Biodiversity (4.2.1): OCR A Level Biology Exam Questions by Topic

17 questions · 32 marks · about 38 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · June 2023 · Q4(b)(iv) · 2 marks

(iv) New Zealand has a high species biodiversity compared to many countries.

Species biodiversity includes the concepts of species richness and species evenness.

Explain the difference between species richness and species evenness.

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..... **[2]**

Question 2 · AS Paper 1 · June 2022 · Q22(a) · 2 marks

22 A student gives a definition of one level of biodiversity as:

The number of different alleles for all the genes in a population.

(a) Name **and** define **two** other levels of biodiversity.

Name .....

Definition .....

.....

Name .....

Definition .....

.....

[2]

Question 3 · A level Paper 2 · June 2025 · Q18(a)(i) · 1 mark

18 Sampling is an important technique for assessing biodiversity.

(a) Sampling is used to measure the abundance of organisms in habitats.

(i) State why sampling is necessary when measuring the abundance of organisms in a habitat.

.....

..... **[1]**

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Question 4 · A level Paper 2 · June 2025 · Q18(a)(ii) · 2 marks

(ii) Explain why it is important that sampling is random.

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.....

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..... **[2]**

Question 5 · A level Paper 2 · June 2018 · Q20(b)(i) · 1 mark

(b) The population of cheetahs has been declining for the past 100 years and is estimated to be between 6000 and 7000.

Within the remaining cheetah population, intraspecific genetic diversity is very low.

One isolated population of cheetahs in Iran has fewer than 100 individuals.

(i) State one way in which genetic diversity can be measured.

.....

..... **[1]**

Question 6 · AS Paper 1 · June 2024 · Q26(a) · 3 marks

26 Several factors can have a negative effect on biodiversity.

(a) Explain how agriculture can have a negative effect on biodiversity.

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..... **[3]**

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Question 7 · A level Paper 2 · June 2025 · Q19(a)(i) · 3 marks

19 The Farne Islands are a group of small islands off the coast of Northern England.

The Farne Islands are a National Nature Reserve and Site of Special Scientific Interest. They are home to many species of bird, including arctic terns, guillemots, cormorants, shags, eider ducks, razorbills, and a variety of gulls. Particularly popular with the public are puffins. Considered by some to be a keystone species, puffins are small birds with large colourful beaks that fly very close to the surface of the sea. They come to the islands only to breed, nesting in underground burrows.

Local tour operators transport large numbers of visitors to the islands each year but no visitors are allowed on the islands during the winter to allow conservation work to be carried out. Such work includes repairing boardwalks and fences, tagging individual birds, and counting how many puffin burrows have been in use.

In 2023, an outbreak of bird flu caused a drop in the numbers of many species, including puffins, and visitors were banned from the islands. Local tour operators reported a drop in income.

(a)
(i) Identify evidence from the information above that supports each of the following claims:

Puffins are important for aesthetic reasons .....

.....

Puffins are important for ecological reasons .....

.....

Puffins are important for economic reasons .....

.....

[3]

Question 8 · A level Paper 2 · June 2025 · Q19(a)(iv) · 1 mark

(iv) There are two types of conservation: *in situ* and *ex situ*.

State the type of conservation taking place on the Farne Islands and give a reason for your choice.

Type .....

Reason .....

.....

[1]

Turn over

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Question 9 · AS Paper 2 · June 2018 · Q5(a)(i) · 1 mark

5 **(a)** Elephants are protected by the treaty known as the Convention on International Trade in Endangered Species (CITES).

(i) Give **one** aim of CITES.

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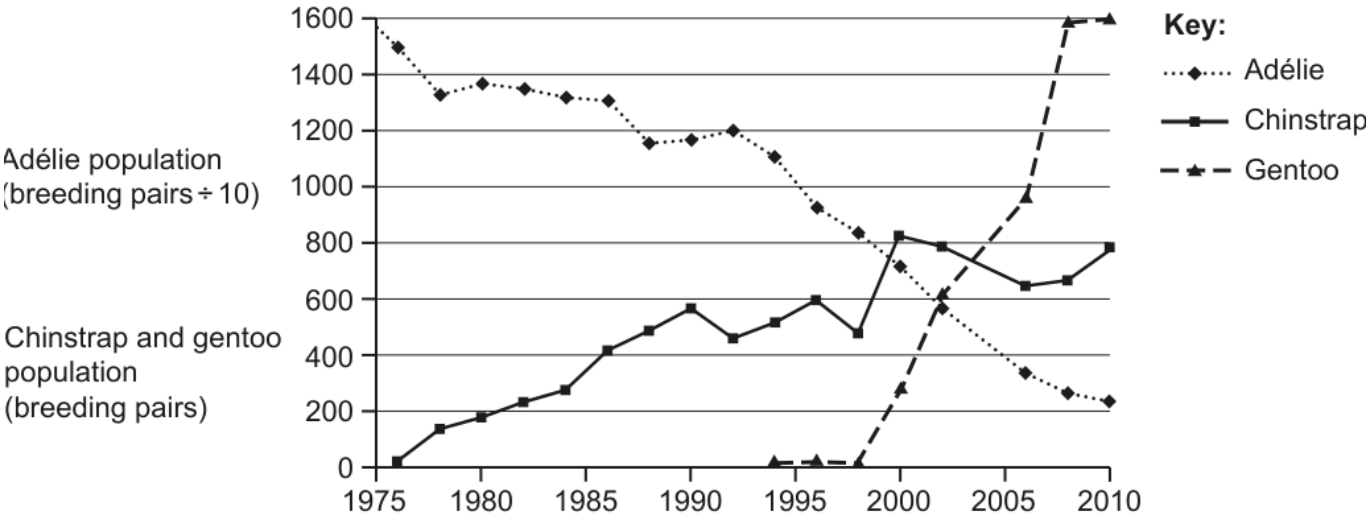
.....

..... **[1]**

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(b) A study was carried out to monitor the population of three penguin species on an island near Antarctica.

The graph shows the results of this study.



15

Use the graph to compare the species richness and species evenness of the penguins found on the island in the years 1980 and 2010.

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..... **[3]**

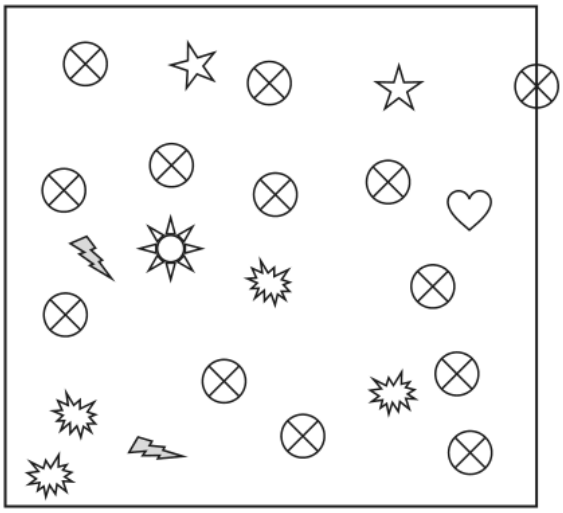
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Question 11 · information from earlier in the question

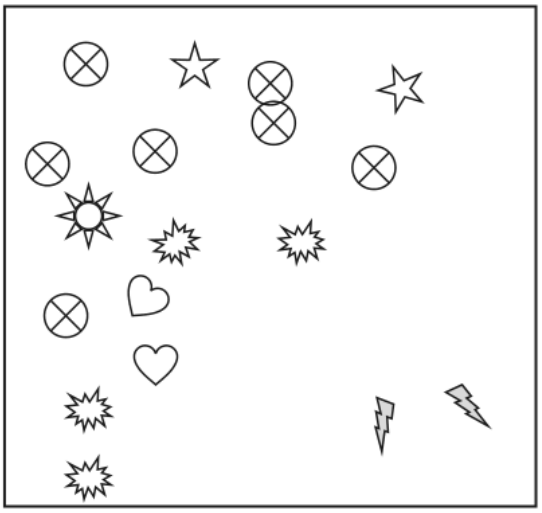
(b) Quadrat sampling is a useful tool for measuring the abundance and distribution of plant species.

A student sampled plants on an area of sports field. Observations recorded by the student for two of the quadrats are shown in the image below. The symbols represent different plant species.

Quadrat A



Quadrat B



(i) State the species richness in quadrat **A**.

..... **[1]**

Question 11 · A level Paper 2 · June 2025 · Q18(b)(ii) · 1 mark

(ii) Compare the species evenness in quadrats **A** and **B**.

.....

.....

..... **[1]**

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 12 · AS Paper 1 · June 2022 · Q22(b)(i) · 2 marks

(b) During the 20th Century, there was a very large decrease in the size of wild populations of the cheetah, *Acinonyx jubatus*. This decrease was largely due to hunting. Recent research shows that wild populations of the cheetah have a very low number of polymorphic genes.

There are 17 863 gene loci in the genome of the cheetah and now only 10% of these gene loci are polymorphic in wild populations.

Scientists investigated the genetic biodiversity of cheetah populations in European zoos. They sampled 256 gene loci and found 18 gene loci to be polymorphic.

(i) Calculate the proportion of polymorphic gene loci in the European zoo population.

Proportion = ... **[2]**

Question 13 · AS Paper 1 · June 2022 · Q22(b)(iii) · 3 marks

(iii) Suggest **and** explain reasons why, in the 21st Century, only 10% of the gene loci are polymorphic in wild populations of cheetah.

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..... **[3]**

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 14 · information from earlier in the question

(b) The students' results are shown in the table.

Plant species	Mean number of individuals per quadrat
Creeping buttercup	3
Daisy	7
Dandelion	1
Grass	26
Red clover	4
Ribwort plantain	3
White clover	6

(i) Calculate the Simpson's Index of Diversity (D) for the students' data.

Use the formula: $D = 1 - \left(\sum\left(\frac{n}{N}\right)^2\right)$

D = ... **[3]**

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Question 14 · A level Paper 2 · June 2022 · Q20(b)(ii) · 2 marks

(ii) The students found grass species difficult to distinguish from one another so they decided to record any grass species as 'grass'.

Explain how the students' decision might have affected the calculated value for *D*.

.....

.....

.....

.....

..... **[2]**

Turn over

Question 15 · information from earlier in the question

1

(a) Students used a transect line to sample species of wildflowers in a field.

(i) Name the type of sampling method used in a transect line.

..... **[1]**

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Question 15 · AS Paper 2 · June 2024 · Q1(a)(ii) · 3 marks

(ii) This table shows their findings.

Species	**Number of organisms (*n*)**	***n*/*N***	$(n/N)^2$
Foxglove	3	0.13	0.02
Meadow buttercup	7		
Oxeye daisy	9		
Yellow rattle	4		
	N =		$\sum(n/N)^2$ =
			$1 - \sum(n/N)^2$ =

Calculate the Simpson's Index of Diversity for the field using the data in the above table.

Use the formula: $D = 1 - \left(\sum\left(\frac{n}{N}\right)^2\right)$

Give your answer to **2** significant figures.

Simpson's Index of Diversity = ... **[3]**

Question 16 · AS Paper 2 · June 2024 · Q1(a)(iii) · 1 mark

(iii) State what can be concluded about the diversity of the field from your answer in **(a)(ii)**.

.....

..... **[1]**

Question 17 · AS Paper 2 · June 2024 · Q1(b) · 1 mark

(b) The students then used a sweep net to sample animals in two different parts of a river.

They did this by holding the sweep net in the water and at the same time kicking the riverbed downstream.

Suggest how they could improve their sampling method to obtain more valid results.

.....

..... **[1]**

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Mark schemes

Question 1 · A level Paper 3 · June 2023 · Q4(b)(iv) · 2 marks

Question			Answer	Mark	AO Element	Guidance
4	(b)	(iv)	species richness is the number of (different) species (in an area or community or ecosystem) ✓ species evenness is the (relative) abundance (of individuals) in each species (in an area or community or ecosystem) ✓	2	1.1	**IGNORE** amount of different species (in an area or community or ecosystem) **ALLOW** 'species evenness is (a comparison of) the number (of individuals) in each species (in an area or community or ecosystem)'

Question 2 · AS Paper 1 · June 2022 · Q22(a) · 2 marks

22	(a)	habitat (biodiversity) **and** (which is) the number of different habitats / a range of different habitats (in an, ecosystem / area) ✓ species (biodiversity) **and** (which is) the richness **and** evenness of a species / the number of different species (in an ecosystem / community) ✓

2	**DO NOT ALLOW** the number of different habitats in a community **DO NOT ALLOW** species richness or species evenness as the name **DO NOT ALLOW** in a population

Question 3 · A level Paper 2 · June 2025 · Q18(a)(i) · 1 mark

18	(a)	(i)	quicker ✓ easier than counting all organisms / AW ✓	**1 max**

1.1	**ALLOW** ora (too) time consuming / impossible / difficult , to count all organisms / to sample whole area **IGNORE** more efficient

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Question 4 · A level Paper 2 · June 2025 · Q18(a)(ii) · 2 marks

18	**(a)**	**(ii)**	reduces / removes / avoids , <u>bias</u> ✓ makes sample (more) representative ✓ improves validity ✓	**2 max**

1.1	**ALLOW** ora, e.g. sample would be less representative if not random

Question 5 · A level Paper 2 · June 2018 · Q20(b)(i) · 1 mark

(b)	**(i)**	genetic polymorphism / proportion of heterozygotes / proportion of gene variants ✓	**1**

CREDIT number of polymorphic genes

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Question 6 · AS Paper 1 · June 2024 · Q26(a) · 3 marks

26	**(a)**	1. *ref.* monoculture ✓ 2. reduces genetic diversity / (crop/s) susceptible to same disease / (crop) populations are unable to adapt to changing conditions ✓ 3. destroys / ruins , habitats ✓ 4. pesticide use may , cause bioaccumulation / kill organisms higher up the food chain / kill non targeted insects or organisms / reduce species biodiversity ✓ 5. reduce food supply further up the food chain / idea of disrupting food webs / chains ✓ 6. fertiliser may cause , eutrophication / described ✓ 7. pesticides kill pollinators / pollinating insects, reduction in pollination / reduced spread of plants ✓	**3 max**

ALLOW monoculture described e.g. large fields of only 1 crop

ALLOW reduces (number of) habitats / habitat diversity
ALLOW named habitats e.g. deforestation / removal of hedgerows

Questions, mark schemes and examiners' report extracts © OCR.

Question 7 · A level Paper 2 · June 2025 · Q19(a)(i) · 3 marks

19	(a)	(i)	*aesthetic* particularly popular with the public are puffins / AW ✓ *ecological* they are (considered by some to be) a keystone species ✓ *economic* (tour operators) reported a drop in income / AW ✓	3	3.2

ALLOW they have large colourful beaks
ALLOW local tour operators transport large numbers of visitors
ALLOW tour operators transport (large numbers of) visitors
ALLOW money for tour operators
ALLOW ecotourism for tour operators
IGNORE general economic benefits of tourism

Question 8 · A level Paper 2 · June 2025 · Q19(a)(iv) · 1 mark

19	(a)	(iv)	*in situ* **AND** (conservation) in their (natural) habitat ✓	1	3.1

ALLOW (named) species , not removed / kept in their natural environment
IGNORE on the islands

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Question 9 · AS Paper 2 · June 2018 · Q5(a)(i) · 1 mark

5(a)(i)	to, protect / conserve, species endangered by trading activities **OR** to, prevent / restrict, trade in endangered species ✓ to, regulate / restrict / reduce , international / cross-border, wildlife trade ✓

1 max	**ALLOW** for 'trading activities' and 'trade' the **buying** or **selling** of, live animals / body parts such as tusks or ivory / plant bulbs / etc. **ALLOW** for 'endangered' - threatened / rare / vulnerable **ALLOW** an example of an endangered species, e.g. *'stop people from selling elephant tusks'* gets mp 1 **ALLOW** for 'wildlife trade' the buying or selling of, live animals / body parts such as tusks or ivory / plant bulbs. **ALLOW** for 'international' and 'cross-border' a description such as import from Africa to Europe, etc.

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Question 10 · AS Paper 2 · June 2023 · Q4(b) · 3 marks

	(b)		**1** Species, richness /evenness, is, greater/ higher in 2010 (compared to 1980)✓ *Species richness* **2** 3 species in 2010 compared to 2 in 1980 ✓ *Species evenness* **3** In 1980 98% of penguin pairs were one species (Adelie) **and** In 2010 only 57% of penguin pairs one species (Adelie) ✓
			Total

3	**2.2 x 1** **3.1 x 2**	**IGNORE** ref to years other than 1980 and 2010 **1 ALLOW** stronger for 'greater' **1 DO NOT ALLOW no** species richness in 1980 **2 ALLOW** (after 1980) a new species/Gentoo, has emerged **3 ALLOW** In 2010 Adelie have decreased and, Chinstrap/Gentoo, have increased (in number) so they are more even. e.g. Adele penguins are 220 in 2010 and Chinstrap are 800 so numbers are closer.
5		

Question 11 · A level Paper 2 · June 2025 · Q18(b)(ii) · 1 mark

Question			Answer	Mark	AO	Guidance
18	**(b)**	**(ii)**	evenness is higher in B **and** (because) number of individuals (of each species) varies less ✓	**1**	**2.4**	**CREDIT** evenness is lower in A **ALLOW** fewer individuals of dominant species in B / no dominant species like in A / smaller range of abundances / smaller ratio between species **ALLOW** correct use of figures to support the statement, e.g. quadrat B has a ratio of 7:2:2:1:4:2 and A has a ratio of 13:2:2:1:4:1

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Question 12 · AS Paper 1 · June 2022 · Q22(b)(i) · 2 marks

22	(b)	(i)	0.07(03125) ✓✓	2

FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 0.07(03125) award 2 marks
ALLOW correct answer anywhere in answer space

ALLOW 7(.03125)% for two marks

If correct answer not given then:
ALLOW one mark for:
number of polymorphic gene loci / total gene loci
OR
18 / 256
OR
9 / 128

Question 13 · AS Paper 1 · June 2022 · Q22(b)(iii) · 3 marks

22	(b)	(iii)	the, population / gene pool, has become (very) small (due to, hunting / habitat destruction / disease susceptibility) ✓ (so) few(er), gene variants / alleles ✓ (so) inbreeding maintains, the same alleles / small gene pool ✓ only (rare) mutation can introduce, new / different, alleles ✓	Max 3	**ALLOW** ref to bottleneck **ALLOW** population / gene pool, has become limited **IGNORE** population gets smaller **ALLOW** low(er) genetic diversity **ALLOW** genetic diversity decreased **IGNORE** inbreeding reduces gene pool

Question	Answer	Mark	Guidance

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Question 14 · A level Paper 2 · June 2022 · Q20(b)(ii) · 2 marks

(ii)	*If treating grass as a single species…* D / calculated diversity / index , is lower ✓ **ora** $\Sigma(n/N)^2$ is higher ✓ **ora** *idea that* $(26/N)^2$ will be bigger than the sum of $(n/N)^2$ for individual grass species ✓

2 max	2.4	**ALLOW** 'value' as AW for calculated diversity **ALLOW** 'a bigger number is subtracted from 1' **ALLOW** e.g. '0.270 is bigger than the equivalent number for individual grasses'

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(ii) **FIRST CHECK THE ANSWER (if answer not on answer line look in the table)**

If answer = 0.71 award 3 marks

0.71 ✓✓✓

If final answer incorrect or not to 2 sig fig, award 2 marks:

0.29 ✓✓

If $\sum(n/N)^2$ / 0.29 incorrect, award 1 mark for:

row values for, n/N **and** $(n/N)^2$, correctly entered ✓

3

Species	n = Number of organisms	n/N	$(n/N)^2$
Foxglove	3	0.13	0.02
Meadow buttercup	7	0.30	0.09
Oxeye daisy	9	0.39	0.15
Yellow rattle	4	0.17	0.03
	$N = 23$		$\sum(n/N)^2 = 0.29$
			$1 - \sum(n/N)^2 = 0.71$

ECF for **one** incorrect rounding in table:

ALLOW 2 marks for
$\sum(n/N)^2$ **and** $1 - \sum(n/N)^2$ to 2 sig fig ✓✓

e.g. $[(n/N)^2]$ 0.09, 0.15, 0.02 so $\sum(n/N)^2 = 0.28$ and $1 - \sum(n/N)^2 = 0.72$ = 2 marks

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Question 16 · AS Paper 2 · June 2024 · Q1(a)(iii) · 1 mark

(iii)	(biodiversity is) high ✓	**1**

ALLOW low as **ECF** from 1(a)(ii)
ALLOW field / it, is diverse / has high species evenness **and** richness

Question 17 · AS Paper 2 · June 2024 · Q1(b) · 1 mark

(b)	**1** (in both areas kick for) same number of times ✓ **2** same, kicking method used / depth of sweep net ✓ **3** sweep net is, downstream of student kicking / facing upstream ✓

max 1	**e.g.** kick sampling for 5 minutes in each part of river **e.g.** heel of foot kicking (in the direction of the net) / kick with same force / same person does the kicking

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