sources;

3. Neutral: less food

3. Accept: less variety of prey

3

[7] (a) 1. No interbreeding / gene pools are separate / <u>geographic(al)</u> isolation;

10

Accept: all marks if answer written in context of producing increased diversity of plants

1 Do not award this mark in context of new species being formed and then not interbreeding

1 Accept reproductive isolation as an alternative to no interbreeding

2. Mutation;

2 Accept: genetic variation

3. Different selection pressures / different foods / niches / habitats;

3 Accept: different environment / biotic / abiotic conditions or <u>named</u> condition

3 Neutral: different climates

4. Adapted organisms survive and breed / differential reproductive success;

5. Change / increase in allele frequency / frequencies;

5

(b) Similar / same environmental / abiotic / biotic factors / similar / same selection pressures / no isolation / gene flow can occur (within a species);

Accept: same environment

1

[6] (a) (i) 1. Groups within groups;

11

1. accept idea of larger groups at the top / smaller groups at thebottom

2. No overlap (between groups);

2

(ii) (Grouped according to) evolutionary links / history / relationships / common ancestry;

Neutral: closely related

Neutral: genetically similar

1

(b) (i) 1. (Only) one amino acid different / least differences / similar amino acid sequence / similar primary structure;

2. (So) similar DNA sequence / base sequence;

2

(ii) 1. Compared with humans / not compared with each other;

Accept: degenerate code / more than one triplet (codes) for an amino acid

2. Differences may be at different positions / different amino acids affected / does not show where the differences are (in the sequence);

1 max

(iii) 1. All organisms respire / have cytochrome c;

Accept: converse arguments for haemoglobin

1. Accept 'more' instead of 'all'

1. Accept 'animals' instead of organisms'

2. (Cytochrome c structure) is more conserved / less varied (betweenorganisms);

2. Neutral: cytochrome c is conserved

1 max

[7]

12 (a) (i) Kingdom / phylum / class;

Accept Animalia / animal kingdom / Chordata / Chordates / Aves

Allow phonetic spelling

1

(ii) Family;

1

(b) 1. Shows the spread of the data / how data varies;

1. Reject range.

Accept varies from the mean

2. Overlap = no difference / due to chance / not significant;

2. Allow converse

2

(c) 1. Different species would have different amino acid sequences;*Accept more closely related = more similar sequence*

2. Amino acid sequence is the result of DNA / alleles / base sequence;

References to incorrect statements about coding negates second mark

2

[6]

13 (a) (i) *Synodontis batensoda / S. batensoda;*

Ignore spellings

1

(ii) *Mochokus niloticus;*

Ignore spellings

1

(b) 5;

1

(c) (i) Fertile offspring produced;

Allow suitable description of offspring being fertile.

1

(ii) 1. Attracts / recognises same species;

Attracts mate of the same species = two marks.

2. Attracts / recognises mate / opposite sex;

3. Indication of sexual maturity / fertility / synchronises mating;*Allow 'ready to mate'.*

4. Stimulates release of gametes;

5. Form pair bond;

2 max

[6]

14 (a) Banding pattern changes as cheetah gets older / difficult to judge as tail is short / fluffy;

1

(b) (i) Mean not (always) a whole number;
Standard deviation not (always) zero;

2

(ii) Movement of tail / angle of sight / confused it with another band / subjective estimation;

*Accept reference to **Figure 1***

E.g. Bands 2 and 3 have same thickness but look different

1

(c) Band width not the same on both sides of tail;

1

(d) Offspring of the same family will be more similar genetically;
As have same mother (and father) / parent;
Expect to see more differences in randomly chosen cheetahs;

3

[8]

15 (a) (i) Phylum, Class, Order, Genus;

Mantophasma (M) / (Mantophasma) zephyra;

2

(ii) Groups within (larger) groups;

No overlap;

2

(b) Comparison of / look for similar features / structures / appearance;

1

[5]

16 (a) Kingdom / phylum / class;

1

(b) (i) 6;

1

(ii) Family;

1

(iii) The two species of *Mirounga* shared a common ancestor more recently than they did with *Monarchus tropicalis*;

1

(c) Difference in DNA / base sequence / alleles / genes;

1 **[5]**

17 (a) Table completed as below:

Kingdom	Animalia / Animals
Phylum	Chordata
Class	Mammalia
Order	Rodentia
Family	Caviidae
Genus	*Cavia*
Species	*porcellus*

Column 1 correct;

Column 2 correct;

2

(b) Mutation occurs;

Correct e.g. of isolating mechanism
e.g.
temporal − different breeding seasons / feeding times /
ecological / behavioural − different courtship displays / different niches / habitats / feeding areas /
mechanical − mismatch of reproductive parts /
gamete incompatibility − sperm killed in female's reproductive tract /
hybrid inviability / hybrid infertility;
Ignore references to "genetic isolation" or "reproductive isolation"

Different selection pressures operate / changes in allele frequency / divergence of gene pools;

3

(c) Using candidate's symbols for alleles −
e.g. B = black, b = brown, S = short, s = long:

Parental genotypes correct: Male **A** SSBb Female **B** SsBB;

Gametes correctly derived from candidate's parental genotypes: SB Sb SB sB;

offspring genotypes correctly derived from candidate's suggested gametes − accept Punnett square or line diagram;

offspring genotypes correct: SSBB SsBB SSBb SsBb;

If monohybrid:cross ⇨ 0 marks

4

(d) There is no (significant) difference between observed and expected results / any differenceis due to chance;

1

[10]

(i) Taxon **A** - there is more than one level / taxon below it / genus only has species / only has

18 one level / taxon above it;

(ii) Taxon **C** - there is more than one level / taxon above it / phylum only has kingdom / only has one level taxon above it;

[2]

(a) group of organisms with similar features;

19 can (interbreed to) produce fertile offspring;

2

(b) directional selection;
any TWO from
selection against one extreme / for one extreme;
against broadest beaks in B and narrowest beaks in **A** / for narrowest in **B** and broadest in **A**; whole distribution / range / mean / mode / median is shifted towards favoured extreme;

3 max

[5] (a) (i) there are no fertile hybrids found in the overlapping regions;

20 **1**

(ii) even if mating took place, there would be no fertile hybrids / different chromosome number / gene pool / evolutionary history / many morphological / biochemical / serological differences;

1

(b) (i)

Kingdom	**Animalia / Animals**
Phylum	Chordata
Class	Mammalia
Order	Xenarthra
Family	Dasypodidae
Genus	***Dasypus***
Species	***(D.) novemcinctus***
1 mark per correct column	

2

(ii) Family, as all three belong to different genera;

1

[5] (a) phylum, class, order;

21 species, *Acinonyx jubatus;*

2

(b) larger groups containing smaller groups;

1

(c) (i) do not interbreed to produce fertile offspring / different DNA /different niches;

1

(ii) fossil record; evolutionary history / phylogeny; biochemical differences e.g. DNA / proteins / cytochromes; homologous features / named feature; karyotype / number and form of chromosomes;
(discount any example credited in (i))

2

[6] (a) colder / below 0°C (January) areas, cyanogenic plants die in this cold / acyanogenic

22

survive; non-cyanogenic allele / gene passed on more often / its frequency increases; warmer (January) areas cyanogenic plants at advantage, because of less herbivore selection pressure / feeding; so cyanogenic survive more often to pass on cyanogenic allele / gene.

4 max

(b) large (and equal) number of quadrats in each area;
(reject several) random sampling method, described;
(accept described 'systematic' method) percentage cover / point hits per quadrat / count plants; mean / average value for each area; statistics test to see if differences significant.

4 max

[8] (a) breed together;

23 if fertile offspring, then same species;

2

(b) <u>isolation</u> of two populations; variation already present due to mutations;

different environmental conditions / selection pressures leading to selection of different features and hence different alleles; different frequency of alleles; separate gene pools / no interbreeding;

4

(c) selection of mate dependent on colour pattern;prevents interbreeding / keeps gene pools separate;

2

[8]

24

(a) large groups are divided into smaller groups;

(*not just 'hierarchical'*) members of a group have features in common based on anatomy / fossils / embryology / DNA / specific aspect of cell biology / homologous structures;

reflects evolutionary history;

3

(b) fungi and animals;

1

(c) (insects and fungi) have common ancestor;they diverged a long time ago / before others referred to in phylogenetic tree;

2

(d) those with similar sequences put in same groups / are more closely related;the greater difference in amino acid sequence the longer ago the groups diverged;

2

(e) A - present in all (eukaryotic) species or organisms / quantifiable;
D - extinct species not considered / no timing of events available / only limited number of amino acid sequences / can't include prokaryotic species

2

[10]

25

(a) principle of sequential multiplication (0.9×0.6×0.75×0.67);

0.27;

(correct answer 2 marks)

2

(b) (i) similar sequence / actions / sign stimuli;

1

(ii) additional action in sequence(species A) / scissor wings blocks sequence in B;

1

(c) (acts as) sign stimulus;responds only to species-specific sound;

2 **[6]**

26

(a) (i) Order, Family, Genus.

(all correct = 2 marks; 2 correct = 1 mark)

2

(ii) 3 concentric circles in Carnivora, labelled Felidae, Panthera and L;

1

(b) (i) large groups split into smaller groups (which do not overlap);

1

(ii) (phylogenetic) based on evolutionary history; shows ancestry of groups / points of divergence / example, e.g. reptiles and birds separated after mammals / reptiles and birds more closely related than mammals;
(hierarchical) based on shared characteristics (seen today);

3

[7] (a) phylum, class, family, genus;

27

1

(b) (i) more recent common ancestor / DNA in common;

1

(ii) mutation causes variation; genes (coding) for protein / cytochrome c with different structures;
EITHER
individuals with a modified cytochrome c have a selective advantage / are selected for / these individuals are more likely to survive to have offspring / have more offspring;

(must link a comparison of survival to reproduction)

gene / allele frequency changes over generations / time;
OR
changed structure does not affect protein function;
these structural differences accumulate over time;

4

[6]