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BIOLOGY

GENETICS, BIODIVERSITY & CLASSIFICATION

Level & Board	AQA (A-LEVEL)
TOPIC:	INVESTIGATING DIVERSITY
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	5
TOTAL MARKS	33

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Investigating Diversity - 2

1.

A student looked into the heathland's plant distribution.

The number of plants he discovered in a 1 m² sample area is displayed in the table below.

Species of plant	Number counted in 1 m ²
Common heather	2
Red fescue	14
Vetch	2
White clover	8

(a) What is meant by species richness of this sample? (1)

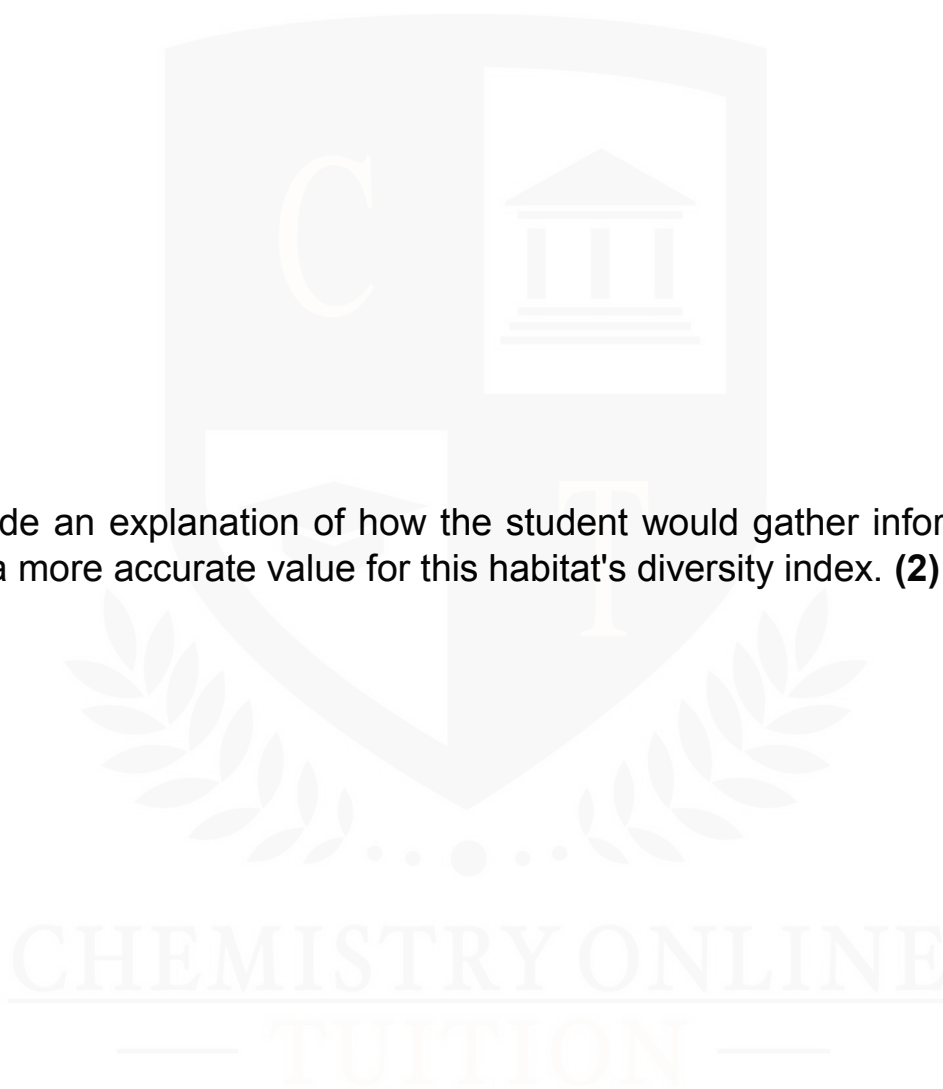
(b) Determine this sample's diversity index. Display your work.

Utilize the subsequent formula to determine the diversity index.

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

where n represents the total number of organisms in each species, and N is the total number of organisms in all species combined. **(2)**

(c) Provide an explanation of how the student would gather information to provide a more accurate value for this habitat's diversity index. **(2)**



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2.

(a) Biologists classification of the bluethroat (*Luscinia svecica*) bird is displayed in Table 1.

Table 1

Taxon	Name of taxon
Domain	Eukaryota
	Animalia
	Chordata
	Aves
	Passeriformes
	Muscicapidae
Genus	
Species	

(a) Fill in the seven blank spaces in Table 1 with the appropriate phrases. (2)

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Scientists looked into the genetic diversity of several bird species. The researchers did the following for each species: they gathered feathers from a sizable number of birds; they separated DNA from the cells that were connected to each feather; and they examined the DNA samples to determine genetic variety.

Their findings are summarized in Table 2.

Table 2

Species of bird	Number of genes examined	Number of genes examined that showed genetic diversity
Willow flycatcher	708	197
House finch	269	80
Bluethroat	232	81

(b) What does the term "genomic diversity" mean in this investigation? **(2)**

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(c) The researchers came to the conclusion that the bluethroat and willow flycatcher have more genetic variety. Describe the reasoning behind their decision. Make computations to back up your response. **(2)**

3.

On a small island, ecologists looked at the size of the bug population. A mark-release-recapture technique was employed. The insects were marked with a luminous powder. When this powder is subjected to ultraviolet (UV) light, it shines brilliant red.

(a) The island's ecologists collected insects from several locations. Explain how they choose the location for their sample collection. **(2)**

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(b) Describe the two underlying presumptions of the mark-release-recapture technique. **(2)**



(c) Describe the benefit of this experiment use of fluorescent powder. **(2)**

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One to five days after releasing the marked insects, the ecologists released none of the insects they had caught.

The ecologists findings are shown in the table below.

Days after release	Number of marked insects remaining in population	Number of insects captured	Number of captured insects that were marked
1	1508	524	78
2	1430	421	30
3	1400	418	18
4	1382	284	2
5	1380	232	9

(d) Determine how many insects there are on this island one day after the marked insects are released.

Display your work. **(2)**

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4.

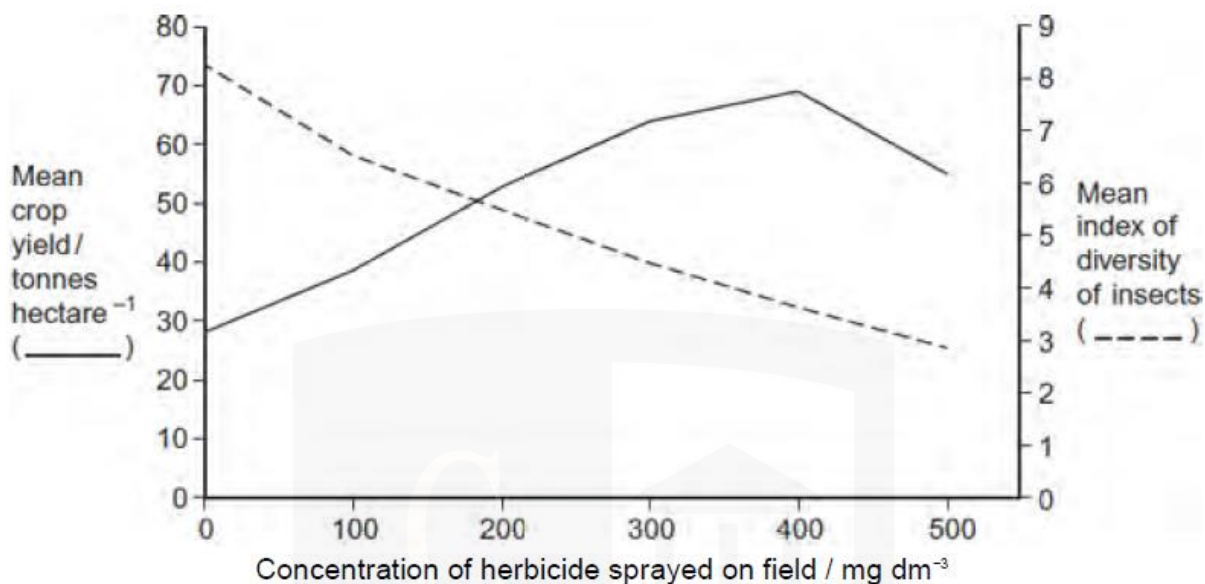
(a) Which two metrics are required in order to compute an index of diversity?

(2)

A substance used to destroy weeds is called a herbicide. Ecologists looked into how a herbicide affected insect diversity and crop yield. They applied the same volume of pesticide in varying concentrations to several fields. The mean crop yield and the mean insect diversity index for fields treated with the same herbicide dose were calculated by the ecologists at harvest.

Their results are shown in the image below.

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(b) A few fields served as safeguards. The pesticide was not present in the solution that was sprayed on them. Describe these control fields objectives.

(1)

(c) Provide a rationale for the connection seen between the average crop yield and the herbicide concentration. **(2)**

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(d) Describe the connection between the mean insect diversity index and the herbicide concentration. **(3)**



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5.

(a) Carbon dioxide is transformed into organic compounds during the photosynthesis reaction, which occurs in the absence of light. Explain how.

(6)



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