

1. The table shows the percentage of woods of different sizes which were inhabited by different species of birds. Each of these woods was surrounded by farmland.

Species	Food	Typical body mass/g	Percentage of woods of each size inhabited by named species				
			0.001 – 0.01 ha	0.01 – 0.1 ha	0.1 – 1 ha	1 – 10 ha	10 – 100 ha
Blackbird	Wide range of insect and plant food	90	13	34	63	72	91
House sparrow	Weed and grass seeds	30	9	21	44	35	22
Great tit	Insects and nuts	20	0	3	12	16	73
Tree creeper	Insects	10	0	0	2	8	25
Great spotted woodpecker	Insects	130	0	0	0	1	26

- (a) Describe the relationship between the size of a wood and the diversity of the birds that it contains.

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(1)

- (b) Use the data in the table to explain

- (i) the different distribution of tree creepers and great spotted woodpeckers;

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(1)

- (ii) why very small woods are inhabited by house sparrows and blackbirds but not by great tits and tree creepers.

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(2)

- (c) It has been suggested that planting trees on farmland would help conserve woodland birds. Use the information in this table to suggest advice that you could give to farmers who wanted to conserve woodland birds on their land. Explain your answer.

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(2)  
(Total 6 marks)

2. Most deciduous trees have leaves with a thin cuticle. The leaves fall off in the autumn. Conifers retain their leaves through the winter, and the cuticle is much thicker. In an investigation, the numbers of detritivores living among the dead leaves on the ground in deciduous and coniferous woodlands were counted. Diversity indices were then calculated. The results are shown in the table.

Type of woodland	Number of detritivore species	Diversity index
Young deciduous	12	7.0
Mature deciduous	11	6.7
Young coniferous	10	6.3
Mature coniferous	8	5.3

- (a) Apart from the number of species in the dead leaves, give **one** other piece of information needed to calculate the diversity index.

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(1)

- (b) (i) What do the results show about the differences between the detritivore populations in the four types of woodland studied?

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(2)

- (ii) Using the information given, suggest a hypothesis to account for the difference between the populations of detritivores in mature deciduous and mature coniferous woodland.

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(1)

(Total 4 marks)

3. Natural woodlands, which once covered 80% of Britain, are stable ecosystems with high levels of diversity. These natural woodlands were dominated by a range of species, such as oak and ash, which lose their leaves in winter. Much of today's woodland consists of evergreen conifer plantations. Conifers are grown for timber. They are planted close together in straight lines. The trees are usually of the same age and the same species.

- (a) Describe how you would obtain the necessary data to calculate the index of diversity for the tree species growing in a natural woodland.

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(3)

S (b) Explain why the diversity of animals is higher in natural woodland than in conifer plantations.

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(4)

S (c) The conifers used in plantations are the result of a long period of selection for desirable characteristics. Explain how a programme of selection might affect the variety of alleles in a population.

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(4)

(Total 11 marks)

4. The table shows the numbers of adult butterflies in two areas of the same tropical forest. In

the logged area

Butterfly species	Logged forest		Virgin forest	
	Number	$n(n-1)$	Number	$n(n-1)$
<i>Eurema tiluba</i>	72	5112	19	342
<i>Cirrochroa emalea</i>	43	1806	132	17292
<i>Partenos sylvia</i>	58	3306	14	182
<i>Neopithecops zalmora</i>	6	30	719	6162
<i>Jamides para</i>	37	1332	38	1406
Total	216	11586	282	25384

(a) Describe a method for finding the number of one of the species of butterfly in the virgin forest.

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(2)

(b) The index of diversity of a forest can be calculated using the equation  $d = \frac{N(N-1)}{\sum n(n-1)}$ .

Calculate the index of diversity for the virgin forest. Show your working.

Answer .....

(2)

(c) What does the table show about the effects of logging on the butterfly populations?

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(2)  
(Total 6 marks)

5. Students investigated the effect of modern farming on the diversity of birds. The table shows some results from one farm.

Species	Number of birds
Greenfinch	12
Goldfinch	7
Partridge	3
Lapwing	2

(a) (i) The index of diversity can be calculated from the formula

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

where

$d$  = Index of diversity

$N$  = total number of organisms of all species

$n$  = total number of organisms of a particular species

Use this formula to calculate the index of diversity for the results shown in the table. Show your working.

Answer.....

(2)

- (ii) It is useful in an investigation like this to calculate the index of diversity. Explain why it is more useful to calculate the index of diversity than to record just the number of species present.

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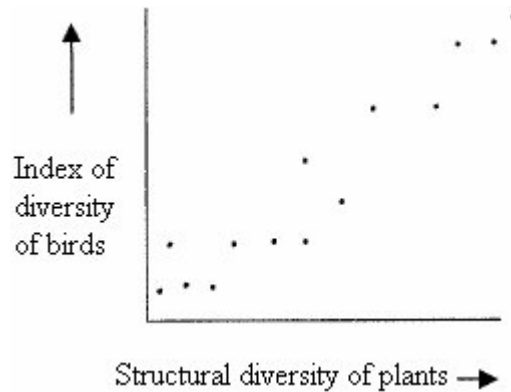
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(2)

Structural diversity refers to the different forms of plants such as herbs, shrubs and trees present in a particular area. The graph shows the relationship between the index diversity of birds and structural diversity of the plants on farmland.



- (b) (i) Describe the relationship between the index of diversity for birds and structural diversity for plants.

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(1)

- (ii) Suggest an explanation for this relationship.

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(2)

- (c) The European Union gives grants to farmers to re-plant hedges previously removed. Explain how re-planting hedges might affect the index diversity for birds found on farms.

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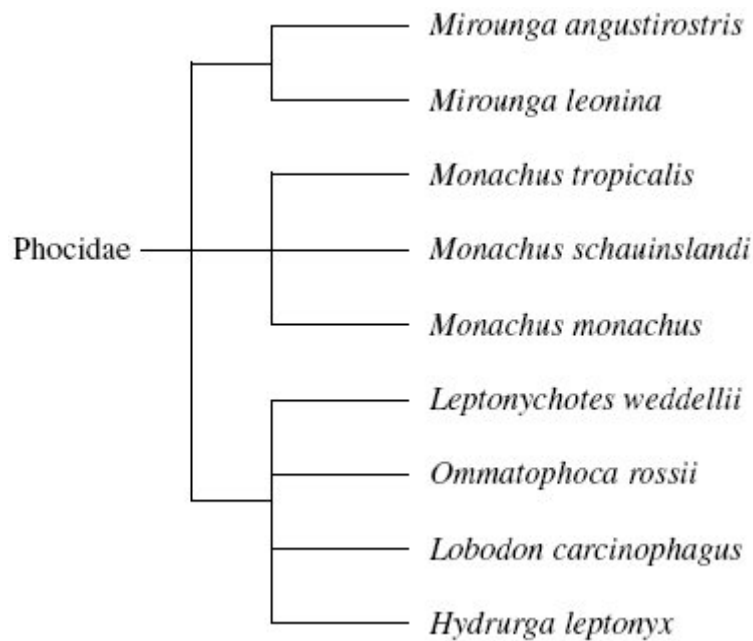
(1)  
(Total 8 marks)

6. (a) An order is a taxonomic group. All seals belong to the same order. Name **one** other taxonomic group to which all seals belong.

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(1)

- (b) The diagram shows how some species of seal are classified.



- (i) How many different genera are shown in this diagram?

(1)



(ii) All the seals shown in the diagram are members of the Phocidae. Phocidae is an example of a taxonomic group. Of which taxonomic group is it an example?

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(1)

(iii) The diagram is based on the evolutionary history of the seals. What does the information in the diagram suggest about the common ancestors of *Mirounga angustirostris*, *Mirounga leonina* and *Monachus tropicalis*?

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(1)

(c) A species of seal shows genetic diversity. Explain what is meant by genetic diversity.

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(1)

(d) In the late 18<sup>th</sup> century, the population of northern elephant seals was estimated to be about 150 000. These seals lived in different colonies in different places. The seals were then hunted. By 1910, the total population had fallen to under 100. All these seals lived in a single colony on one island. Hunting then stopped. Numbers increased and there are now approximately 150 000 seals living in many different colonies.

Use this information to explain

(i) what is meant by a genetic bottleneck

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(2)

- (ii) how you would expect the founder effect to have influenced the genetic diversity of northern elephant seals after 1910.

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(2)  
(Total 9 marks)