

Mark schemes

1

- (a) (i) 1. Groups within groups;
1. accept idea of larger groups at the top / smaller groups at the bottom
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 (between organisms);
- 2. Neutral: cytochrome c is conserved* 1 max

[7]

2

- (a) 1. No interbreeding / gene pools are separate / geographic(al) isolation;
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 named 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]

3

- (a) (i) Reliable / representative / for statistical tests;
Accept: identify anomalies
Neutral: accurate / valid / bias
- (ii) 1. Find coordinates (on a grid) / split area into squares / number the sites;
1. Ignore references to tape measures, metre rulers etc
2. Method of generating / finding random numbers eg calculator / computer / random number generator / random numbers table;
2. Accept: numbers out of a hat / use of dice

1

2

- (iii) 1. Breeding (of lizards);
Neutral: weather / climate / hurricanes / hibernation / migration / emigration / immigration
2. Food source / prey;
3. Predator;
4. Variation in malarial infection;
5. Temperature variation;
6. Availability of water eg drought / 'rainy season'
- 2 max**
- (b) 1. Number in sample varies;
2. Allow a (valid) comparison;
- 2**
- (c) 1. (Overall) positive correlation (for either / both species);
Neutral: only one study / no repeats
2. Reference to (site) 5 / 300 metres;
3. Limited results for *A. watsi* / small sample / number / percentage infected for *A. watsi*;
- 2 max**
- (d) (i) 1. Fewer *A. watsi* infected / more *A. gingivinus* infected;
2. Higher number of *A. watsi* present when higher percentage / number of *A. gingivinus* infected / no *A. watsi* present when *A. gingivinus* has zero infection;
- 2**
- (ii) 1. Reduced immunity / increased susceptibility to disease;
1. Accept: idea that energy / resources are used to combat malaria
2. Reduced oxygen transport / uptake / respiration / reduced activity / movement;
- 2**

- (iii) 1. There is a probability of less than 1% / 0.01;
 1. *Reject: probability is / equal to 1% / 0.01;*
 1. *Reject 0.01% / 5% / 0.05 / 0.05%*
2. That result(s) / correlation / it is due to chance;
 2. *Allow correct interpretation using above (incorrect) figures eg there is a probability of less than 5% that the results are due to chance =1 mark*

OR

3. There is a probability of more than 99% / 0.99;
4. That result(s) / correlation / it is not due to chance;
Note: there is a probability of more than 5% that the results are due to chance =0 marks
 3. *Reject: probability is / equal to 99% / 0.99;*
 3. *Reject 0.99% / 95% / 0.95 / 0.95%*
 4. *Allow correct interpretation of above figures ie 0.99% / 95% / 0.95 / 0.95% but reject if less than*

2
[15]

4

- (a) One / an amino acid (can be) coded for by more than one triplet;
Accept codon for triplet
Accept description of triplet – three bases / nucleotides
- (b) 1. Triplet / three bases on mRNA;
 1. *Accept nucleotide for base*
 1. *Accept DNA for mRNA*
 1. *Ignore references to RNA unqualified*
2. That code for an amino acid;
 2. *Accept code for stop / start*
- (c) (i) To join nucleotides together to form mRNA / premRNA / RNA;
Reject forming base pairs
Accept checking and correcting mismatched base pairs
- (ii) Reverse transcriptase;
If they give two enzymes, no mark

1

2

1

1

- (d) GGATCC same as CCTAGG in opposite direction;
Accept reads same both ways / same forward and back
Neutral bases are the opposite of each other / reference to base pairs

1

[6]

5

- (a) (i) (We should maintain biodiversity to)
Prevent extinction / loss of populations / reduction in populations / loss of habitats / save organisms for future generations (idea of);
Neutral: references to 'playing God' / animal rights

1

- (ii) A suitable example of how some species may be important financially e.g.

1. medical / pharmaceutical uses;
2. commercial products / example given;
3. tourism;
4. agriculture;
5. saving local forest communities;

1 max

- (b) 1. Fewer plant species / decrease in plant diversity;
Accept: converse arguments for islands with a high percentage of forest remaining
1. Neutral: fewer plants
2. Fewer habitats nesting sites / niches / food sources / varieties / less protection from predators / hunters / environment;
2. Neutral: fewer homes
2. Neutral: less food

2

- (c) 1. Number of (individuals / birds of) each species;
1. Neutral: number of species
2. Total number of individuals / birds of all species;
2. Accept: 'total number of birds' as given context for 'all species' in the investigation

2

- (d) 1. (Larger birds have) a low(er) SA:VOL;
Neutral: reference to fat / feathers
2. (So) less heat loss / more heat retained;
MP2 is independent of MP1

2

[8]

6

(a) 2 of the following pairs:

Mark for explanation must be paired with correct change in structure

1. Larger leaves;
2. Photosynthesis;

OR

Accept converse descriptions of leaves, root and stem: longer root, taller stem, smaller leaves

3. Larger / bigger / thicker root;
4. Storage;

OR

5. Stem shorter / absent;

Accept converse correct explanation

6. Less energy used in stem growth / more energy for producing sugar;

4 max

(b) Beet ready quicker / less time required / allows land to be used again / harvested earlier;

Allow more crops / many harvests. Ignore references to yield / profit

1

- (c) 1. (Diversity) reduced / fewer different alleles / less variation / smaller gene pool;
2. As alleles have been chosen / rejected;

2

[7]

7

(a) (i) Repeating units / nucleotides / monomer / molecules;

Allow more than one, but reject two

1

(ii) 1. C = hydrogen bonds;

2. D = deoxyribose;
Ignore sugar

3. E = phosphate;

Ignore phosphorus, Ignore molecule

3

(iii)

Name of base	Percentage
Thymine	34
Cytosine / Guanine	16
Adenine	34
Cytosine / Guanine	16

Spelling must be correct to gain MP1

First mark = names correct

Second mark = % correct, with adenine as 34%

2

(b) (i) 153;

1

(ii) Some regions of the gene are non-coding / introns / start / stop code / triplet / there are two DNA strands;

Allow addition mutation

Ignore unqualified reference to mutation

Accept reference to introns and exons if given together

Ignore 'junk' DNA / multiple repeats

1

[8]

8

(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]

9

(a) Removes bias;

1

- (b) (i) 1. 1.28 / 1.29 / 1.285 / 1.3
1. Ignore more than 3dp
2. Answer incorrect but shows clear understanding of Σ
2. $\Sigma = 318250$. Allow mark if denominator written out. Incorrect denominator but evidence of understanding gains mark

2

(ii) Diversity index would be lower (NO MARK)

Assume wheat field if site unspecified

1. Fewer species / Beech aphid / Large white butterfly / 7-spot ladybird absent / only three species / species diversity lower / mostly one species / mostly bird-cherry aphid;
1. Allow species richness in context of few species
2. Fewer plant species;
2. Allow one type of food source if clearly plant

2

(c) For:

1. Data support the claim / evidence supports claim;
1. Ignore reference to correlation / causation

Against:

2. Only wheat field / only comparing with wood / one type of habitat / only insects considered;

2 max

- (d) 1. Greater variety of plants;
2. Another habitat / more habitats / places to live / niches / another food source / more food types;
2. Answers referring to 'more food' should not be credited. Allow reference to either animal or plant as foods

2

[9]

- 10** (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]**
- 11** (a) (i) (Human cells) don't have a cell wall;
Accept "they" refers to human cells. 1
- (ii) (Affects) protein synthesis;
Allow description e.g. 'amino acids not joined together / translation.
Reject: affects transcription. 1
- (b) 1. Mutation present / occurs;
Ignore antibiotic causes mutation.
2. Resistance gene / allele;
1. or 2.
Reference to immunity disqualifies first credited marking point.
3. Resistant bacteria (survive and) reproduce;
Reference to mitosis negates marking point 3. 2
- [4]**

12	<p>(a) (i) Produces a more reliable mean / average / makes sure sample was representative / reduce effect of extreme values / identify anomalies; <i>Ignore references to chance</i></p> <p style="text-align: right;">1</p> <p>(ii) Removes bias;</p> <p style="text-align: right;">1</p> <p>(b) Two marks for correct answer of 5.8; One mark for incorrect answer that clearly shows denominator as 216;</p> <p style="text-align: right;">2</p> <p>(c) 1. Increase in variety of plants / shrubs / grass; 2. More habitats / niches; 3. Greater variety of food sources / more food sources; <i>Answers only referring to 'more food' should not be credited</i></p> <p style="text-align: right;">3</p>	[7]
13	<p>(a) Difference in DNA / base sequence / difference in alleles / genes / gene pool; <i>Neutral: 'fewer alleles' unless qualified e.g. fewer different alleles.</i></p> <p style="text-align: right;">1</p> <p>(b) Environmental; <i>Accept: Environment</i></p> <p style="text-align: right;">1</p> <p>(c) Reduced (genetic diversity); As fewer different / varied alleles / genes / reduced gene pool;</p> <p style="text-align: right;">2</p>	[4]
14	<p>(a) (i) 9; <i>Accept: nine</i></p> <p style="text-align: right;">1</p> <p>(ii) Introns / non-coding DNA / junk DNA; Start / stop code / triplet; <i>Neutral: Repeats.</i> <i>Accept: 'Introns and exons present'.</i> <i>Reject: 'Due to exons'.</i></p>	1 max

(b) Change in amino acid / s / primary structure;

Change in hydrogen / ionic / disulfide bonds;

Alters tertiary structure;

Reject: 'Different amino acid is formed' – negates first marking point.

Neutral: Reference to active site.

3

(c) Number of bases

	Number of bases			
	C	G	A	T
Strand A	26	19	20	9
Strand B	19	26	9	20

Second column correct;

Columns three and four correct;

2

[7]

15

(a) Greater variety / different foods;

More habitats / niches;

Answers only referring to 'more food' should not be credited but allow 'more food sources'.

2

(b) Also measures number of individuals in a species / different proportions of species;

Some species may be present in low / high numbers;

First marking point can only be awarded if there is a reference to species.

2

(c) (i) Large surface area to volume (ratio) / permeable / thin (outer layer); Correct reference to diffusion;

Accept (Eggs) cannot move (out of water) for 1 mark

2

(ii) Concentration (of pesticide) is increased;

1

[7]

16

- (a) (i) Phosphate and ribose;
Accept in either order. Both correct for one mark.
For phosphate accept PO₄ / Pi / $\textcircled{\text{P}}$ but not P.
Do not accept phosphorus.
Ignore references to pentose / sugar.

1

- (ii) TAGGCA;

1

- (b) (i) Does not contain hydrogen bonds / base pairs / contains codons / does not contain anticodon / straight / not folded / no amino acid binding site / longer;
Assume that "it" refers to mRNA.
Do not accept double stranded.

1

- (ii) (pre-mRNA) contains introns / mRNA contains only exons;
Assume that "it" refers to pre-mRNA.
Accept non-coding as equivalent to intron.

1

- (c) (i)

Part of chromosome	U
Middle	18
End	21

One mark for both figures correct

1

- (ii) 1. Have different (base) sequences / combinations of (bases);
 2. (Pre-mRNA) transcribed from different DNA / codes for different proteins;

2

[7]

17

- (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]