HELICATE · AS AND A-LEVEL BIOLOGY · TOPIC BANK

3.4.6 Biodiversity within a community

Topic question bank

Version 1 · 9 October 2026

Name

Date

QUESTIONS	TOTAL MARKS	TIME	YOUR SCORE
5	36	No time limit	/ 36

Contents

Subtopic	Questions	Marks
Species richness and index of diversity Specification 3.4.6	01–02	12
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Farming techniques and conservation Specification 3.4.6	04–05	18
Total		**36**

Instructions

- Answer the questions in the spaces provided. Show all your working.
- The marks for each question are shown in brackets. Use them to judge how much detail to give.
- Work through a subtopic at a time, then mark your answers with the matching mark scheme.

Original questions by Helicate for AQA AS and A-level Biology (7401/7402), specification section 3.4.6. Not affiliated with or endorsed by AQA.

Do not write outside the box

Species richness and index of diversity 3.4.6

0 1 . 1 An ecologist wants to calculate an index of diversity for the plants in a grassland community.
Which data must the ecologist collect?
Tick (✓) one box.

[1 mark]

- The number of different plant species only ☐
- The total number of individual plants of all species only ☐
- The number of different plant species and the number of individual plants of each species ☐
- The number of different alleles in each plant population ☐

0 1 . 2 Give the meaning of the terms species richness and index of diversity.

[2 marks]

Species richness .....

.....

Index of diversity .....

.....

.....

3

Turn over for the next question

Do not write outside the box

A student compared the biodiversity of invertebrates living in the leaf litter of two woods.

On the same afternoon in October, she collected all of the leaf litter from one 0.25 m^2 square of ground in each wood. She sorted through each sample by eye and with a hand lens, then identified and counted every invertebrate she found. She found the same six species in both woods.

Table 1 shows her results.

Table 1

Species	Number of individuals in sample	
	Wood 1	Wood 2
A	12	41
B	9	3
C	15	6
D	6	2
E	8	4
F	10	4

The index of diversity (d) of a community can be found with this formula:

$$d = \frac{N(N-1)}{\Sigma n(n-1)}$$

In this formula, N is the number of individual organisms of all of the species added together, and n is the number of individual organisms of one species.

0 2 . 1 Use the formula and Table 1 to calculate the index of diversity for the invertebrates in Wood 2.
Give your answer to **two** significant figures.

[2 marks]

.....

.....

.....

Answer .....

Question 2 continues on the next page

Do not write outside the box

0 2 . 2 The index of diversity for the invertebrates in Wood 1 is 6.0.
Both woods have the same species richness. Use Table 1 to explain why the index of diversity in Wood 2 is lower than in Wood 1.

[2 marks]

0 2 . 3 The student concluded that the biodiversity of Wood 1 is higher than the biodiversity of Wood 2.
Use the information about her method to suggest **three** reasons why this conclusion may not be valid.

[3 marks]

1

2

3

0 2 . 4 The student sampled a third wood in the same way. For this wood, $N = 50$ and $d = 5.0$.
Calculate the value of $\Sigma n(n - 1)$ for this wood.

[1 mark]

Answer

Question 2 continues on the next page

Do not write outside the box

0 2 . 5 Each row in the table describes a different community. Every community contains 40 individuals in total.
Use the formula for *d* to decide which community has the highest index of diversity.
Tick (✓) one box.

[1 mark]

Number of species	Number of individuals of each species	
4	25, 5, 5, 5	☐
3	14, 13, 13	☐
5	32, 2, 2, 2, 2	☐
2	20, 20	☐

9

Turn over for the next question

Do not write outside the box

Comparing the biodiversity of communities 3.4.6

Ecologists investigated the biodiversity of moths in 10 gardens in a city centre and 10 gardens in the suburbs of the same city.

In each garden, they set one light trap overnight. All of the traps were set on the same night in July. The next morning, the ecologists identified and counted the moths caught in each trap.

The ecologists used Simpson's index of diversity (D):

$$D = 1 - \Sigma \left(\frac{n}{N}\right)^2$$

In this formula, n is the number of moths of one species and N is the number of moths of all species added together. Values of D lie between 0 and 1. The closer the value is to 1, the higher the diversity.

Before the main study, the ecologists tested their method. They set one light trap for one night in early April, in a garden that was not part of the main study. Few species of moth are active in early April. Table 2 shows the moths caught in this trial trap.

Table 2

Moth species	P	Q	R	S	T
Number of moths caught	18	11	6	3	2

0 3 . 1 Use Simpson's index and Table 2 to calculate D for the moths caught in this trial trap.
Give your answer to **two** significant figures.

[2 marks]

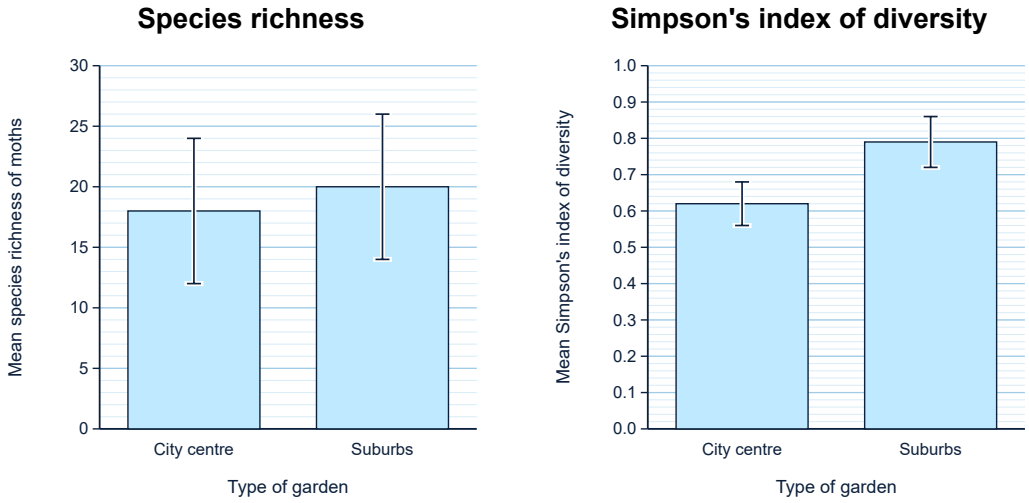
Answer .....

Question 3 continues on the next page

Do not write outside the box

Figure 1 shows the mean species richness and the mean Simpson's index of diversity of moths in each type of garden. The error bars show ±2 standard deviations from the mean. About 95% of the data lie within this range.

Figure 1



A student concluded that moth biodiversity is significantly higher in suburban gardens than in city-centre gardens.

0 3 . 2 Evaluate the student's conclusion. Use all of the information provided.

[4 marks]

6

Turn over for the next question

Do not write outside the box

Farming techniques and conservation 3.4.6

Ecologists compared two systems of growing barley.

- In system **A**, the hedgerows between fields had been removed. Barley was grown across the whole of each field, and the whole field was sprayed with a herbicide that kills plants other than barley.
- In system **B**, the hedgerows were kept. A 6-metre strip of sown wild grasses and flowers was left around the edge of each field. Barley was grown in the rest of the field, and only the barley was sprayed with herbicide.

The ecologists studied 8 farms using each system for one year. Table 3 shows their results.

Table 3

Measurement	System A	System B
Mean number of plant species per field	4	23
Mean index of diversity (*d*) of ground-dwelling invertebrates	2.8	7.4
Mean barley yield / tonnes per hectare of farmland	6.9	6.4

0 4 . 1 Use Table 3 to explain why the index of diversity of ground-dwelling invertebrates was higher in system **B**.

[3 marks]

Question 4 continues on the next page

Do not write outside the box

0 4 . 2 The farms using each system were chosen so that they all had the same soil type and similar weather.
Suggest why.

[1 mark]

0 4 . 3 Calculate the percentage decrease in mean barley yield in system **B** compared with system **A**.

[1 mark]

Answer ..... **%**

Question 4 continues on the next page

Do not write outside the box

0 4 . 4 A government adviser recommends paying farmers to change from system **A** to system **B**.
Use all of the information to evaluate this recommendation, considering the balance between conservation and farming.

[5 marks]

10

0 5 . 1 Conserving biodiversity can reduce the amount of land available for growing food.
Give **two** reasons why it is important to conserve biodiversity.

[2 marks]

1

2

Question 5 continues on the next page

Do not write outside the box

A farmer plans to turn a meadow of wild grasses and flowers, surrounded by hedgerows, into a field for growing maize. To do this, the farmer will:

- remove the hedgerows
- plough the meadow and sow only maize
- spray a herbicide that kills all plants except maize
- spray an insecticide that kills insects that feed on maize.

0 5 . 2 Explain how these farming techniques are likely to reduce the biodiversity of this area of land.
In your answer, refer to species richness and the index of diversity.

[6 marks]

8

END OF QUESTIONS

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