

Mark schemes

- (a) (No – no mark)

1

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 mostcommon allele (of this gene).

3

[8] (a) Community;

2

1

- (b) (Less) competition for food/resource;

Ignore: competition for niche/habitat.

Accept: space/named resource.

Reject: intraspecific competition.

1

- (c) 1. **Correlation but** does not mean a causal effect;

Ignore: positive/ negative (correlation).

2. Other abiotic/biotic/named factor involved;

Accept: due to presence/absence of fish.

Reject: 'other factors' unless further qualified.

3. Variation in numbers of beetles species at same/similar/particular pH;

Accept: same number of beetles at different pHs.

- Accept: 'scattered results' / 'anomalies' / 'spread of results'.* 4. Large sample;

Max 3

- (d) Fish feed on predator/consumer of water beetle;

Accept: beetles feed on fish/faeces.

1

[6]

- (b) 1. Respiration/metabolism/ammonification;

3

2. (Releases/produces) heat;
Reject: 'produces energy'.

2

- (c) 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.*

2 max

- (d) 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;

2 max

- (e) 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 hostile 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.

3 max

[9]

4

- (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.

[15] (a) 9 (hours);;

3

5

If multiply 75 by 0.11 and 0.23 but wrong answer, then 1 mark

Accept for **one** mark if multiply 75 by two wrong proportions near to 0.11 ± 0.01 and 0.23 ± 0.01 or multiply by the difference between the two (wrong) proportions

2

(b) (Yes because)

1. Both/Each species (mean) time spent looking around greater where many predators;
2. Differences (appear to be) significant because SDs do not overlap;

(No because)

3. Wildebeest spend same (mean) time looking around where many predators as impalas where few predators;
4. Don't know what they are looking for (when heads up);
5. Habitats might be different in different areas (which could affect the behaviour);

Accept 'mean proportion' means 'time'

1. Require idea of both, not just quoting numbers

2. This point must be in the context of point 1

2. Do not accept results significant

2. Accept 'because bars do not overlap'

2. Do not accept SE for SD

3. Accept overlap in SD as equivalent to same time

5. Ignore 'other factors' unqualified and discussions of experimental variables

4 max

(c) 1. Less time spent feeding

OR

More energy lifting head/looking round;

2. (So) less food/biomass for respiration

OR

less energy for growth/reproduction/care of young;

OR

3. Raising head makes them more visible to predators;

4. So more likely to be attacked/eaten/killed;

2. Accept any appropriate suggestion of less energy for something to do with life of the herbivore

2. Allow less food/biomass for growth/reproduction

2. Ignore references to energy for respiration

2

[8]

(a) (i) Unit of energy / mass, per area, per year.

6

1

(ii) 1. Less light / more shading / more competition for light;

Neutral: references to animals

2. Reduced photosynthesis.

Accept: no photosynthesis

2

(b) 1. Pioneer species;

2. Change in abiotic conditions / less hostile / more habitats / niches;

Accept: named abiotic change or example of change e.g. formation of soil / humus / organic matter / increase in nutrients Neutral: reference to change in environment unqualified Neutral: more hospitable / habitable / homes / shelters

3. Increase in number / amount / diversity of species / plants / animals.

Accept: other / new species (colonise)

3

(c) 1. Net productivity = gross productivity minus respiratory loss;

2. Decrease in gross productivity / photosynthesis / increase in respiration.

2

(d) 1. Conserving / protecting habitats / niches;

2. Conserving / protecting (endangered) species / maintains / increases (bio) diversity;

3. Reduces global warming / greenhouse effect / climate change / remove / takeup carbon dioxide;

4. Source of medicines / chemicals / wood;

5. Reduces erosion / eutrophication.

Accept: tourism / aesthetics / named recreational activity

1 max

[9]

(b) 1. Geographic(al) isolation;

2. Separate gene pools / no interbreeding / gene flow (between populations);

Accept: reproductive isolation

This mark should only be awarded in context of during the process of speciation. Do not credit if context is after speciation has occurred.

7

3. Variation due to mutation;
4. Different selection pressures / different abiotic / biotic conditions / environments / habitats;
Neutral: different conditions / climates if not qualified
Accept: named abiotic / biotic conditions
5. Different(ial) reproductive success / selected organisms (survive and) reproduce;
Accept: pass on alleles / genes to next generation as equivalent to reproduce
6. Leads to change / increase in allele frequency.
Accept: increase in proportion / percentage as equivalent to frequency

6

- (c)
1. Capture / collect sample, mark and release;
 2. Method of marking does not harm lizard / make it more visible to predators;
 3. Leave sufficient time for lizards to (randomly) distribute (on island) before collecting a second sample;
 4. (Population =) number in first sample × number in second sample divided by number of marked lizards in second sample / number recaptured.

4

- (d)
1. High concentration of / increase in carbon dioxide linked with respiration at night / in darkness;
 2. No photosynthesis in dark / night / photosynthesis only in light / day; *Neutral: less photosynthesis*
 3. In light net uptake of carbon dioxide / use more carbon dioxide than produced / (rate of) photosynthesis greater than rate of respiration;
 4. Decrease in carbon dioxide concentration with height;
More carbon dioxide absorbed higher up
Accept: less carbon dioxide higher up / more carbon dioxide lower down
 5. (At ground level) less photosynthesis / less photosynthesising tissue / more respiration / more micro-organisms / micro-organisms produce carbon dioxide.
Neutral: less leaves unqualified or reference to animals

5

[15]

8

- (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 / CO₂ / 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

- (e) (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] (a) (i) (Organisms that) can breed together / interbreed **and** produce fertile offspring;

9

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

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

(b)

2 marks for correct answer

1 mark for having A on top of equation (recognises that total population related to total area)

Note:

$$P = A \times S / R \text{ or}$$

$$P = A / R \times S$$

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] (a) *Ulva lactuca*;

10

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]

- 1.P Pathogens and effects on host

11

- 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 relationships and interactions between organisms not just the topics themselves

Breadth, one mark for use of an example from each of the following approaches – 3 max:

1. *Pathogen and host*
2. *Evolution (related topics)*
3. *Ecological*
4. *Human intervention in relationships*

[25] (a) (i) 1. No overall pattern / pattern (of right or left most

12

common) is not the same for all islands;

Allow expression in other ways e.g. three islands show left on top is more common

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]

13

- (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 competition / 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 sources;

'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. $17 \times 20 \div 10$;

Reject correct formula multiplied by 100

2

[9] (a) Crabgrass;

14

Reject: grass or grassland

Reject: crabgrass if another organism is also included

1

(b) 1. Species / plants / animals change the environment / conditions / add humus / nutrients etc. / less hostile (habitat);

Accept ‘they’ for species / plants in mark points 1 and 2

2. Species / plants better competitors;

2

(c) (Only) plants which can photosynthesise with less light (remain);

Accept converse but do not award mark for idea that plants cannot photosynthesise and die because there is no light

Answers must be in context of being or not being able to photosynthesise with less light

1

[4]

(a) 0.8;

15

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

16

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 CO₂ as a resource negates mark point 2
Ignore intraspecific / interspecific for 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]

17

- (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] (a) (i) Each treatment occurs in each row and each column;

18

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]

19

- (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] (a) 1. Place transect up / down shore / transect from low to high tide;

20

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] (a) All the fish / all the species / all the populations / all the organisms;

21

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.

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

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] (a) (i) Non-living / physical / chemical factor / non biological;

22

Do not accept named factor unless general answer given.

1

- (ii) Accept an abiotic factor that may limit photosynthesis / growth;

Reject altitude / height

Water

Named soil factor

Not "soil" / "weather"

Light

Carbon dioxide

Accept Oxygen

Incline / aspect

Wind / wind speed

1

- (b) 1. Correct explanation for differences between day and night e.g. photosynthesis only during the daytime / no photosynthesis / only respiration at night;

2. Net carbon dioxide uptake during the day / in light

OR

No carbon dioxide taken up at night / in dark / carbon dioxide released at night / in dark;

3. At ground level more respiration / in leaves more photosynthesis;

4. Carbon dioxide produced at ground level / carbon dioxide taken up in leaves;

Principles

Comparing day and night / light and dark

1. *Explanation in terms of photosynthesis / respiration*

2. *Effect on carbon dioxide production / uptake*

Comparing leaves with ground level

3. *Explanation in terms of photosynthesis / respiration*

4. *Effect on carbon dioxide production / uptake*

2 and 4 must relate to why the change occurs

4

- (c) 1. Variation in original colonisers / mutations took place;

2. Some better (adapted for) survival (in mountains);

2. *Allow "advantage so able to survive"*

3. Greater reproductive success;
4. Allele frequencies change;
 4. *Reject gene / genotype*

3 max

[9] (a) 1. Transect / lay line / tape measure (from one side of the dune to the other);

23

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] (a) 1. Breeding less successful;

24

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] (a) Greater when treated with herbicide **G**;

25

Same number but total biomass larger;

Can be shown by figures

2

- (b) Fewer weeds left to produce seeds;
Less contamination of crop (by weeds); / fewer weeds to separate from crop; / less competition (between crop and weeds);

2

(c) **Advantage**

Weeds growing fast / photosynthesising fast so effect will be seen / will have large effect;

Disadvantage

No information about winter / other seasons / weeds not growing fast / could kill (beneficial) insects / crop may be harvested before effects noticeable;

One mark for advantage and one mark for disadvantage

2

(d) **Limitations of investigation**

1. No control / untreated field;
2. Amount of herbicide may be different;
3. May be differences between fields; Eg soil Nutrients / fertiliser added Type of weedMicroclimates
4. May be different number of weeds (at start);

Limitations of results

5. No replicates / one set of data;
6. Field size may vary / not specified;

Scientific Research

7. Scientific research / example of scientific research has led to greater yield;

When marking please number the marking points

e.g. ⁵✓ means a mark award for point 5

5 max

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

26

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 compete / in Y / 76% when roots compete / X

When marking please number marking points

E.g. 4 ✓ 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]

- (a) (i) Decrease in spadefoot toad;

27

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.

For first mark candidate must clearly indicate that the newts are feeding on the toads. Answers simply stating that newts are increasing and toads are decreasing are not sufficient.

2

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

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

If candidate clearly indicates fewer frog tadpoles survive, negate the first marking point. However, accept decrease in overall number of tadpoles which may include frog tadpoles.

2

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

- (b) (i) Produce null hypothesis;

Carry out Spearman Rank correlation test / find correlation coefficient;

Use values to show $P < \text{critical value}$ / find probability of results being due to chance;

Accept valid example

E.g. There is no correlation between inhibition of germination and the concentration of the extract.

2 max

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

e.g. amount of water in extract

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] (a) 1. (Colonisation by) pioneer (species);

29

2. Change in environment / example of change caused by organisms present;

3. Enables other species to colonise / survive;

4. Change in diversity / biodiversity;

5. Stability increases / less hostile environment;

6. Climax community;

Example of change e.g. formation of soil / humus / organic matter / increase in nutrients;

Do not accept genetic diversity for mark point 4.

5 max

- (b) 1. Geographical isolation;

2. Variation due to mutation;
3. Different environmental / abiotic / biotic conditions / selection pressures;
4. Selection for different / advantageous, features / characteristics / mutation / /allele / differential reproductive success / (selected) organisms survive and reproduce;
5. Leads to change in allele frequency;

In this question must refer to allele where appropriate, not gene.

5

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

30

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

31

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]

- (a) (i) Fewest people at site R as mean is lowest;

Accept use of mean values to show 2.2 is the lowest

Standard deviations do not overlap so significant / not due to chance;

*Accept use of values / description of standard deviation even in
wording 'standard deviation' is not used*

2

- (ii) There was a probability of less than 0.05 / 5 in a hundred / 5%;

*In the context of less than
Accept converse: probability of more than 95%*

That the difference was due to chance;

Look for idea of difference (between sites)

2

- (b) (i) (Would not be reliable as) number of species is still increasing;

Accept: has not reached peak / maximum or if shown by values

1

- (ii) Idea of curve has flattened / no more species found so no benefit / no point
/takes unnecessary time / takes unnecessary effort / can get same results
with fewer quadrats; *Basic idea is of minimising effort.*

If values used reward idea rather than accuracy of numbers

1

- (c) Combustion / would burn / cause loss of substances (other than water) / named substance
/ cause loss of dry mass;;

Accept: only want water to be lost

Ignore: reference to decomposition

1

32

- (d) Seaweeds / plants are producers / lower / first trophic level / animals are consumers / higher trophic level / feed on seaweeds;

Accept relevant position in food chain as trophic level

Loss of energy between trophic levels as a result of respiration / as heat;

Accept: energy transfer is inefficient

Accept: description of trophic levels

Accept: not all seaweed / eaten

2

- (e) (i) The site / site U with most people / 34.6 has the largest ratio / 3.24;

Accept: as number of people increases, ratio increases

(Large value of ratio due to) large biomass ÷ small number / large size ÷ small number / biomass greater than abundance;

Explanation of seaweed ratio

2

- (ii) 1. Fewer larger animals / more smaller animals where more people / more disturbance; *Principle*

2. 0.09 linked to 34.6 / appropriate link between row 4 and row 1; *Use of data*

3. Larger animals affected by human activity; *Accept: converse*

4. Smaller animals are young animals; *Accept: converse*

5. Fewer species of seaweed (with disturbance); *Accept if shown by figures*

6. (So) fewer niches / habitats (for large animals); *Accept idea of disturbance / damage to niche / habitat*

4 max

- [15] (a) 1. Evidence for red oak is reliable because 100% healthy and large sample size /

33

evidence for paper birch unreliable because sample size too small;

2. Other species show injury so may not be tolerant;

3. Amount of injury is subjective so not reliable;

4. Paper birch is 100% healthy with high chloride in tissues so may be tolerant;

4

- (b) (Resource B suggests that) sodium chloride decreases the percentage germination

(of barley);

(Resource C suggests that) sodium chloride decreases the yield of some grasses / named grasses / named crops;

(Resource D suggests that) the damage in susceptible plants / trees is associated with chloride accumulating in the tissues;

Some plants / trees are able to prevent chloride from entering the tissues and are not damaged;

4

[8] Lay tape / rope at right angle / perpendicular to road;

34

Take samples at regular / stated intervals;
Using a quadrat;
Count numbers / percentage cover of dandelions;
Use several transects;

4 max

[4]

(a) Two marks for correct answer, 41.9 / 42 ;;

35

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]