Biodiversity, Adaptation and Classification (Topic 4): Edexcel SNAB A Level Biology Exam Questions by Topic

20 questions · 52 marks · about 62 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 2 · June 2017 · Q3(a)(i) · 1 mark

3 Conservation programmes are used to save endangered species.

The Scottish wildcat, shown in the photograph, is a subspecies of the European wildcat, *Felis silvestris silvestris*.



The Cairngorms Wildcat Project estimates that there are 150 breeding pairs left, but the Scottish Wildcat Association believes that only 35 cats remain.

A conservation group proposed that a captive breeding programme, and the relocation of Scottish wildcats, would be necessary to prevent extinction.

(a) (i) State why the Scottish wildcat has been described as **endemic**.

(1)

.....

.....

.....

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(ii) The biodiversity of the land area of Earth has been estimated.

The table shows information on the number of species of plants and vertebrate animals in the rainforests of Madagascar and for the land area of Earth.

Region	Plants		Vertebrate animals		Land area / km²
	Number of known species	Number of known endemic species	Number of known species	Number of known endemic species	
Madagascar	12 000	9704	987	771	59 300
Land area of the Earth	300 000	300 000	27 300	27 300	149 000 000

Analyse the data to determine the importance of the rainforests of Madagascar in maintaining biodiversity on Earth.

(3)

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Question 3 · A level Paper 1 · June 2022 · Q9(b) · 2 marks

(b) Biodiversity hotspots have at least 1500 endemic plant species.
These hotspots have lost at least 70% of their natural vegetation.

Explain how protection of these hotspots can affect global biodiversity.

(2)

Question 4 · AS Paper 2 · June 2017 · Q3(a)(ii) · 2 marks

(ii) The Scottish wildcat can interbreed successfully with domestic cats.

Explain the effect this could have on the genetic diversity of the Scottish wildcat.

(2)

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Question 5 · AS Paper 2 · June 2019 · Q4(d) · 2 marks

(d) Scientists measure biodiversity using both species richness and the heterozygosity index.

State what is meant by the following terms:

(2)

species richness

heterozygosity index

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Question 6 · A level Paper 1 · November 2021 · Q5(b)(ii) · 4 marks

(ii) To decide which of the two link roads should be built, studies of the biodiversity of woodlands P and Q need to be carried out.

Discuss what information needs to be collected from the two woodlands to make a decision about the site of the link road.

(4)

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Question 7 · AS Paper 2 · June 2025 · Q4(b)(ii) · 2 marks

(ii) Biodiversity can also be measured using an index of diversity.

The table shows data collected from one rockpool.

Species of seaweed	Number of individuals (n)	n(n – 1)
Chondrus crispus	5	20
Cladophora rupestris	5	20
Corallina officinalis	11	110
Fucus serratus	4	12
Fucus spiralis	9	72
Ulva lactuca	8	56
Total number of individuals (N)	**42**	

Calculate the index of diversity for this rockpool using the formula:

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

Give your answer to two decimal places.

(2)

Answer .....

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Question 8 · AS Paper 2 · June 2025 · Q4(b)(iii) · 2 marks

(iii) Explain why an index of diversity is more useful than species richness for determining biodiversity.

(2)

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8 Sloths are mammals found in Central and South America.

(a) Sloths are slow moving and use their hooked claws to hold onto branches. They sleep for over 15 hours a day. During this time, their slow metabolism processes their diet of low nutrition vegetation.



Sloths have behavioural, physiological and anatomical adaptations to their environment.

Complete the table using the information provided.

(3)

Type of adaptation	Example
Behavioural	
Physiological	
Anatomical	

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2 The banded snail *Cepaea nemoralis* occupies many habitats.

The thrush is a major predator of the banded snail.

The thrush and the banded snail, shown in the photograph, occupy different niches.



Source: © Dave Watts/Alamy

(a) Describe the difference between the terms niche and habitat.

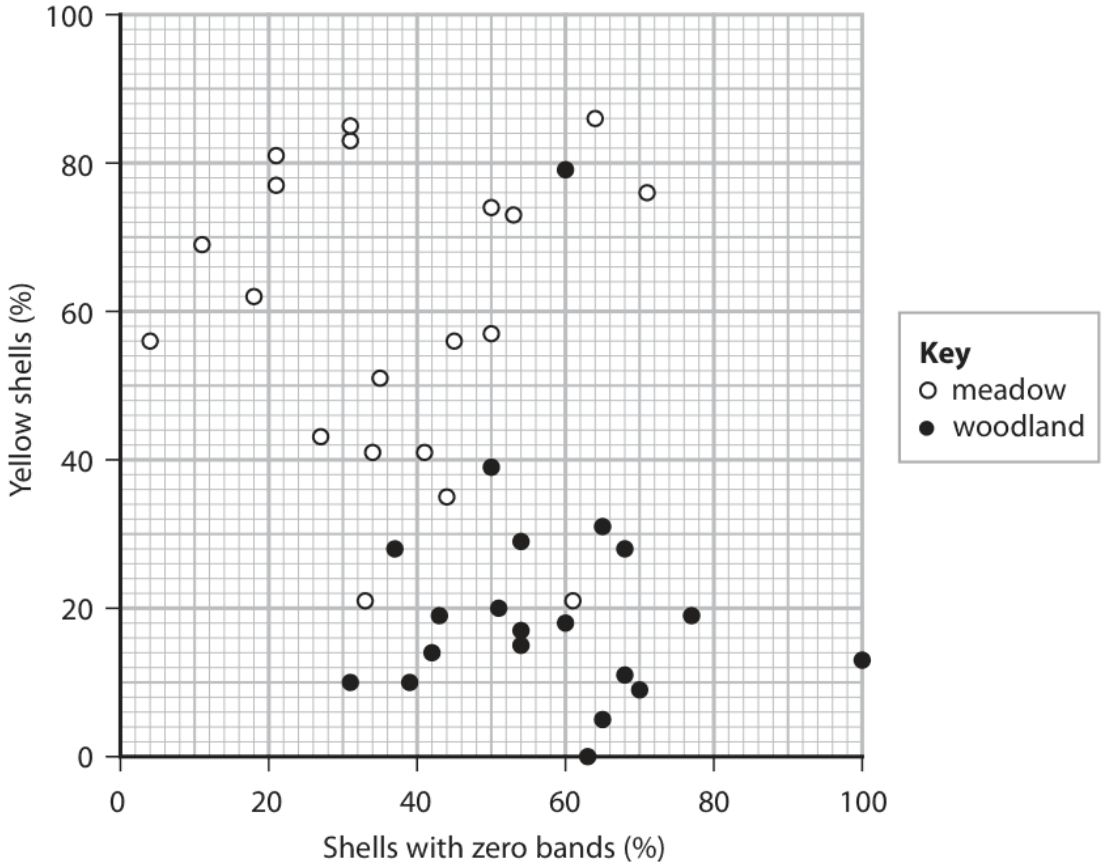
(2)

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(c) The shells of the banded snail can have from zero to five black bands.

The populations of banded snails in 20 meadow habitats and 20 woodland habitats were investigated.

At each location the percentage of snails with yellow shells was recorded. The percentage of snails with shells with zero bands was also recorded.



(i) Explain the importance of the different shell patterns in these two habitats.

(3)

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Question 12 · A level Paper 1 · June 2022 · Q9(d) · 4 marks

(d) The table shows the heterozygosity index for each population of white-tailed deer.

Heterozygosity index for Finland population	Heterozygosity index for North American population
0.692	0.742

Climate change may affect the habitat of both populations of deer.

Explain which population is more likely to adapt to changing conditions.

(4)

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Question 13 · information from earlier in the question

(b) The Pyrenean desman has a number of adaptations that allow it to survive in its habitat:

1. it feeds on insects
2. it has webbed feet to enable it to swim
3. it has a long snout that it can use to find food in between rocks
4. it has nostrils on the upper surface of the snout
5. it is nocturnal – feeding at night.

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Question 13 · AS Paper 2 · June 2025 · Q2(b)(ii) · 5 marks

(ii) The Pyrenean desman is thought to have evolved from a land-living animal similar to a mole.

Explain how the Pyrenean desman could have evolved by natural selection from a land-living animal similar to a mole.

(5)

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Question 14 · AS Paper 2 · June 2024 · Q5(a)(i) · 3 marks

5 In 1832, the great bustard became extinct in the UK.

A reintroduction project released 20 of these birds into the wild.

(a) The Hardy–Weinberg equation can be used to calculate allele frequencies in populations.

This was used to determine the genetic diversity of this group of birds.

Two alleles were identified for one gene. The frequency of the dominant allele for this gene was found to be 0.8

(i) Use the Hardy–Weinberg equation to calculate the number of birds in this group that would have the dominant phenotype.

(3)

$$p^2 + 2pq + q^2 = 1$$

Answer .....

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(b) In one species of deer, a mutation has led to the occurrence of white deer. In some reserves, these white deer have increased in number.

The results of a study of one of these reserves are shown in the table.

Colour of deer	Number of deer
Brown	550
White	250

(i) The colour of the coats of deer is controlled by a single gene.

The allele for brown coats is dominant and the allele for white coats is recessive.

Calculate the number of heterozygotes in this population using the Hardy–Weinberg equation.

$$p^2 + 2pq + q^2 = 1.0$$

(3)

Answer .....

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Question 16 · A level Paper 1 · November 2021 · Q3(b)(ii) · 2 marks

(ii) Describe how the Hardy-Weinberg equation can be used to provide evidence for changes in the elephant population in Mozambique.

(2)

Question 17 · AS Paper 2 · June 2018 · Q8(b)(i) · 2 marks

(b) Three species of sloth are described in the table.

Species	Common name	Status
Bradypus pygmaeus	pygmy three-toed sloth	critically endangered
Choloepus didactylus	Linné's two-toed sloth	least concern
Choloepus hoffmanni	Hoffmann's two-toed sloth	least concern

It is believed that *C. hoffmanni* and *C. didactylus* shared a common ancestor before becoming isolated on either side of the Andes mountain range.

(i) Explain why they are now classed as different species.

(2)

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Question 18 · AS Paper 2 · June 2025 · Q4(a) · 2 marks

4 Rockpools on the seashore contain seaweeds that provide habitats for other organisms.

The photograph shows *Fucus serratus*, a species of seaweed found in rockpools.



(Source: © NIGEL DOWNER/SCIENCE PHOTO LIBRARY)

(a) State what is meant by the term **species**.

(2)

Question 19 · AS Paper 2 · June 2017 · Q3(b) · 2 marks

(b) Explain how molecular phylogeny could be used to determine the relationships between the Scottish wildcat and other subspecies of European wildcat.

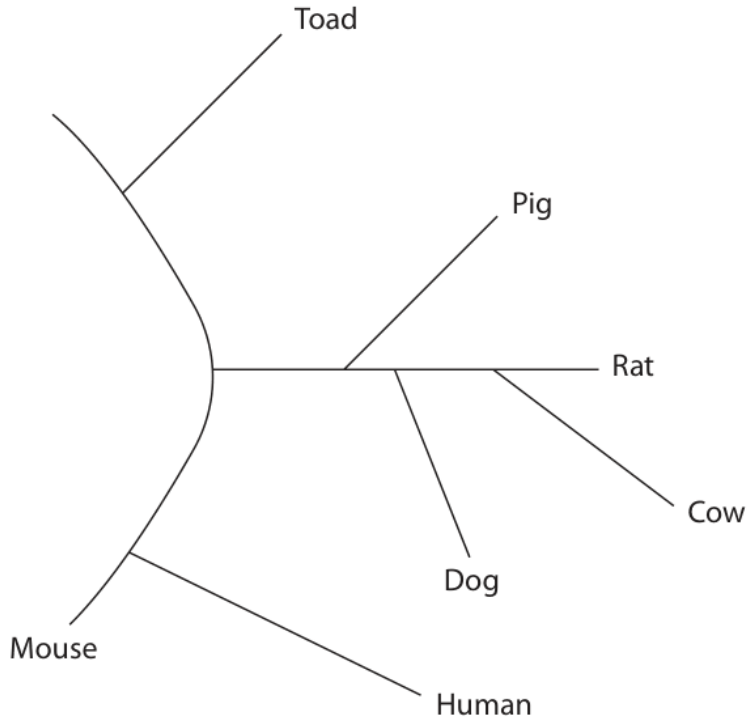
(2)

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Question 20 · A level Paper 1 · June 2018 · Q8(b) · 3 marks

(b) The primary structures of trypsin molecules from different species have been used to produce a phylogenetic tree for trypsin.

Each branch of the following phylogenetic diagram represents trypsin from a different species.



Explain how the primary structure of trypsin molecules can be used to produce a phylogenetic tree.

(3)

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Mark schemes

Question 1 · AS Paper 2 · June 2017 · Q3(a)(i) · 1 mark

Question Number	Answer
3(a)(i)	An answer that makes reference to the following: • it is found {in one location / only in Scotland} **(1)**

Additional Guidance	Mark
DO NOT ALLOW habitat	**(1)**

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Question 2 · A level Paper 1 · June 2018 · Q9(c)(ii) · 3 marks

Question Number	Answer
9(c)(ii)	An answer that makes reference to • appropriate calculation e.g. percentage of world {plants / vertebrates / total} found in Madagascar or percentage of {plants / vertebrate } in Madagascar that are endemic to Madagascar e.g. or percentage of world {plant / vertebrates / total} endemic to Madagascar or density of {plant / vertebrates / total} on {Madagascar / Earth} (1) • species density of {animals / plants} in Madagascar is higher than for the Earth (1) • many of the species found in Madagascar are not found anywhere else (1)

Additional guidance	Mark
4% of plants, 3.6% of vertebrates or 4% of the combined total 80.9% plants 78.1% of vertebrates endemic 3.2% of plants, 2.8% of vertebrates or 3.2% of the combined total ALLOW a large number of species relative to the area	**(3)**

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Question 3 · A level Paper 1 · June 2022 · Q9(b) · 2 marks

Question Number	Answer
9(b)	An explanation that makes reference to two of the following • endemic (species) that are only found in that one location (1) • protection of hotspots prevents extinction (of endemic species) (1) • the loss of these species will (significantly) reduce global biodiversity (1)

Additional guidance	Mark
	(2)

Question 4 · AS Paper 2 · June 2017 · Q3(a)(ii) · 2 marks

Question Number	**Answer**
3(a)(ii)	An explanation that makes reference to the following: • increases (genetic diversity)/increases size of gene pool **(1)** • because of introduction of {new/different} alleles (into the population) **(1)**

Additional Guidance	**Mark**
ALLOW increase variety of alleles ALLOW maintain genetic diversity	**(2)**

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Question 5 · AS Paper 2 · June 2019 · Q4(d) · 2 marks

Question Number	Answer
4(d)	An answer that makes reference to the following: • (species richness) measures number of species (in a habitat) (1) • (heterozygosity index) is a measure of genetic diversity within a { species / population } (1)

Additional Guidance	Mark
ALLOW proportion of heterozygous individuals in a population / formula for heterozygosity index	**(2)**

Question 6 · A level Paper 1 · November 2021 · Q5(b)(ii) · 4 marks

Question Number	Answer
5 (b)(ii)	An answer that makes reference to the following: • biodiversity {measured / compared} using a diversity index (1) • species richness (assessed) (1) • genetic diversity of {populations / species} (1) • presence of any {endemic / rare} species (1)

Additional guidance	Mark
ALLOW count the number of different species in an area ALLOW endangered species / species at risk of extinction	**(4)**

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Question 7 · AS Paper 2 · June 2025 · Q4(b)(ii) · 2 marks

Question number	Answer
4(b)(ii)	An explanation that makes reference to the following: • correct numerator or denominator in the equation (1) • correct use of both values to calculate diversity and answer given to two decimal places (1)

Additional guidance	Mark
<u>Example of calculation</u> Numerator 1722 Denominator 290 1722 ÷ 290 = 5.94 Correct answer with no working gains full marks.	(2)

Question 8 · AS Paper 2 · June 2025 · Q4(b)(iii) · 2 marks

Question number	Answer
4(b)(iii)	An explanation that makes reference to the following: • species richness only gives the number of species in an area (1) • however the index of diversity also takes into account {population sizes / abundance / species evenness} (1)

Additional guidance	Mark
ALLOW species richness does not take into account {abundance /population sizes / species evenness }	(2)

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Question 9 · AS Paper 2 · June 2018 · Q8(a) · 3 marks

Question Number	Answer
8(a)	An answer which makes reference to the following: • (behavioural) slow moving/sleep for long periods (1) • (physiological) slow metabolism (1) • (anatomical) hooked claws (1)

Additional Guidance	Mark
ALLOW sleep for 15 hours	(3)

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Question 10 · A level Paper 3 · October 2020 · Q2(a) · 2 marks

Question number	Answer
2(a)	An answer that makes reference to the following: • niche is the way an organism interacts with its environment (1) • habitat is the place (with distinct set of conditions) where an {organism lives / community of organisms live} (1)

Additional guidance	Mark
ALLOW niche is the role an organism plays in its {habitat / environment / where it lives} ALLOW the {environment / place} where organisms live	**(2)**

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Question 11 · A level Paper 3 · October 2020 · Q2(c)(i) · 3 marks

Question number	Answer
2(c)(i)	An explanation that makes reference to three of the following: • the frequency of the different shell patterns in different habitats is an example of adaptation (1) • provides camouflage (appropriate to the habitat) (1) • reducing predation (in different habitats) / providing protection from predators (1) • therefore increasing the chance of (surviving to) reproduce (1)

Additional guidance	Mark
ALLOW other reasonable suggestions e.g. temperature regulation IGNORE increasing survival rate	(3)

Question 12 · A level Paper 1 · June 2022 · Q9(d) · 4 marks

Question Number	Answer
9(d)	An explanation that makes reference to the following • North American population is more genetically diverse (therefore more likely to adapt) (1) • (more different alleles) therefore more likely to have an allele that gives advantage (1) • the individuals with an advantageous allele are more likely to survive and breed (1) • the frequency of that allele will increase (1)

Additional guidance	Mark
	(4)

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Question 13 · AS Paper 2 · June 2025 · Q2(b)(ii) · 5 marks

Question number	Answer
2(b)(ii)	An explanation that makes reference to five of the following: • genetic variation in populations of (shrews / common ancestor / moles) (1) • selection pressure identified (1) • identification of favourable characteristic (1) • those with alleles for favourable characteristics survive and reproduce (1) • passing on advantageous allele to offspring (1) • over time there is a change in allele frequency / desmans no longer able to breed with the original species (1)

Additional guidance	Mark
ALLOW mutations lead to {genetic variation / new alleles} e.g. availability of food, competition for food, presence of predators e.g. webbed feet, long snout or nostrils on upper surface of snout ALLOW converse – those without advantageous allele do not survive or reproduce ALLOW increase frequency of advantageous allele	(5)

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Question 14 · AS Paper 2 · June 2024 · Q5(a)(i) · 3 marks

Question number	Answer
5(a)(i)	• correct value for p^2 (1) • correct value for 2pq (1) • correct number of individuals (whole number) (1)

Additional guidance	Mark
<u>Example of calculation</u> 0.64 0.32 (ALLOW 2 marks for 0.96 if answer is incorrect for using correct values to determine $p^2 + 2pq$) 19 Correct answer with no working gains full marks	(3)

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Question 15 · A level Paper 1 · June 2024 · Q7(b)(i) · 3 marks

Question Number	Answer
7(b)(i)	An answer that makes reference to the following • correct calculation of the frequency of both alleles (1) • correct calculation of 2pq (1) • correct calculation of the number of heterozygotes (1)

Additional guidance	Mark
Example of calculation q^2 =250 ÷ 800 = 0.3125 q= 0.56 / 0.559 and p = 0.44 / 0.441 2pq = 0.493 / 0.49 394 ALLOW 392 Correct answer with no working gains full marks	(3)

Question 16 · A level Paper 1 · November 2021 · Q3(b)(ii) · 2 marks

3(b)(ii)	A description that makes reference to the following • calculate the {allele frequencies/ number of dominant and recessive alleles} (in the population in Mozambique) (1) • (regular) sampling over a period of time (1) **(2)**

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Question 17 · AS Paper 2 · June 2018 · Q8(b)(i) · 2 marks

Question Number	Answer
8(b)(i)	An explanation which makes reference to the following: • they are no longer able to interbreed to produce fertile offspring (1) • because populations have become reproductively isolated (1)

Additional Guidance	Mark
	(2)

Question 18 · AS Paper 2 · June 2025 · Q4(a) · 2 marks

Question number	Answer
4(a)	An answer that makes reference to the following: • group of organisms with similar {characteristics / features } (1) • that can reproduce (with one another) to produce fertile offspring (1)

Additional guidance	Mark
ALLOW 'interbreed / breed / mate' for 'reproduce'	(2)

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Question 19 · AS Paper 2 · June 2017 · Q3(b) · 2 marks

Question Number	Answer
3(b)	An explanation that makes reference to the following: • (compare) sequences of {bases in DNA /amino acids in proteins} **(1)** • the more similarities in common the more closely-related the subspecies **(1)**

Additional Guidance	Mark
ALLOW nucleotides for bases ALLOW more recently evolved from a common ancestor ALLOW converse statements	**(2)**

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Question 20 · A level Paper 1 · June 2018 · Q8(b) · 3 marks

Question Number	Answer
8(b)	An explanation that makes reference to • determine the sequence of amino acids (for trypsin) (1) • determine the number of {differences / similarities} in sequences (of amino acids) between species (1) • the greater the number of differences the less closely related the species are (1)

Additional Guidance	Mark
ALLOW differences and similarities in primary structure ALLOW more similarities more closely related ALLOW greater difference in sequence longer the time from a common ancestor	**(3)**

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