Required Practicals 10 and 12, Animal Behaviour and Species Distributio

11 questions · 29 marks · about 38 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2024 · Q05.1 · 5 marks

0 5 . 1 A weed is a plant growing where it is not wanted. Fat hen is a weed which grows in some crop fields.

Describe how you could estimate the **number** of fat hen plants in a field.

[5 marks]

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Question 2 · A level Paper 2 · November 2021 · Q09.1 · 3 marks

0 9 A coral reef is an underwater ecosystem formed as a ridge of mainly calcium carbonate deposits. Algae are photosynthesising organisms. Some algae grow on coral reefs. Succession results in a wide variety of fish living on coral reefs.

0 9 . 1 Describe a method that could be used to determine the mean percentage cover of algae on a coral reef.

Do **not** include information on the difficulties of using your method underwater.

[3 marks]

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Question 3 · information from earlier in the question

1 0 Read the following passage.

Lake Malawi in East Africa has more species of fish than any other lake in the world. Many of these species have evolved from a common ancestor. Lake Malawi is one of the largest lakes in the world and was formed several million years ago. Since then, the water level has fluctuated greatly. As a result, what is now a large lake was at one time many smaller, separate lakes.

The country of Malawi has a total area of 118 000 km^2. The actual land area is only 94 080 km^2, because approximately one-fifth of the country is Lake Malawi.

In December 1990, forests covered 41.4% of the actual land area of Malawi. In December 2016, forests covered 26.4% of the actual land area of Malawi.

Deforestation and farming along the shores of Lake Malawi have caused increased soil erosion and loss of nutrients into the lake. This has resulted in a decrease in some fish populations. The mark-release-recapture method can be used to estimate the size of a fish population. However, this method can produce unreliable results in very large lakes.

Use the information in the passage and your own knowledge to answer the following questions.

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Question 3 · A level Paper 2 · November 2021 · Q10.4 · 4 marks

1 0 . 4 The mark-release-recapture method can be used to estimate the size of a fish population (lines 13–14).

Explain how.

[4 marks]

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Question 4 · information from earlier in the question

1 0 Read the following passage.

The wall gecko is a medium-sized lizard. In an isolated habitat of southern Italy, the wall gecko shows phenotypic diversity. Scientists investigated whether disruptive selection was leading to sympatric speciation in the wall gecko.

Pale geckos live only on walls and are nocturnal (active at night). Dark geckos live mainly on the dark trunks of olive trees and are diurnal (active during the day). These diurnal geckos can change skin colour when occupying different surfaces during the day.

Comparison of mitochondrial genes indicated that the diurnal geckos formed a distinct genetic group. This comparison also confirmed that all the geckos in the habitat were of the same species.

The scientists used the mark-release-recapture method to estimate the size of the population of geckos in the habitat.

Use the information in the passage and your own knowledge to answer the following questions.

Question 4 · A level Paper 2 · June 2024 · Q10.5 · 3 marks

1 0 . 5 Describe and explain **two** precautions required to ensure that the estimate of the size of the population of geckos was valid (lines 12–13).

Do **not** include sample size as one of the required precautions.

In your answer, include the formula to estimate the size of the population using the mark-release-recapture method.

[3 marks]

Precaution 1 _____

_____

_____

Precaution 2 _____

_____

_____

Formula _____

_____

_____

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Question 5 · information from earlier in the question

1 0 Read the following passage.

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Use the information in the passage and your own knowledge to answer the following questions.

Question 5 · A level Paper 2 · November 2021 · Q10.5 · 1 mark

1 0 . 5 Suggest why the mark-release-recapture method can produce unreliable results in very large lakes (lines 14–15).

[1 mark]

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Question 6 · information from earlier in the question

0 3 Tansy, *Tanacetum vulgare*, is a plant that grows in dense patches. The tansy beetle, *Chrysolina graminis*, feeds on, and completes its life cycle on *T. vulgare.*

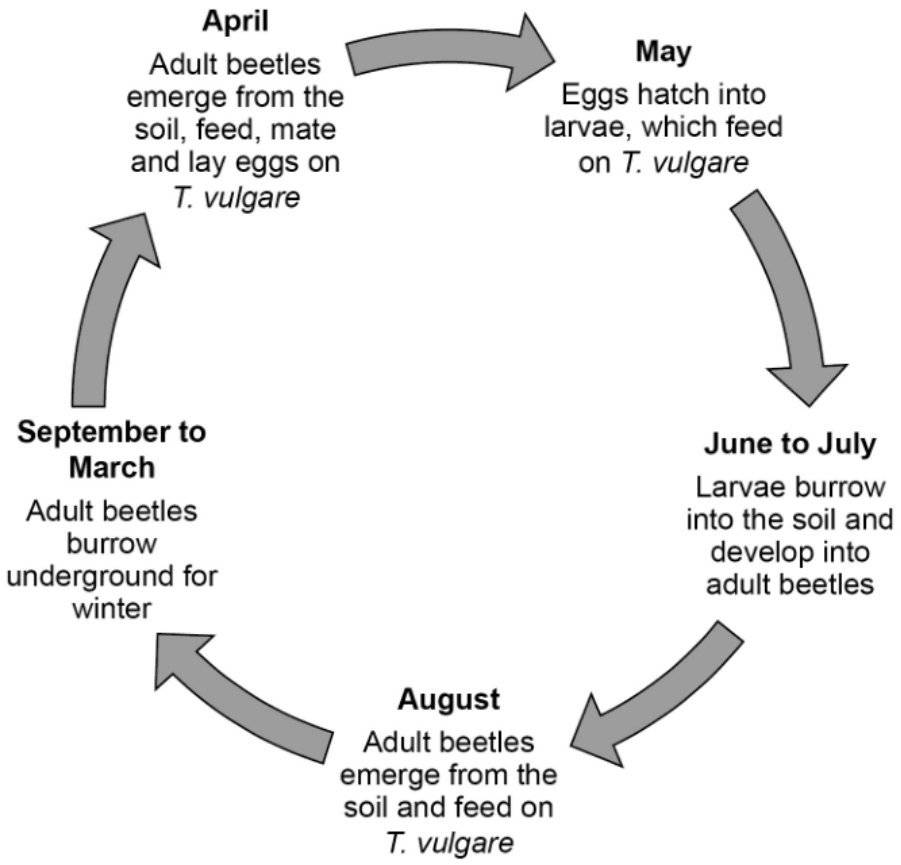
C. graminis is 8–10 mm long and green in colour.

Two other green beetles can also be found in the same habitat.

- The dock beetle, *Gastrophysa viridula,* which is 4–7 mm long.
- The mint leaf beetle, *Chrysolina herbacea,* which is 6–10 mm long.

Figure 2 shows the life cycle of *C. graminis*.

Figure 2



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Ecologists investigated the population size of *C. graminis* using the mark-release-recapture method.

Table 2 shows the ecologists' results.

Table 2

Number of *C. graminis* captured and marked in first sample	Number of unmarked *C. graminis* captured in the second sample	Number of marked *C. graminis* captured in the second sample
405	248	124

0 3 . 2 The ecologists captured and marked the first sample of beetles during the second week of August. They identified the species of beetle before marking them.

Use the information provided to suggest:

[3 marks]

two reasons why the first sample of beetles was captured during the second week of August

1 _____

2 _____

one reason why the beetles had to be identified before being marked.

1 _____

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Question 7 · A level Paper 3 · June 2025 · Q03.4 · 2 marks

0 3 . 4 The ecologists repeated the investigation over a five–year period to monitor the population size of *C. graminis*.

State **two** precautions they would have taken each year to obtain comparable data.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

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0 7 . 1 **Figure 3** shows *Gammarus pulex*, commonly known as a freshwater shrimp.

Figure 3

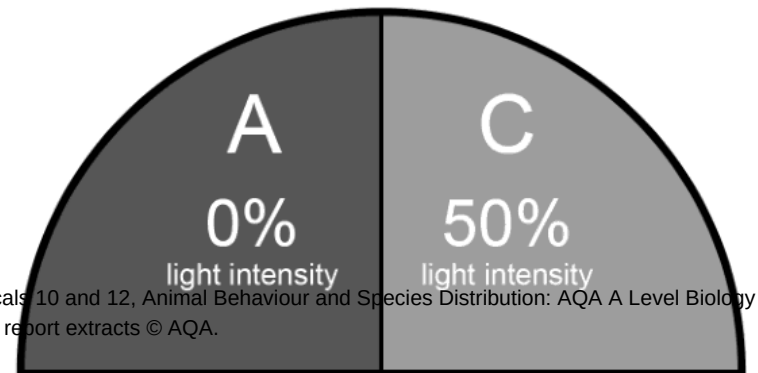


A student used a choice chamber to investigate the effect of light intensity on the movement of *G. pulex*.

The student:

- collected 30 shrimps from a freshwater stream
- added freshwater and gravel substrate from the same stream to each segment
- used layers of black paper on the lid of the choice chamber to reduce the percentage light intensity in 3 segments of the choice chamber as shown in **Figure 4**
- placed 30 shrimps at the centre of the choice chamber
- waited 10 minutes before counting the number of shrimps in each segment.

Figure 4



Question 9 · information from earlier in the question

0 5 The crown-of-thorns starfish (COTS) is one of the main causes of the decline of the world's coral reefs.

Marine biologists used a choice chamber to investigate the effects of flashing and constant light on the behaviour of COTS.

Table 1 shows their results as they presented them. The P values show results from a statistical test.

Table 1

Behaviour of COTS	Type of light used in choice chamber	
	Flashing	Constant
COTS moving towards the stimulus	22	12
COTS moving away from the stimulus	28	38
P value	0.69	0.02

Question 9 · A level Paper 3 · June 2019 · Q05.2 · 1 mark

0 5 . 2 The natural habitat of COTS is coral reefs of tropical oceans.

Suggest **two** factors that should be kept constant in the choice chambers so that COTS display normal behaviour.

[1 mark]

1 _____

2 _____

Question 10 · information from earlier in the question

Ecologists investigated the population size of *C. graminis* using the mark-release-recapture method.

Table 2 shows the ecologists' results.

Table 2

Number of *C. graminis* captured and marked in first sample	Number of unmarked *C. graminis* captured in the second sample	Number of marked *C. graminis* captured in the second sample
405	248	124

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Question 10 · A level Paper 3 · June 2025 · Q03.3 · 2 marks

0 3 . 3 Use the data provided in **Table 2** to estimate the population size of *C. graminis*.

Show your working.

[2 marks]

Answer = _____ beetles

Question 11 · information from earlier in the question

0 7 . 2 **Table 3** shows the student's results.

Table 3

Segment of choice chamber	Percentage light intensity	Number of *G. pulex* counted after 10 minutes
A	0	15
B	25	8
C	50	4
D	100	3

The student observed directional movement by *G. pulex*.

Name the type of behaviour shown by *G. pulex* **and** suggest an advantage to *G. pulex* of this behaviour.

Use the information in **Table 3** in your answer.

[2 marks]

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0 7 . 3 The student analysed the results in **Table 3** using the chi-squared test (χ^2) and calculated a χ^2 value of 11.87

Table 4 shows the critical values of χ^2 at different probability (**P**) values for different degrees of freedom.

Table 4

	Critical values of χ^2 at different **P** values				
Degrees of freedom	**P = 0.95**	**P = 0.5**	**P = 0.05**	**P = 0.01**	**P = 0.005**
1	0.00	0.46	3.84	6.64	7.88
2	0.10	1.39	5.99	9.21	10.60
3	0.35	2.37	7.82	11.35	12.84
4	0.71	3.36	9.49	13.28	14.86
5	1.15	4.35	11.07	15.09	16.75

State a null hypothesis for this investigation **and** explain why the χ^2 test was the appropriate statistical test to use.

[2 marks]

Null hypothesis _____

_____

_____

Explanation for using a χ^2 test _____

_____

_____

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Mark schemes

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05.1	1. Use a grid **OR** Divide field/area into squares; 2. Method of obtaining random coordinates/numbers e.g. calculator/computer/random numbers table/generator; 3. Count number/frequency in a quadrat; 4. Large sample and calculate mean number (per quadrat); 5. Multiply mean number of plants per m^2 by area of field **OR** Divide area of field by area of quadrat x mean number of plants per quadrat **OR** Multiply mean number of plants per quadrat/section by number of quadrats/sections in field;	5 (5 x AO1)

1. Accept use of tape measures/map/area with coordinates.

1. Accept Belt transect.

2. If transect method used accept quadrats at regular intervals.

3. Ignore amount/abundance.

3, 4 and 5. Accept sections/squares for

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Question 2 · A level Paper 2 · November 2021 · Q09.1 · 3 marks

09.1	1. Method of randomly determining position (of quadrats) e.g. random numbers table/generator; 2. Large number/sample of quadrats; 3. Divide total percentage by number of quadrats/samples/readings;	3	1. Ignore line/belt transect. 2. Accept many/multiple/lots but ignore several. 2. Ignore point quadrat. 2. Accept squares/frames (of a grid) for quadrats. 2. If a specified number is given, it must be 10 or more.

Question 3 · A level Paper 2 · November 2021 · Q10.4 · 4 marks

10.4	1. Capture/collect sample, mark and release; 2. Ensure marking is not harmful (to fish) **OR** Ensure marking does not affect survival (of fish); 3. Allow (time for) fish to (randomly) distribute before collecting a second sample; 4. (Population =) number in first sample × number in second sample divided by number of marked fish in second sample/number recaptured;	4	2. Accept examples e.g., marking should not be toxic.

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10.5	1. Marking not toxic **so** does not affect survival **OR** Marking not visible to predators **OR**
	Marking does not wash/rub off **so** recaptured (geckos) identified; 2. Time/delay after release **so** (geckos) spread (in the population) **OR** Time/delay before recapture **so** (geckos) spread (in the population); 3. (Population =) (number in) first sample × (number in) second sample divided by (number) marked in second sample / number recaptured;

3 (1 x AO1, 2 x AO2)	1 and 2. Ignore births, deaths, reproduction, immigration, emigration. 1. Accept 'does not cause harm/death' for
	'does not affect survival'. 1. Idea of marking affecting visibility required in relation to predators. 2. Accept 'after

Question 5 · A level Paper 2 · November 2021 · Q10.5 · 1 mark

10.5	1. Less chance of recapturing fish **OR** Unlikely fish distribute randomly/evenly;	1	Accept 'harder to capture marked fish' (recaptured fish) but ignore 'harder to capture fish'. Accept that fish may remain in one area. Accept fish may congregate.

Question 6 · A level Paper 3 · June 2025 · Q03.2 · 3 marks

03.2	**Max 2 marks for MP1-5 and Max 1 mark for MP6-8** **Reasons for capture** 1. (So beetles) have emerged (from the soil) **OR** (So beetles) are not still in burrows **OR** (So beetles) are not under the soil/ground; 2. (To allow beetles to) evenly/randomly distribute (before they burrow underground); 3. To allow **time** for (re)capture (before they burrow underground); 4. To not disturb mating/egg laying (in April); 5. To ensure no population changes/increase (due to production of eggs/larvae); **Reason for identification** 6. (All three beetles are) same colour/green; 7. (All three beetles are a) similar length; 8. Only *C. graminis*/tansy beetle (population size being) investigated **OR** Only investigated one/correct species **OR** Did not investigate (the) other/wrong species;	3 max (3 x AO3)	7. Accept size

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03.4	1. Collected samples during the second week of August **OR** Collected samples at the same time of year; 2. Collected samples from the same location/area/habitat; 3. Used the same method; 4. Used a different mark (each year); 5. Marking does not affect survival/predation/ behaviour/recapture **OR** Mark is not toxic **OR** Mark is not removed (before second capture);	2 max (2 x AO3)

3. Accept any correct named part of the method used being the same

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Question 8 · A level Paper 2 · June 2025 · Q07.1 · 3 marks

07.1	1. Same/stream water/gravel so natural/usual/ normal habitat/environment **OR** Same/stream water/gravel so normal/usual behaviour **OR** Same/stream water/gravel so variables controlled/same **OR** Same/stream water so oxygen/pH controlled/ same; 2. 30/large sample so representative/reliable; 3. (Placed at) centre so same distance to each segment/light intensity **OR** (Placed at) centre so no bias; 4. (10 minute) delay so shrimps can acclimatise/equilibrate; **OR** (10 minute) delay so shrimps enough time to respond/react/distribute **OR** (10 minute) delay so shrimps not stressed;	3 max (3 x AO3)

1. First 3 options can refer to same stream/water/gravel or stream water/gravel

1. Accept 'so light is the only variable' for 'so variables controlled'

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05.2	Accept any **two** factors for **one** mark from the list below; Salinity / salt concentration of the water Temperature (of the water) Amount / distribution of food pH (of the water) Oxygen/carbon dioxide concentration Intensity/wavelength of (constant and flashing) light	1 max

List rule applies

Ignore humidity

Ignore type of coral

Ignore depth of water

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03.3	Correct answer of 1215 = **2 marks**;; Evidence of 810 (not calculated total number in 2nd sample) = **1 mark** **OR** Evidence of 608 (divided by unmarked rather than marked) = **1 mark** **OR** Evidence of $\frac{150\ 660}{124}$ (correct working but incorrect or no answer) = **1 mark** **OR** Evidence of $\frac{405 \times 372}{124}$ (correct working but incorrect or no answer) = **1 mark** **OR** Evidence of $\frac{405}{n} \times \frac{124}{372}$ (correct working but incorrect or no answer) = **1 mark**;	2 (2 x AO2)

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07.3	1. There is no (significant) difference in the distribution/ movement /behaviour/number of shrimps at different light intensities **OR** (Different) light intensity/intensities has/have **no** effect/relationship on/with the distribution/movement/behaviour of shrimp(s); 2. The data are discrete/categoric **OR** (To determine) if there is a difference between the observed and expected (results/data/values/frequencies);	2 (2 x AO2)

1.Accept 'shrimps show **no** preference for (different) light intensity/intensities

1. Accept correlation for mark point 1 but ignore for mark point 2.

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