7.4 Genetics, populations, evolution, ecosystems (A-Level Only) - Populations in ecosystems 1 - Mark schemes

Q1.

(a) 1. Compete (with fertile males) to mate / for food / resources
OR
<u>intraspecific</u> competition;
2. Do not reproduce / breed
OR
Reduces population (of mosquitoes);
      1. *Must convey idea of competition.*
      2. *Accept: 'fewer mosquitoes' / 'fewer offspring'.*

2

(b) 1. Capture / collect / sample, mark **and** release;
2. Leave time for mosquitoes / Aedes to disperse before second sampling / collection;
3. (Population =) number in first sample × number in second sample divided by number of marked in second sample / number recaptured;
      3. *Accept: correct equation.*

3

(c) (Radiation) affects their 'attractiveness' / courtship / survival / life span;
      *Accept: 'die / less likely to survive **due** to radiation'.*
      Accept: 'disease can be transmitted by other means' (other than mosquitoes).

1

(d) To maintain number / competition as they die / have a short life span;
      Accept: to replace mosquitoes that have died.

1

(e) 1. Number (of mosquitoes in treated area) is low / lower at / after 12/13/14/15/16 weeks = **2 marks**;

2. For one mark accept number (of mosquitoes in treated area) is low/lower without reference to relevant week;
      Accept: amount for number.
      Accept: comparison of numbers (of mosquitoes) for lower/low.

2

[9]

Q2.

(a) 1. Correct answer of 19.4 / 19.41%
OR
19.47 / 19.5% = **2 marks**;
2. Incorrect answer but shows increase of 1,048,320 **OR** 1,051,200 = one mark;

Accept: 19.46% for one mark.

2

(b) 1. Less / no acetylcholine broken down;
    2. Acetylcholine attaches to <u>receptors</u>;
    3. (More) Na$^+$ enter to reach threshold / for depolarisation / action potential / impulse;

> 1. *Accept: more acetylcholine present / remains.*
>
> *1 and 2. Accept: remains attached for longer = 2 marks.*
>
> 3. *Must be sodium ions.*

3

(c) 1. Isolated **so** inbreeding / low genetic diversity / small gene pool;
    2. <u>Allele</u> inherited (through generations) from (common) ancestor;

> 1. *Ignore: Founder effect.*
>
> 1. *Accept: no interbreeding with other populations.*
>
> 1. *Reject: interbreeding within the population.*

2

(d) 1. AD / symptoms develops late / at 49;
    2. Have already reproduced;

> *Note: 'It' is not equivalent to AD / symptom as the question stem relates to the mutation.*

2

(e) 1. Epigenetics / environment / named factor e.g. stress, alcohol, toxins, diet, exercise, smoking;
    2. methylation (of genes)
        OR
        acetylation (of histones);

> 1. *Ignore: gender and lifestyle.*
>
> 2. *If further details are provided the context must be correct e.g. increased methylation or decreased acetylation inhibit gene expression / transcription.*

2

(f) 1. One person was homozygous dominant / has two dominant alleles = **2 marks**;
    2. For one mark has two alleles / chromosomes;

> 1. *Accept; homozygous dominant genotype e.g. 'one person has AA' for 2 marks.*
>
> 2. *Accept: is diploid or has two copies of the gene.*

2

(g) 1. (GCA / triplet) is common / found in other places;
    2. Would not know if it was the mutation / allele / gene
        OR
        Produces 'false positives'

> 1. *Accept: Probe will bind elsewhere.*

Q3.

(a)   Correct answer of 4.92, 2 marks;
        If N(N-1) = 3540, **OR** ∑n(n-1) = 720, then award 1 mark
                Accept 4.916 / 4.917 / 4.9

2

(b)   1.   A method of selecting sampling sites at random;
        2.   Use of quadrat;
        3.   Identify (plant) species (at site / in each quadrat)
               OR
               Count number of (different plant) species (at site / in each
               quadrat);
                    1.   *E.g. grid with coordinates selected using*
                           random number table
                    2.   *Frame or point*
                    3.   *Reject refs to % cover, or counting individuals*

3

(c)   1.   Significant increase in species richness on Islay and Colonsay
               and (significant) fall on Harris;
        2.   Change in diversity on Islay not significant;
        3.   Greater than 0.05 / 5% probability of getting this change /
               difference by chance (on Islay)
               OR
               (For other differences) less than 0.001 / 0.1% probability of
               getting this change / difference by chance (for species richness
               on Colonsay, Harris, Islay)
               OR
               Less than 0.01/1% probability of getting this change/difference
               by chance (for diversity index on Colonsay, Harris);
                    2.   *Accept converse about significance of*
                           differences in other cases
                    3.   *Reject **results** are due / not due to chance*
                    3.   *Ignore refs to P unqualified*

3

[8]

Q4.

(a)   1.   (Overall, data show an) increase in species richness / increase in
               species diversity / increase in total number of living organisms;

        2.   *Baetis quilleri* and / or *Pentaneurini guttipennis* are pioneers;

        3.   (Pioneers cause) named change of environment e.g. provide food for
               other species;

        4.   New species / example from data colonise once there is a change;

5. *Baetis quilleri* / *Pentaneurini guttipennis* / *Helicopsyche mexicana* decline / outcompeted / eaten as succession continues.

5

(b) Correct answer 5.5 = 2 marks;

Allow 1 mark for correct calculation of mean population growth rate per day for each species, i.e:

Cryptolabis paradoxa = 3.226

Leptohyphes packeri = 0.585

2

(c) 1. Same species present (over long time) / stable community (over long time);

2. Abiotic factors (more or less) constant (over time)

3. Populations stable (around carrying capacity)

2 max

[9]

Q5.

(a) 1. Only cleared and abandoned and introduction of non-native species make (significant) difference;

2. Because only (means of) these ± 2 SDs from zero / no change;

3. About same number / 4 to 3 increase or decrease (species) richness / biodiversity;
    Accept converse for others

3

(b) 1. Non-native species out-competes / kills / eats / is a disease of native plants;

2. Some (populations of) native species become extinct (in the community);

2

(c) 1. Set up grid system with coordinates;

2. Place large number of quadrats (at coordinates) selected at random;

3. Count number of / estimate percentage cover of native plant in quadrats;

3. Repeat at same time each year (for many years);

3 max

(d) 1. Correct answer two marks – 0.0599;

1 mark for writing $\dfrac{\log_e(SR2/SR1)}{\text{Time in decades}}$

Award 1 mark for answer of – 5.985 or 0.290

2

[10]

Q6.

(a) (No – no mark)
Graph / bar chart only shows number of species, not the name of the species.

1

(b) (No – no mark)
1. Mutations are spontaneous / random;
2. Only the rate of mutation is affected by environment;
3. Different species do not interbreed / do not produce fertile offspring;
4. So mutation / gene / allele cannot be passed from one species to another.

> *Ignore references to correlation does not prove causation*

4

(c) 1. Initially one / few insects with favourable mutation / allele;
2. Individuals with (favourable) mutation / allele will have more offspring;
3. Takes many generations for (favourable) mutation / allele to become the most common allele (of this gene).

3

[8]

Q7.

(a) 1. (Use) coordinates / number the rocks/sites/squares;

> *Ignore: references to grid, tape measures, metre rulers etc.*

2. Method of generating/finding random numbers e.g. calculator/computer/random number generator/random numbers table;

> *Accept: numbers out of a hat / use of dice.*

2

(b) Difficult/too many to count / individual organisms not identifiable / too small to identify/count / grows in clumps;

> *Ignore: easier/quicker/representative/ more accurate, unless qualified.*

1

(c) Any suitable factor with valid explanation = 1 mark
1. Wave action - firmer grip on rock is necessary (at either site);
2. Wind/air movement/less humid - more evaporation at site A / more (physical) damage;
3. Light – (linked to) photosynthesis (at either site);

4. Temperature – (linked to) photosynthesis/respiration/enzymes/ evaporation (at either site);
5. pH – (linked to) enzymes/proteins;

Note: other common factors include salt (salinity) linked to water potential / named nutrient e.g. nitrate linked to protein/DNA.

Ignore: carbon dioxide/oxygen/pollution/rainfall/food/nutrients.

Reject: biotic factors e.g. predation.

2 max

(d) 1. Greater variety of food / more food sources;

Ignore: more food.

2. More/variety of habitats/niches;

Ignore: homes/shelters.

Accept: different habitats.

2

(e) (i) 1. (So they were) hungry/not full;

Accept: description of hunger e.g. appetite / 'empty stomach'/'so they eat'.

2. (Allows) comparison;

2

(ii) 1. Alga without consumer/named consumer/animal;

Accept: repeat experiment without consumer.

Accept: in separate tank / in tank where not eaten.

2. (Find change in mass) in dark;

3. For 50 hours;

Accept: 'same time as in experiment'.

Accept: For lower time period then scaled up to 50.

3

(iii) 1. For *Laurencia pacifica* **and** *Cystoseira osmondacea* (difference in results) significant /reject null hypothesis / not due to chance / less than 5%/0.05 probability due to chance;

Accept: for Laurencia pacifica 'less than 1%/0.01 probability'.

2. For *Egregia leavigata* **and** *Microcystis pyrifera* no significant (difference in results)/accept null hypothesis / is due to chance/more than 5%/0.05 probability due to chance;

Accept: 'insignificant' for 'no significant difference'.

3. (Difference in results) for *Laurencia pacifica* is the most significant;

Note: reference to probabilities on their own is not sufficient.

1, 2 and 3. Accept: abbreviations for all species.

Q8.

(a)　1.　Respiration/metabolism/ammonification;
　　　2.　(Releases/produces) heat;
　　　　　　Reject: 'produces energy'.

(b)　1.　SD is spread of data around the mean;
　　　　　　Accept: variation around the mean.
　　　　　　*Accept: range is difference between highest and lowest values/extremes **or** range includes anomalies/outliers.*
　　　2.　(SD) reduces effect of anomalies/ outliers;
　　　　　　Reject: (SD) removes anomalies/outliers.
　　　3.　(SD) can be used to determine if (difference in results is) significant/not significant/due to chance /not due to chance;
　　　　　　Ignore: reliability/accuracy/validity.

(c)　1.　Distributes heat / prevents 'hot' spots;
　　　2.　Distributes microorganisms;
　　　3.　More enzyme-substrate complexes;
　　　4.　Increases rate of decomposition;
　　　　　　Accept: increases nitrification/ammonification or 'breaks down waste faster'.
　　　5.　Aeration/provides oxygen;

(d)　1.　Microorganisms change the abiotic conditions/temperature/organic waste /provide nutrients;
　　　　　　Must refer to microorganisms or bacteria/named bacteria causing the change.
　　　　　　Ignore: change the environment.
　　　2.　Less <u>hostile</u> conditions;
　　　3.　Decline in Cocci **and** increase in rods;
　　　　　　Accept: 'decrease in cocci, others are going up'.
　　　　　　Accept: decrease in cocci and increase in either rod type or increase in both types.
　　　4.　Gram positive outcompete / better competitors;
　　　　　　Accept: rods outcompete (cocci) / better competitors.

Q9.

(a)　1.　No / few consumers / pests / pathogens;
　　　　　　Accept: No / few predators.

Accept: description of competition for a named resource with reference to 'other species'.

Accept: More resistance to disease.

2. Outcompetes / better competitor for resources / light / CO_2 / abiotic factor / ideal niche;

Neutral: competition for food.

2

(b) 1. (Cost of) control / removal;

2. (Cost of) restoring habitat / conservation;

3. (Loss of income) from fishing;

4. (Loss of income) from boating / tourism / recreation;

Accept: any valid recreational activity e.g. canoeing.

2 max

(c) (i) 1. Removes water;

2. Water content can vary in sample / plant;

Note: Reweighing / constant mass indicates all water removed = 2 marks. ;

2

(ii) 1. 0.5 is not effective / has little effect / 1.0 is less effective (than 5.0) / concentrations below 5.0 less effective;

Accept: for first 3 mark points effect on growth / biomass as a measure of effectiveness.

Accept: references to 'this concentration' = 5.0.

Accept: 5.0 is the minimum effective concentration.

1. and 2.   5.0 is the minimum effective concentration that reduces growth = 2 marks.

2. At 5.0 biomass / growth is reduced;

3. Small difference between using 5.0 and 25.0;

4. Using 5.0 is cost effective / using 25.0 is expensive / high concentrations may affect the environment / other organisms / chemical may remain in habitat / bioaccumulation;

Accept: any impact on the habitat e.g. contaminate water supply.

4

(d) (i) To compare / see effect with / without fungus / fluridone / control agent / s;

Neutral: for comparison on its own.

Neutral: to see effect of variables / results / treatments / factors without further qualification.

1

     (ii)   1.   Is specific / grows / survives in Hydrilla / habitat;
Accept: 'known to work'

            2.   Can reproduce / only one application required;

            3.   Does not become a pest;

2

     (iii) 1.   Fluridone / chemical acts quickly / quickly reduces Hydrilla;

            2.   Fungus / biological control keeps Hydrilla in low numbers / fungus / biological control works over a long time / can reproduce / resistance does not develop against fungus / biological control;

2

[15]

Q10.

  (a) (i)   (Organisms that) can breed together / interbreed **and** produce fertile offspring;
Need both aspects. Reject 'inbreed'
Reject viable offspring

1

      (ii) Same number (of organisms) in each region / (organisms) equally spread;
Allow other ways of expressing 'region' or 'equally spread', eg not clumped together, same number per unit area

1

  (b)

$$P = \frac{AS}{R} \;\;;;$$

2 marks for correct answer
*1 mark for having **A** on top of equation (recognises that total population related to total area)*

Note:

P = A × S / R or
P = A / R × S

are also correct.

Allow 1 mark for

$$\frac{S}{P} = \frac{R}{A}$$

2

  (c) (i)   *In mark–release-recapture (technique)*

Accept converse by considering assumptions of proportional sampling

1. No assumption that organisms are uniformly distributed;

2. Size of total area / size of sampled region not required;
    Marking point 1 or marking point 2 do not have to start with the same technique
    In this case, allow difference by implication i.e. do not penalise if the two techniques are not compared

    2

(ii) Animals are from / all part of the same population;

    1

    [7]

Q11.

(a) *Ulva lactuca*;
        Reject: Ulva on its own
        Accept: lactuca on its own
        Accept: Incorrect spelling

    1

(b) (i) Difficult / too many / too many to count / individual organisms not identifiable / too small to identify / grows in clumps;
            Neutral: easier / quicker / representative / more accurate, unless qualified

    1

(ii) Any described feature of concrete eg texture / flat / composition chemicals / nutrients etc;
            Neutral: not natural / man made / are different, without further qualification

    1

(c) 1. Pioneer species / *Ulva* increases then decreases;
            1 and 4. Growth / reproduces = increases. Dies = decrease

2. Principle of a species changing the conditions / a species makes the conditions less hostile;
            2. Accept description of change in conditions eg soil / humus forms, nutrients increased

3. New / named species better competitor / previous / named / pioneer species outcompeted;
            Pioneer species grows, dies and forms humus = 2 marks
            G. coulteri / Gelidium outcompetes other / named species = 2 marks

4. *G. coulteri / Gelidium* increases and other / named species

decreases;

4

[7]

Q12.

1.P   Pathogens and effects on host

2.T   Taxonomy

2.C   Classification and evolution.

2.I   Inheritance and evolution

2.Gc Genetic code, universal

2.B   Behaviour

2.Ev Populations and evolution, variation between individuals within a species

3.BP Relationships within ecosystems − eg predator / prey

3.E   Energy transfer in ecosystems

3.N   Nutrient cycles, the organisms involved

3.S   Succession, biodiversity, species and individuals in a community

4.H   Human impacts on the environment and its effect on relationships between organisms − including farming

4.Gt   Gene technology and GMO and selective breeding

4.Ar   Antibiotic resistance

Examiners are free to select other letters if they wish

The emphasis in answers should be on the <u>relationships and interactions between organisms</u> not just the topics themselves

Breadth, one mark for use of an example from each of the following approaches − <u>3 max:</u>

1. Pathogen and host

2. Evolution (related topics)

3. Ecological

4. Human intervention in relationships

[25]

Q13.
(a)   (i)   1.   No overall pattern / pattern (of right or left most common) is not the same for all islands;

    2.   For **(B) C** and **E** there is little difference;

    3.   Large differences on **A** *and* **D** *and* opposite ways (to each other);

    Need both aspects but allow other expressions of 'opposite ways'

2 max

(ii) 1.   Can record all individuals on (small) islands;

     2.   (So) no / less sampling error;

     3.   (Maybe) different rates of mutation / different selection pressures / different environmental conditions;

     4.   Inbreeding / breeding with close relatives (more likely);

     5.   (Little) gene flow / (more chance of) genetic drift;
       Accept reference to either of these ideas for this point

2 max

(b) 1.   If R is recessive, R × R parents cannot produce L offspring;
       Accept use of genetic diagrams to illustrate points 1 and 2

     2.   If L is recessive, L × L parents cannot produce R offspring;
       Accept right arm on top as R etc.

     3.   R × R **and** L × L parents produce both types of offspring;
       Need reference to two parent crosses for this mark

3

(c) Both L and R in a set of twins / (some) twins show different arm-folding;

1

[8]

Q14.

(a) 0.8;

1

(b) (i) 1.   Aerobic respiration;
       1. Allow description e.g. respiration using oxygen
       1. Accept 'oxidative phosphorylation'

       2.   Increase in uptake (of oxygen) with growth / reproduction / division of yeast cells;

       3.   Glucose / nutrients / oxygen decreases / becomes limiting

/ cells die / ethanol / toxins form / heat produced /
anaerobic respiration occurs;

3. Ignore any reference to time

*3. Accept decrease in oxygen being linked to
oxygen being 'used up' or equivalent*

3

    (ii) 1.   (Ethanol produced) by anaerobic respiration / from
pyruvate in anaerobic conditions;

1. 'Fermentation' is not enough on its own

        2.   (Ethanol / anaerobic respiration) increases as oxygen
(uptake / concentration) decreased / decreases as
glucose is used up / ethanol kills cells;

2

(c) 1.   Oxygen uptake decreases / stopped;

     2.   Oxygen is final (electron) acceptor / combines with electrons
(and protons);

     3.   Ethanol produced sooner / more ethanol produced;

*3. Accept ethanol produced at any specified time
before 16 hours*

3

[9]

Q15.

(a) 1.   Decrease in (percentage cover) of bare ground / water linked to more
plants / species / increase in plant coverage;

*Allow **one maximum mark** for answers which
describe all three changes **without** a suitable
explanation for any change*

*Must be idea of more / increase not just change in
species / plants*

     2.   Change in diversity / number of plant / species / named
(species) as abiotic conditions altered / due to <u>competition</u> /
more soil / less hostile;

Accept pioneer species replaced due to competition

Accept description of change in species

Accept 'more suitable' = less hostile

     3.   Increase in depth of soil as plants die / humus formed;

3

(b) 1.   Greater variety of food / more food <u>sources</u>;

'More food' = neutral

     2.   More / variety of habitats / niches;

Ignore 'more homes' or reference to 'shelters'

2

(c) (i) 1. Marking is not removed / marking does not affect survival / predation;

2. Limited / no immigration / emigration;

Accept 'migration' and descriptions of immigration / emigration

2. and 4. Increase / decrease in population is not sufficient – there must be a reason

3. Sufficient time for (marked) individuals to mix (within the population);

Accept – 'For mixing to occur between samples'

4. No / little births / deaths / breeding;

5. Sampling method is the same;

Ignore 'random sampling'

2 max

(ii) Correct answer of ...34 = 2 marks;

Allow one mark for an answer of 51 as candidate has misinterpreted the second sample as being = 30

Incorrect answer but shows correct formula in words or numbers
e.g. 17 × 20 ÷ 10;

Reject correct formula multiplied by 100

2

[9]

Q16.

(a) All / group of species / all / group of populations / all the organisms;

Accept equivalent terms for group.

*Answers which only refer to organisms must have idea of **all** the organisms not just a group of organisms*

Reject answers which include 'environment' or abiotic factors as part of the definition

1

(b) (i) 7.2 - 8.4 (metres);

Accept answer of 1.2

1

(ii) 1. Food / prey / oxygen;

Do not accept 'resource' for mark point 1 unless this is qualified as food / prey / oxygen

2. Less / no competition;

Reference to light and CO_2 as a resource negates mark point 2

2

(c) 1. Increase in depth linked to decrease in temperature / decrease in depth linked to increase in temperature;

Accept increase or decrease in temperature is related to 'higher depth' or 'lower depth' due to ambiguity of these terms

2. Correlation / relationship between temperature and fish distribution does not indicate a causal effect;

Ignore any reference to correlation unless it is clearly in context of temperature and fish distribution

3. Overlap in ranges / different fish / species occupy same depth;

Temperature does not determine fish distribution is not sufficient for idea of causal effect

4. Other abiotic / biotic / named factor involved;

Reject: 'casual' for mark point 2

Reject 'other factors' for mark point 4 unless further qualified

3 max

[7]

Q17.

(a) (i) Each treatment occurs in each row <u>and</u> each column;

Ignore references to random

1

(ii) 1. Different environments or different variables in the field / in different plots / variables change across rows / down columns / from one side to another;

2. Minimises / removes the effect of variables;

2

(b) Standardising any two relevant factors, for example:

To gain credit here, factor must be something that the scientists could do and must relate to field conditions

1. Water;

2. Fertiliser / manure / soil nutrient;

3. Weed killer;

4. Soil pH;

Reject answers such as keep light / carbon dioxide / temperature constant

2 max

(d) (i) 1. Survival falls as time increases;

2. Survival falls as sowing density increases;

3. Up to 15 / 25 seeds per m² all survive / above 250 seeds per m² survival falls rapidly;

3

(ii) 1. Intraspecific competition / competition between bean / soya plants / for water / nutrients / light;

2. Greater as plants grow / increase in size;

2

[10]

Q18.

(a) 1. Quadrats placed at intervals along transect;

2. Number of seeds counted per quadrat to calculate seeds per m²;

2

(b) (i) 1. Wind from North East;
Accept blowing to South West

2. Seeds blown further;

2

(ii) 1. Seeds have different distances to fall / seeds have different times in air;

2. Blown by wind a different amount;

3. (Candidates investigation) shows that seeds travel further when dropped from higher;
Supported by reference to candidate's investigation

2 max

(c) (i) 1. Produces large number of seeds / produces seeds blown by wind;

2. Greater probability (of colonising);
Accept greater chance

2

(ii) 1. Small size;

2. Too little food in seed to become established;

3.   Not enough light for photosynthesis;

2 max

[10]

Q19.

(a)   1.   Competition (from) parent tree;

       2.   (From) large number of seeds;

       3.   For light / nutrients / water;

3

(b)   1.   Few seeds / young plants;

       2.   Interspecific competition / unsuitable conditions means not all survive;

2

[5]

Q20.

(a)   1.   Place transect up / down shore / transect from low to high tide;
           Must give direction

       2.   Use quadrats at regular / measured / known intervals;

       3.   Repeats / more than one quadrat at each interval;

3

(b)   1.   *U. pertusa* will be uncovered for most of the day / *M. yendoi* is covered by sea water most of the time;

       2.   Thick walls will allow *U. pertusa* to withstand desiccation / thick walls will reduce damage / thick walls will provide support;
           Accept description of desiccation.

       3.   *U.pertusa* better competitor / better adapted in uncovered areas;

3

[6]

Q21.

(a)   All the fish / all the species / all the populations / all the organisms;
           Must indicate all / every species.
           Reject answers that suggest other fish / organisms might be present.

1

(b)   (i)   1.   Capture sample, mark and release;

            2.   Appropriate method of marking suggested / method of marking does not harm fish;

E.g. Cutting a fin / attaching a tag / paint / marker.

    3.   Take second sample and count marked organisms;
        May be awarded from equation if not given here.

$$\text{Population} = \frac{\text{No in sample}_1 \times \text{No in sample}_2}{\text{Number marked in sample}_2};$$

    4.

        *Accept any valid alternative to equation or answer
        expressed as a ratio.*

3 max

    (ii)   One suitable reason;
            *Accept other valid answers, which must, however,
            relate to breeding / only works if population
            constant.*

            E.g. population increases / changes (between first and second
            sample)

1

(c)   1.   With different mouth eats different food / has different way of
          feeding / specific mouth shape for specific food;
             Catches more food and gas exchange are neutral

        2.   Competition between species / interspecific competition is
           reduced;
             Reject intraspecific

2

[7]

Q22.

    (a)   1.   Transect / lay line / tape measure (from one side of the dune to the
            other);
               *1. & 2.   Reject random in context of placing
               transect / quadrats*

        2.   Place quadrats at regular intervals along the line;
             *Accept references to stratified sampling / different
             seral stages*

        3.   Count plants / percentage cover / abundance scale (in
           quadrats)
             Accept abundance scale

        OR

        Count plants and record where they touch line / transect;

3 max

    (b)   1.   Stabilises sand / stops sand shifting;

2. Forms / improves soil / makes conditions less hostile;

> *Allow credit for example of making conditions less hostile such as:*
> *Adds nutrients*
> *Improves water retention*

2

[5]

Q23.

(a) 1. Breeding less successful;

2. Feathers in poor condition;

3. Less energy for breeding / reproduction / stated aspect of reproduction;

> *1. Reject cannot breed.*
> *2. Ignore "wings damaged".*

2 max

(b) (i) 1. Avoids bias / data representative / choice of nest not influencing results;

2. Allows use of statistical tests / named statistical test;

2

(ii) Accept general statements or statements based on data that make the required points.

1. Correct statement about range of 0 – 15;

2. Correct statement about 0;

3. Correct statement about 170;

4. Correct statement about gap between 15 and 170;

> *1. e.g. No pattern / no correlation between 0 and 15.*
> *2. e.g. Birds with no feather mites did not have (the) high(est) breeding success / 86%.*
> *3. e.g. Highest number of feather mites linked to lowest breeding success.*
> *4. e.g. No data between 15 and 170.*

3 max

(c) (i) There is no correlation between the number of feather mites and breeding success / the number of feather mites does not affect breeding success;

> *These specific variables must be stated.*
> *Reject difference between feather mite and breeding success.*

1

(ii) Breeding success decreases as feather mites increases / negative
correlation between feather mites and breeding success;

Accept reproductive or breeding success.

1

(d) (i) 1. The larger the size of the oil gland the larger the number of feather mites;

2. Positive correlation;

3. (Wide) scatter of points / points not on line;
3. Accept any answer that conveys the idea of a wide spread.
Ignore any reference to anomalies.

2max

(ii) No mark for effect on reliability, marks are for explanation.

1. Oil gland size / number of mites could vary;

2. At different times of the day / due to preening;
Ignore responses that state oil gland affects numbers of mites.
Allow preening affects mite numbers / size of oil gland.

2

(e) 1. Improve health of birds / reduces disease / reduces harm;

2. Healthier birds may find more food for young / do not pass on disease / have greater specified aspect of breeding success;
1. Ignore death of birds.
2. Specified aspect can include longer breeding life.

2

[15]

Q24.

(a) Two marks for correct answer, 41.9 / 42 ;;
One mark for incorrect answer of 0.42;

2

(b) Increases proportion of crop that is used / greater proportion is grain / reduces proportion of crop that is not used / is not grain;

1

(c) Quadrats from different parts of field;
Biotic / abiotic factors / named biotic / abiotic factor different;

2

(d) Water (in plants and grain);
Varies;

2

[7]

Q25.

(a)   Shows mass of wheat seedlings when grown on their own;

Allows percentage to be calculated / allows comparison / allows
effect of competition to be seen;

2

(b)   1.   Interspecific competition / ryegrass reduces growth of wheat;

2.   Justification by using values;
*100% with wheat but less when grown with
ryegrass*

3.   Competition between shoots had a greater effect than
competition between roots;

4.   Justification by use of values;
*46% when shoots complete / in **Y** / 76% when roots
compete / **X***
*When marking please number marking points
E.g. ✓ means a mark awarded for point 4.*

4

(c)   Growth involves enzymes / enzyme-controlled reactions;

Lower temperature means less kinetic energy / fewer collisions /
fewer E–S complexes formed;

Wheat and ryegrass affected to a different extent;
*Accept other valid physiological processes such as
growth involves diffusion / lower temperature
means less kinetic energy / molecules move
slower.*

2 max

[8]

Q26.

(a)   (i)   Decrease in spadefoot toad;

Decrease in southern toad up to 4 newts per pond, then
increase
(at 8 newts per pond);
*Allow one mark for answers stating decrease in
both toad species*

2

(ii)   Predators / newts eat / feed / prey on toad (tadpoles);

Less competition more food / resources / fewer toads feeding
on frogs;
*Allow first mark if reference is made to either toad
species being eaten.*

2

(b)   Fewer toads / tadpoles (as number of predators increases in Figure 1);

More food, so are larger / grow more / increase in mass;

2

[6]

Q27.

(a)   Same number of ryegrass seedlings in distilled water;

1

(b)   (i)   Produce null hypothesis;

Carry out Spearman Rank correlation test / find correlation coefficient;

Use values to show P < critical value / find probability of results being due to chance;

2 max

(ii)   May be another factor / named factor (that also inhibits germination);

1

(c)   (i)   Extract inhibits ryegrass germination / extract stops ryegrass starting to grow;

Inhibition of root length / causes ryegrass to have shorter roots;

2

(ii)   Scientists crushed plants to get extract;

Plants might not secrete substances in the extract into the soil;

These substances might get broken down in the soil;

Wheat and ryegrass might not grow at the same time / wheat plants might not produce substance when ryegrass is growing;

Concentration of extract in the soil might be different from that

in solution;

3 max

[9]

Q28.

(a) Two marks for correct answer of 59 / 60;;

One mark for incorrect answer clearly derived from figures of 18, 28 and 38;
Ignore: any figures after decimal point.

2

(b) (i) Population changes;
Reject: population decreases

As young birds leave nest / join population;
Reject first point if (young) birds are leaving population / migrating

2

(ii) (Would be likely to) catch all birds (again) in second sample / sample sizes are the same;
Neutral: references to breeding

Birds (in territories and) not mixing with population;
Accept: idea of the population is divided

Accept only estimates number of birds in territories sampled / territory sample not representative (of population) for 1 mark

2

(c) (Recording) DNA / base sequence is like marking (animal) / wouldn't need to mark;

(Finding identical / same base sequence) would show animal has been caught / recorded before;

2

[8]

Q29.

(a) (Increase in) dead organisms / humus / decomposition;

Leading to (increase in) nitrification / ammonia to nitrate / activity of nitrifying bacteria;

2

(b) (i) Bare soil temperatures fluctuate;
Reject: environmental temperature
Accept: converse

More bare soil, early / at start of succession / when few plants;

2

(ii)   Plant will grow / survive in the shade / when overshadowed
        (by taller plants) / when receiving less light;
                Effect on plant with reason for effect
                Ignore reference to competition

                                                                        1

(c)   (Grassland consists of) small / annual plants which will be replaced
       by / outcompeted by woody plants;
                Must be in the context of grassland
                *Need idea of replaced not just an increase in
                percentage cover*

       So these (woody plants) must be removed / have growth checked /
       grazed;

                                                                        2

                                                                        [7]

Q30.

Lay tape / rope at right angle / perpendicular to road;
Take samples at regular / stated intervals;
Using a quadrat;
Count numbers / percentage cover of dandelions;
Use several transects;

                                                                        4 max

                                                                        [4]

Q31.

(a)   Shows trend of mean temperature rise;
       Higher temperatures more frequent since 1984 (in January and February);
       Considerable variation in temperature from year to year;
       Which may be due to chance;
                *No mark for yes or no Do not penalise candidates
                who state there is no trend*

                                                                        2 max

(b)   Construct null nypothesis;
       Use Spearman rank (and calculate test statistic);
       Look up in table (to find critical value of P = 0.05 / 5 %);
       Use figure (in table) to accept or reject null hypothesis;

                                                                        3 max

(c)   (i)   (Particular daylength) always occurs at same time of year /
              valid example;
              Birds do not start laying eggs when period of warm weather
              occurs early in year;
              Synchronises breeding behaviour;
              Sufficient foraging time for food collection for young;

                                                                        2 max

       (ii)   Birds able to respond to changing climate;
              Food availability (mainly) determined by temperature;
              As insect / invertebrate development temperature-dependent;

                                                                        2 max

(d) A correlation does not indicate a causal relationship;
As may be due to another factor / named factor;

2

(e) Visits could be up to 5 days apart;
Date of egg-laying may be inaccurate by 5+ days;

2

[13]

Q32.

(a) Small surface area to volume ratio / more fat;

Lose less heat (to the environment) / for insulation when they are sitting on eggs;

2

(b) (i) The further north / higher the latitude, the higher the percentage (of white snow geese);

1

(ii) Snow lying longer / melts slower further north / at greater latitudes;

White geese better camouflaged (further north);

Predation linked to survival / reproductive success;

> **Q** *In order to gain the last marking point, candidates must explain how survival or reproductive success is affected.*

3

(c) Snow melts earlier / snow melts further north / less snow;

White geese decreasing as less well camouflaged / at disadvantage / blue geese increasing as better camouflaged / at an advantage;

2

(d) (i) Stabilising;
> *Do not accept stable*

1

(ii) Few geese survive at the extremes / most survive from the middle of the range;

1

[10]

Q33.

(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 more than 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
                environmental conditions;

                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 positive correlation;

1

        (ii)   Curve / line of best fit (almost) parallel to x-axis / horizontal /
                level / no correlation / 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]

Q34.

(a) (i) ecosystem is (self-supporting) system in which all organisms / community interact with physical environment / community + environment / biotic + abiotic;

1

(ii) A + B + E + F + G + I;

1

(b) pygmy weed competes for CO_2 / light / nutrients; reduction in numbers of original plants;
some of original plant <u>species</u> lost;
loss of habitats / niches / shelter / food sources;
consumers die / some migrate;

3 max

[5]

Q35.

(i) Population is the total number of organisms / individuals of a species / tigers in an area (at a given time);

1

(ii) (Deforestation involves) habitat destruction / destruction of niches;

Some prey animals move out or die / fewer suitable prey for tiger / less food for tiger; Reduces tiger population if prey biomass falls below 600 (tonnes per km^2);

3

[4