Mark schemes

1

(a) Number of a / each (species);

Accept answers expressed differently providing they convey this information.

Ignore extra information if it does not contradict answer.

1

(b) 1. Lower diversity of plants / few species of plants / less varietyof plants / few plant layers;

2. Few sources / types of food / feeding sites; / few habitats / niches;

3. Fewer (species of) herbivore so few (species of) carnivores;

3

(c) (i) Cannot predict / do not know intermediate values;

1

(ii) To see what would happen / compare <u>with</u> no management work / to see if numbers fell anyway / To show that it was not a factor;

Management as a term not required. Allow explanations.

1

(d) 1. Total <u>number</u> of birds along ditch B / ditch with one side cleared greater than along ditch A / ditch with both sides cleared;

2. But only gives data for all birds / does not give data for species / data not aboutdiversity;

3. Single ditch / single occasion / not repeated / no control;*Principles:*

Correct from evidence

Total number not diversity

Flaws in technique

3

[9] (a) Most closely (related) to chimpanzee / most recent common ancestor;

2

1

Least (related) to dogfish / least recent common ancestor;

Allow 'chicken is second' to chimpanzee as equivalent to second mark point.

Allow answers which compare similarity in DNA / genetic material.

Marks should not be awarded for answers which only compare amino acid sequences without any indication of relationships.

Allow 'monkey' for chimpanzee and 'fish' for dogfish

(b)   Is present in all eukaryotes;

(c)   Reference to base triplet / triplet code / more bases than amino acids / longer
       basesequence than amino acid sequence;

       Introns / non-coding DNA; / same amino acid may be coded for / DNA code is
       degenerate;

                Reject different amino acids are formed / produced.
                Ignore reference to codon.

                                                                                    2

                                                                              [5

] (a)   (So results) can be compared / so measurement is the same each time / because eye is

3

       not perfectly round / uniform;
                Accept eye opens to different amounts

                                                                                    1

(b)   (i)   1.   Eye (diameter) is smaller and antennae longer;

              2.   Antennae detecting touch;

              3.   Data only refers to shrimps / data may not apply to all animals / only inone
                    area;
                    *The principle here is that candidate has recognised that both
                    features confirm suggestion. Exact wording does not matter.*

                                                                              2 max

       (ii)   1.   Standard deviation gives a measure of spread / variation;

              2.   More standard deviations overlap, the less likely it is that differences are
                    real / significant / the more likely they are caused by chance;
                    Do not accept range
                    Accept converse.
                    *Although we are looking for the idea of significance, we cannot
                    require this term.*

                                                                                    2

(c)   (i)   Qualitative statement about

                     difference in size /

              difference in variation /

              overlap in size;

              Quantitative statement about

difference in size /

difference in variation /

overlap in size;

Supported by relevant two sets of figures from graph;;

Note simplistic answer involving a quantitative statement gains 1 mark.

More specific answer involving quantitative information gains 2 marks.

2

    (ii)   (No) for same body length, antenna are longer / antenna are shorter / some with longer body have short antennae / some with shorter body length have longer antennae;

        OR

        (Yes) positive correlation in open / in cave;

        Habitat not critical as a term.

        Must refer to idea of same habitat

        Accept description

1

(d)   More alleles of each gene / shrimps in open have all the alleles;

        Candidates are required to use the information from the table. Must therefore refer to alleles.

1

(e)   1.   A small number of shrimps were / went into the cave;

        2.   All / high proportion of shrimps had allele L;

        3.   Cave population descended from these / these reproduce;

3

(f)   (i)   1.   Cross shrimps from two sites / watch courtship;

            2.   Breed young together / observe mating;

            3.   Allow 1 mark for any method of improving quality of results e.g. carry outreciprocal crosses / large number of crosses / isolate beforehand; *Other valid equivalent suggestions should be accepted.*

    (ii)   If same species the shrimps would breed, producing fertile young / courtship species specific;

        Accept any form of evidence – mating / laying eggs / giving birth to young.

3

[15] (a)   (i)   To cut the DNA;

4

Reject breakdown, cutting out

1

    (ii)   To separate the (pieces of) DNA;

1

    (b)   Complimentary base sequence / complementary DNA; binds to both (haplotypes);

Label would show up in both;
    Idea of complimentarity required

2

    (c)   (i)   Y chromosome inherited / comes from male parents / only found in males;

1

           (ii)   Mitochondria in egg / female gamete / no mitochondria come from sperm / malegamete;

1

    (d)   (i)   Allows comparison;

Different (sized) areas covered;

2

           (ii)   Wolves do not eat all of prey animal / do not eat (large) bones / skin;

Inedible parts make up different proportions / wolf eats different proportions;

2

    (e)   Limited by food / prey; as prey increases so do wolf numbers / positive correlation;

Large range so other factors involved;

2

                               [12] (a)   Recognition of same species;

5

Stimulates release of gametes;

Recognition of mate / opposite gender;

Indication of sexual maturity / fertility;

2 max

    (b)   (i)   Internal fertilisation / fertilisation occurs in pouch / limited area;
                  Q *The term fertilisation is not required in the answer but must be implied.*

1

        (ii)   Protection from predators (developing in pouch);

1

(c) (i) Less stress caused to seahorse / quicker / more accurate method / body iscurved / head is linear;

> **Q** *Do not accept "easier" unless qualified.*

1

(ii) Head length proportional to body length / or described;

1

(d) Positive correlation between head / body lengths of male and female / female andmale with similar head / body lengths pair together;

1

(e) Use line of best fit;

And extrapolate / extend line as required;

2

(f) (Compare) DNA;

Sequence of bases / nucleotides;

Compare same / named protein;

Sequence of amino acids / primary structure;

Immunological evidence – not a mark

Inject (seahorse) protein / serum into animal;

(Obtain) antibodies / serum;

Add protein / serum / plasma from other (seahorse) species;

Amount of precipitate indicates relationship;

> **Q** *The marks awarded for reference to DNA and sequence of bases / nucleotides must be in a different context to DNA hybridisation.*

6 max

[15]

6 (a) (i) Method of positioning quadrats,

E.g. Find direction and distance from specified point / find coordinates on a grid / split area into squares;

Method of generating random numbers;

E.g. From calculator / telephone directory / numbers drawn from a hat;
> *Last point represents minimum answer*
> **Q** *Do not credit any method that relies on throwing a quadrat*

2

(ii) Calculate running mean / description of running mean;

When enough quadrats, this shows little change / levels out (if plotted as a graph);

Enough to carry out a statistical test;

A large number to make sure results are reliable;
> *Ignore terms that are not incorrect*
> *Regards large numbers as 10 / 10% +*

Need to make sure work can be carried out in the time available;

2 max

(b)   Coppice different parts of the wood at different times;

As data show many daffodils flowering 4 / 5 years after coppicing;
> **Q** *Second point needs specific reference to the graph, numbers and time after coppicing. Accept any correct answer that does this.*

2

(c)   <u>Positive</u> correlation between rainfall and flowering / the higher the rainfall, the more daffodil flowers;

<u>Negative</u> correlation / the higher the temperature the fewer daffodils in flower;

All statistically significant so not likely to be / not due to chance;

2 max

[8

] 7 (a)   (i)   Will work in all weather conditions / hairs will stick to it even if shrew / animal is wet / withstand rain;

1

(ii)   So shrews come into contact with glue;

1

(b)   Avoids bias / allows statistical tests to be carried out;
> *Allow description*

1

(c)   (i)   Increases the reliability of the measurements;

If measurements are repeatable, differences less likely to be due to measurement / personal error / anomalies unlikely;
> *Accept advantages of repeatable results. E.g. identifying anomalies / remove errors*

2

(ii)   Plot graph / scatter diagram of one set of results against the other;
> **Q** *To gain first marking point, candidates must say what has been plotted.*

Expect to see points lying close to line / Line should slope upwards / show positive correlation;

> *If what is being plotted is not clear, second point cannot be awarded.*

OR

Plot measurement against hair number;

Look for overlying / corresponding points;

2

(d) (i) One mark for a valid explanation based on individual shrews entering morethan one hair tube / many hairs from same shrew / shrews enter without leaving hair;

1

(ii) Rules out differences due to changes in population / changes in environmentalconditions;

That could be produced by births / deaths / migration / specific example of environmental conditions affects results;

2

(e) (A statistical test) determines the probability of results being due to chance;

Enables null hypothesis / description of null hypothesis to be accepted / rejected / determines whether correlation / result is significant;

2

(f) (i) (Curve / line of best fit shows) positive correlation / description of positivecorrelation;

1

(ii) Curve / line of best fit (almost) parallel to x-axis / horizontal / level / nocorrelation / index is independent of number of shrews;

Hair tubes with positive results when no shrews trapped;

Small size of shrews means shrews may not trigger traps;

2 max

[15]

(a) 1. Large surface area provided by lamellae / filaments increases diffusion / makes
8 diffusion efficient;;

> ***Q** Candidates are required to refer to lamellae or filaments. Do not penalise for confusion between two*

2. Thin epithelium / distance between water and blood;

3. Water and blood flow in opposite directions / countercurrent;

4. (Point 4) maintains concentration gradient (along gill) / equilibrium not reached /as water always next to blood with lower concentration of oxygen;

5. Circulation replaces blood saturated with oxygen;

6. Ventilation replaces water (as oxygen removed);

6

(b) Mixing of air and water (at surface);

Air has higher concentration of oxygen than water;

Diffusion into water;

Plants / seaweeds near surface / in light;

Produce oxygen by photosynthesis;

2 max

(c) Not much oxygen near sea bed;

Toadfish haemoglobin (nearly) saturated / loads readily at / has higher affinity for oxygen at low <u>partial pressure</u> (of oxygen);

2

(d) The chimpanzee and the bonobo are more closely related (than to the gorilla);

They have identical amino acids / one of the amino acids is different in the gorilla;

2

[12] (a) Randomly collected / collected from many ponds / same species / same time of year;

9

Accept other answers providing they might reasonably impact on data

1

(b) 9;

1

(c) Curve / line of best fit;

Shows upward slope / positive correlation / description of positive correlation;

Correlation does not necessarily mean causation;

Some other factor might be involved;

Some ponds had no worms but had frogs with deformed legs;
    Q No mark awarded for "yes" or "no"

4 max

(d) (i) Sample too small to establish a pattern / to be representative / to identify anomalies;

(ii)   Must compare like with like / must be a fair test;

       Note that fair test is acceptable if used in context defined in How Science Works glossary

       Some factors differ in mountains / named factor differs in mountains;

2

(e)   27% of the frogs had deformed legs in pond 2;

Agricultural run-off and cage mesh diameter of 500 μm;

2

(f)   Worms cause deformed legs;

Deformed legs in 500 μm mesh cages / deformed legs when worms in cage;

Run off (on its own) does not cause deformed legs;

No deformed legs with run off and 75 μm mesh / no worms;

When run off present makes effect of worms worse;

Quantitative statement e.g. increased by factor of 7 to 8 times;

4 max

[15] (a)   Increase in number of species;

10

Increase in numbers of some species;

2

(b)   Initial environment hostile / few organisms adapted;

These organisms change the environment / suitable example;

More niches / more habitats;

Allowing other organisms to become established;

max. 3

[5]

(a)   To enable (valid) comparison;

11

Bigger / smaller tomatoes could compress more easily;

2

(b)   SD bars do not overlap ;

Difference (in ripeness) is real;

More variation in normal tomatoes (than in GM tomatoes);

2 max

[4

12

] (a) deforestation removes many habitats / niches fewer species / fewer types of organisms;

   (do not credit just fewer organisms);

   2

(b) 1. nitrate ions in fertiliser available / absorbed immediately;
   2. ammonium converted to nitrate by nitrifying bacteria
   3. fertiliser would provide only the initial release of nitrate / potassium nitrate;

   3

[5] (a) Samples collected at random;

13

   Method for choosing random sites – random coordinates /
   position from tables / calculator / other suitable means;

   Other named factor constant e.g.:

   Same size of net / same width of opening of net / use of one
   quadrat / Quadrats of same size / of stated size / same area
   disturbed / collect each
   Sample for same time;

   3

(b) *Caenidae* in deep water – because highest standard deviation / 'S.D.= 7.92'

   1

(c) (i) An organism's role / in the ecosystem / community;
      [ALLOW refs. To trophic levels / named]
         (IGNORE refs. To habitat)

      1

   (ii) *Caenidae* found mainly in deep water AND *Baetidae* in shallow
      water / one family mainly in deep water AND the other in
      shallow water;

      1

   (iii) Reduces competition for named factor – e.g. food / shelter / O_2
      ; To ensure both types survive / otherwise better adapted type
      displaces other type;
      OR
      Ref. to 'Competitive exclusion principle' = 2 marks

      max 2

[8] (a) (i) EITHER: Correct answer: 3.45 / 3.44 / 3.4   = 2 marks

14

      OR: Understanding of $\sum n(n-1)$ / use of
              134 / (2 + 90 + 12 + 30)
              + wrong answer   = 1 mark

(ii) Takes account of number of individuals / abundance /
population size (as well as number of species);

1

(b) The species at A / *F.spiralis* loses less water /
loses water less rapidly / loses less mass;

The species at A / *F.spiralis* better adapted to / can survive where
exposed for longer / to drier conditions;

The species at A / *F.spiralis* avoids competition For named aspect
– e.g. light / substratum / space / CO_2;
ACCEPT converse argument re. F. serratus

3

[6] (a) Tapes / string / axes laid out at right angles / grid area;

15

Method of obtaining random co-ordinates;
Do not allow "Use random number generator"

2

(b) (i) Decrease then remain constant;
From 200 cm / over 150 cm;

2

(ii) Oxygen decreasing because soil becomes more compacted / notreplaced;
Decrease in oxygen leads to fewer aerobes surviving;

2

(c) Anaerobic bacteria replace aerobic as oxygen decreased by aerobic bacteria;
Remove competition;
Aerobic bacteria no longer able to survive in these conditions;

3

(d) (i) Near the surface / in top 50 cm;
Table shows decrease with time at greater depths;

2

(ii) Decrease;
Fewer aerobic bacteria with depth;
Oxygen concentration decreases / less oxygen at depth;

3

(e) Probability greater than 95% / 0.95;
Results are not due to chance / results are significant;
Because bars do not overlap;

3

(f) Plot as graph;
Draw line of best fit;

Read off appropriate value;

3

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

16 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

17

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;

18 if fertile offspring, then same species;

2

(b)   isolation 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

19

[8] (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]

20

(a) (i) transect line may not go through representative areas / may avoid certain areas;

1

(ii) large sample; how random coordinates are generated / how random places chosen;

2

(b) (i) spread of values around the <u>mean</u> height of the plant;

1

(ii) smaller plants at higher altitude;greater the altitude the lower the standard deviation ; reference to figures to make a comparison;

2 max

(iii) the plants measured were grown under uniform conditions;

1

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

21

　　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] (a)　<u>generation</u> of random co-ordinates;

22

　　use of 10 or more quadrats; <u>collection</u>
　　of all dog whelks in quadrat;

3

(b)　greater variation for sheltered population / population A;range /
　　spread around the <u>mean</u>;
　　　　(or converse)

2

(c)　(i)　smaller ratio means relatively larger foot / population B
　　hasrelatively large foot; better able to grip; larger / longer shells
　　have greater area exposed / are subject to greater force;

　　(ii)　wave action limits the max. L / A ratio / extremes; valid
　　　　point about age, e.g. greater age range on sheltered
　　　　shore / live longer on sheltered shore;
　　　　　　(allow shell size marking point in either (c)(i)
　　　　　　or (c)(ii) but only credit once)

4 max

[9] (a)　phylum, class, family, genus;

23

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] (a)   random sampling method;

24

use of large numbers / many / 10 or more quadrats in each area;
counting daisies and dividing by area;

3

(b)   the cutting has no effect;

1

(c)   daisy, dandelion, buttercup show (statistically) significant differences;no significant
effect on plantains; comment on relative significance of daisy / dandelion /
buttercup; regular cutting linked to significant increase in density of daisy /
dandelion; linked to significant decrease in density of buttercup;
          (no marks if significance idea omitted)

3 max

[7]

(a)   angle, moisture and pH

25

          (all required)

1

(b)   system for subdividing quadrat into, e.g. many squares;method of estimating cover in small
squares, e.g. counting those where cover over 50%, or cover at points (of intersection);
          (not just 'count squares with vegetation' unless very small)

2

(c)   increasing vegetation cover is related to increasing moisture content
          (allow 'affects' moisture content or vice versa, not 'causes);

correlation is significant / not due to chance / can reject null hypothesis
/ only 1 in 20 / 5% probability that the correlation is due to chance;

2

(d)   factor; and linked effect e.g.
wind-blown particles trapped;
accumulation of soil;
OR
accumulation of organic / dead / decomposed matter / humus;
increase in mineral ions / improved water retention / improved
soil structure;
OR
nitrogen fixation;
increased nitrate concentration / improved soil fertility;

2 max

[7]