PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 3: CLASSIFICATION AND BIODIVERSITY

BIODIVERSITY

SCORE	PERCENTAGE
/86	%

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Q1.

A survey was carried out to compare the biodiversity in different areas of a village.

The photograph shows a children's playing field in this village.



Honeybees are important pollinators of flowers.

Surveys have suggested that butterflies, ladybirds, beetles, flies and dragonflies are also important pollinators of flowers.

A recent report has suggested that a large increase in honeybees kept in towns and cities could affect biodiversity.

Explain how the increase in honeybees in towns and cities could affect biodiversity.

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(Total for question = 2 marks)

Q2.

A survey was carried out to compare the biodiversity in different areas of a village.

The photograph shows a children's playing field in this village.



Quadrats placed in the playing field showed predominantly grass with a few dandelion species, ribbed plantains, yarrow and clover. No animal species were observed.

The biodiversity of this playing field was low.

(i) Explain the reasons why the biodiversity of this playing field was low.

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(ii) The photograph shows a path in a woodland nature reserve near the playing field in this village.



After surveying the playing field, a survey of the woodland reserve was carried out using the following method:

- quadrats were placed at various intervals either side of the path
- plant species were counted in the quadrats
- animal species were counted at regular intervals along the path.

The table shows the results of this survey.

	Species	Number
Plant	Dock	10
	Thistle	10
	Hawthorn	6
	Wild cherry	2
	Hazel	5
	Yarrow	5
Animal	Meadow brown butterfly	2
	Shield bug	4
	Beetle	20
	Honeybee	20
	Dragonfly	4
	Spider	5

Calculate the biodiversity index for this woodland nature reserve.

Use the formula

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

(3)

Answer .....

(iii) It was suggested that the biodiversity index calculated from this survey was an underestimate.

Criticise the method used in the survey of the woodland nature reserve.

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(Total for question = 12 marks)

Q3.

The photograph shows a brown tree snake.



© staticflickr.com

The brown tree snake is found in areas of Indonesia.
This snake eats small mammals, birds and reptiles.

In the 1940s, the brown tree snake was introduced to the Pacific Island of Guam.
The population of this snake is now over two million.

Its introduction has had major effects on bird species in Guam.

The table shows the numbers of individuals of each bird species surveyed in the areas where this snake was present.

Species	1981	1982	1983	1984	1985	1986
Island collared-dove	0	0	3	19	1	0
White-throated ground-dove	1	3	5	5	0	0
Marian fruit-dove	11	19	3	0	0	0
Micronesian kingfisher	29	17	35	26	4	0
Marian crow	28	33	47	36	51	0
Guam flycatcher	6	23	11	0	0	0
Rufous fantail	74	55	43	0	0	0
Micronesian starling	148	159	135	71	7	0
Micronesian honeyeater	31	31	33	2	0	0
Bridled white-eye	108	98	2	0	0	0
Index of diversity (D)	4.6	4.7	4.1	3.5		0.0

(i) Calculate the index of diversity for 1985 using the formula

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

(3)

Answer .....

(ii) Explain why using an index of diversity is a better measure of biodiversity

than counting the number of species only.

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(iii) Comment on the effects of introducing the brown tree snake to Guam.

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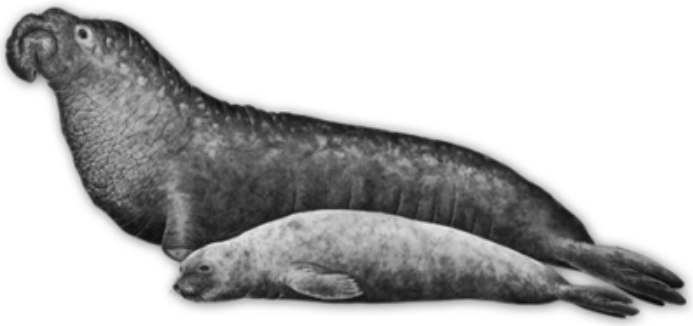
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(Total for question = 9 marks)

Q4.

The Northern elephant seal is a mammal found in the Eastern Pacific Ocean.



In the nineteenth century, Northern elephant seals were hunted and this reduced the population to about 20 seals.

The seals were listed as an Appendix II species when CITES was established in the 1970s.

The population has now recovered to over 100 000 individuals.

The seals in this population have developed health problems, including a high mortality rate for newborn pups, deformities and weak immune systems.

(i) Describe the role of treaties such as CITES in maintaining global biodiversity.

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(ii) Explain why, although the population of seals has recovered, many of the seals have health problems.

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(Total for question = 4 marks)

Q5.

Tapirs are nocturnal mammals that are found in South America.

In 2013, the Journal of Mammalogy published an article describing the discovery of a new species of tapir, *Tapirus kabomani*.

Scientists already knew about the animal but thought that it was the same species as *Tapirus*

terrestris.



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(a) Give **one** reason why scientists thought that *Tapirus kabomani* was the same species as *Tapirus terrestris*.

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(b) These two species of tapir can be distinguished using gene sequencing.

Describe how sufficient amounts of DNA could be obtained in preparation for gene sequencing.

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(c) Explain how distinguishing *Tapirus kabomani* as a separate species could affect the index of diversity of the area.

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(Total for question = 7 marks)

Q6.

* The photograph shows a tawny owl. These owls live in areas close to the Arctic Circle.



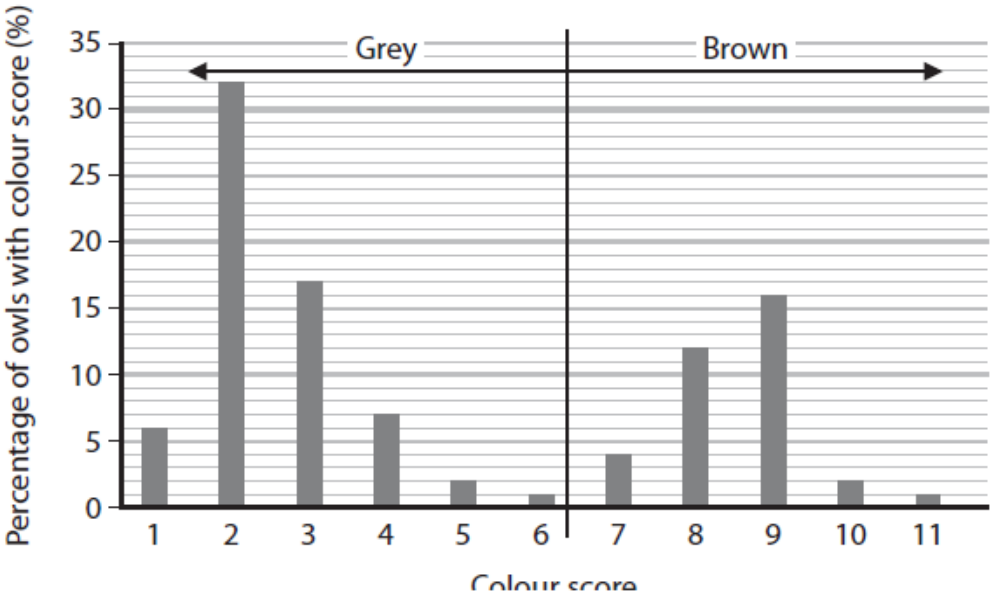
(Source: © LINDA WRIGHT/SCIENCE PHOTO LIBRARY)

Scientists investigated the feather colours of a population of tawny owls. Feather colours of the owls were scored on a scale of 1 to 11, according to how grey or brown they were.

Grey feathered owls were given a score between 6 and 1, with 1 being the most grey.

Brown feathered owls were given a score between 7 and 11, with 11 being the most brown.

The graph shows the percentages of owls in the population with each of the colour scores.



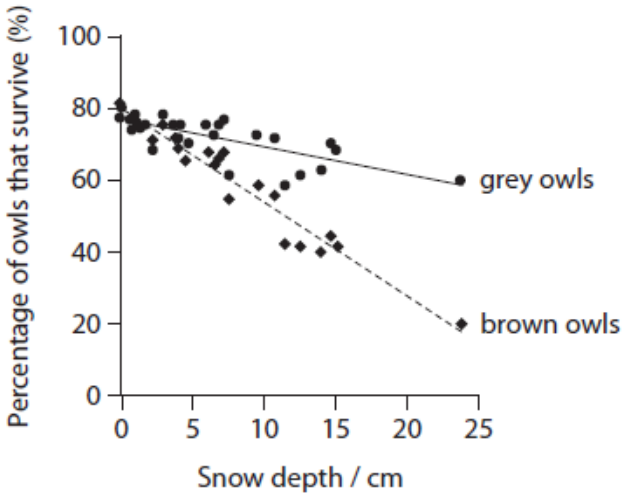
The scientists investigated the effect of climate change on the frequencies of these two alleles for feather colour in populations of tawny owls.

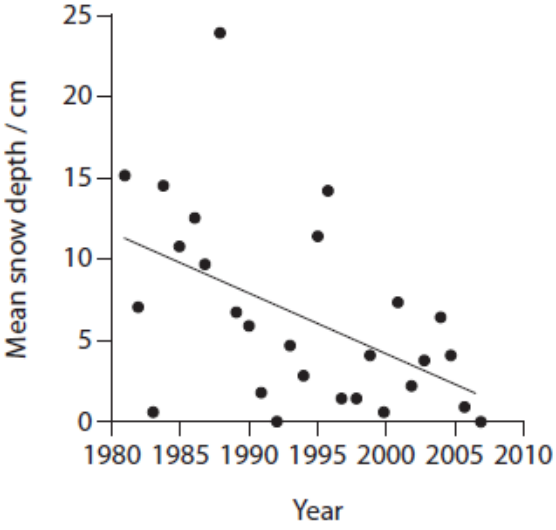
The percentage survival rates of both colours of owl were measured when there were different depths of snow.

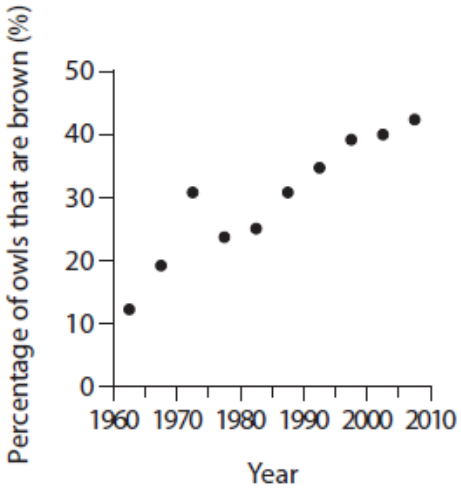
The mean depth of snow was recorded each year between 1980 and 2007.

The percentage of owls that were coloured brown between 1960 and 2007 was also recorded.

The graphs show the results.







The scientists concluded that increased greenhouse gases from human activity are resulting in an increase in the frequency of the brown allele.

Analyse the data to evaluate this conclusion.

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(Total for question = 6 marks)

Q7.

The diagram shows four varieties of rabbit.



Fur colour in rabbits is controlled by four different alleles:

- the allele for brown fur, C, is dominant to all other alleles
- the allele for chinchilla fur, c^{ch}, is dominant to the alleles for Himalayan and albino
- the allele for Himalayan fur, c^{h}, is dominant to the allele for albino
- the allele for albino fur, c, is recessive to all other alleles

The fur colour of animals can be affected by natural selection.

Compare and contrast stabilising selection with disruptive selection.

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(Total for question = 3 marks)

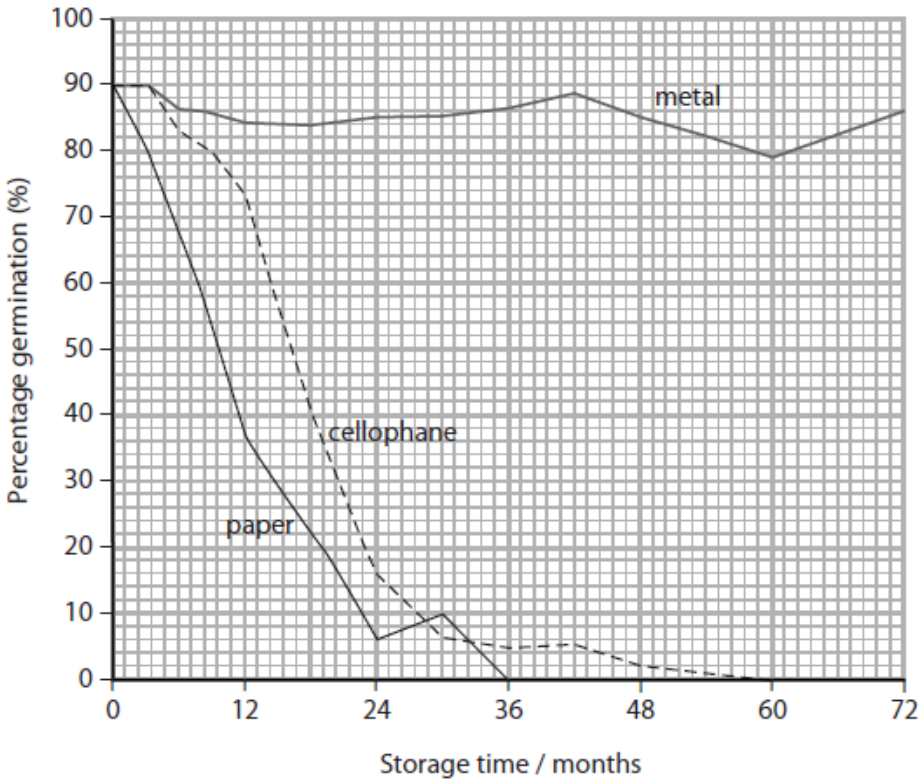
Q8.

Seed banks store seeds for future use. Seeds can be stored for a long time if the seeds are kept dry with a moisture content of less than 8%.

The seeds are stored in closed containers. The percentage germination of the seeds is measured to test their viability during storage.

At the Millennium Seed Bank, the seeds are stored in closed glass containers at 15% relative humidity at a temperature of –20°C.

The graph shows the percentage germination of seeds kept in three different closed containers: metal, cellophane and paper. They were kept for 72 months at a temperature of –20°C.



(a) Analyse the data to explain why seeds are stored in glass containers in the Millennium Seed Bank.

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(b) Each time the seeds are tested for viability, 50 seeds are used.

State why 50 seeds are used.

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(c) Calculate the rate of change in viability of the seeds stored in a cellophane container for the first two years.

(2)

Answer .....

(d) Seeds from other parts of the world are stored in seed banks.

(i) Explain how the viability test would be different for these seeds from other parts of the world.

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(ii) Explain why plants grown from these germinating seeds may not flower at the same time of year as they would have done in their country of origin.

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(Total for question = 12 marks)

Q9.

In Kenya, an in-situ conservation project has been set up to make paper from elephant dung.

This project aims to help conserve elephant populations, conserve biodiversity and help local communities.

Elephant conservation often involves the setting up of protected areas to stop poaching. Local people are banned from entering these areas.

This method of elephant conservation sometimes causes conflict with local people, as elephants can trample and eat crops in nearby farmland. Farmers sometimes burn areas of grassland and forest to stop elephants destroying their farmland.

The new paper conservation project encourages local people to make paper from elephant dung they collect from the conservation area. The paper they make is sold at a high price.

Conservationists measured the effect of the new paper project on the index of diversity of the area over two years. They also measured the effect of a protected conservation area where local people were banned from entering on the index of diversity. The results are shown in the table.

Area	Index of diversity	
	At start of project	After two years
Conservation area with paper project	2.8	3.6
Conservation area where local people are banned from entering	2.4	2.2

(i) State why calculating an index of diversity is a better measure of biodiversity than counting the number of different species.

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(ii) Give two advantages of in-situ conservation of elephants compared with ex-situ conservation of elephants.

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(iii) Explain the effect of the new paper project on biodiversity compared with the protected area where local people were banned.

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(Total for question = 7 marks)

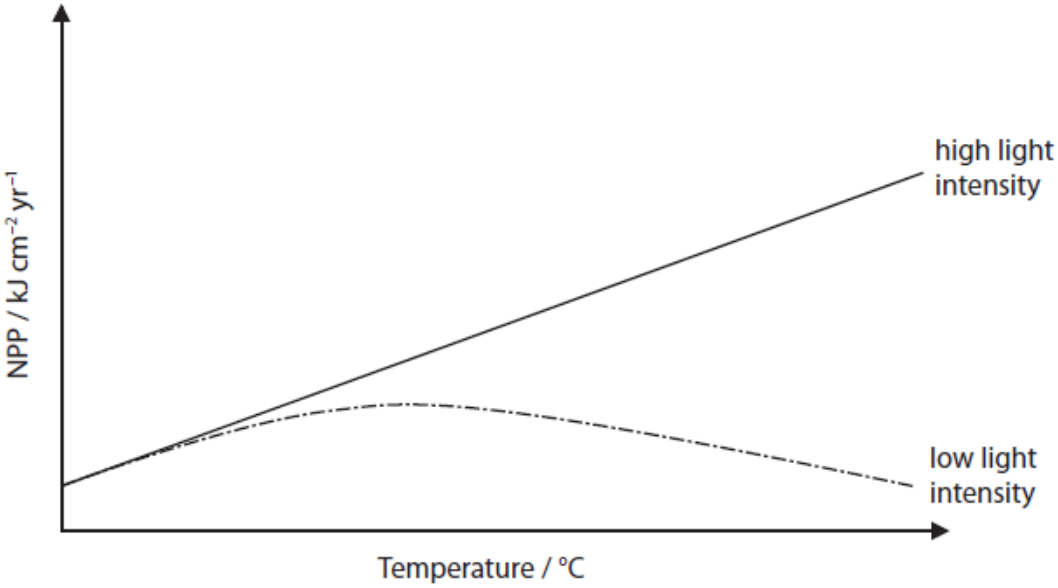
Q10.

The effects of light intensity and temperature on the net primary productivity (NPP) of young willow trees were investigated.

Young willow trees were grown in two greenhouses: one with high light intensity and one with low light intensity.

In each greenhouse, groups of these willow trees were kept at different temperatures for six months.

The results are shown in the graph.



* In a further investigation, succession was monitored for fifty years in an abandoned field.

The field was originally used to grow crops.

After fifty years, large numbers of coniferous trees were growing in the field.

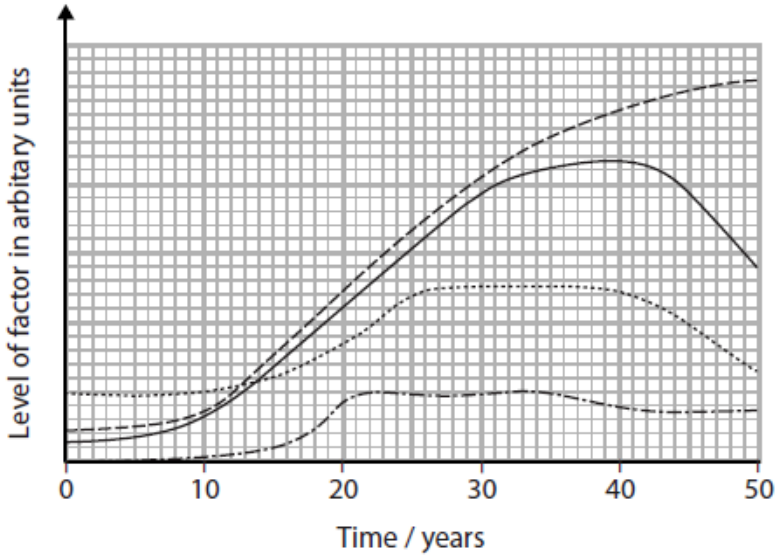
These coniferous trees do not shed many leaves.

When compared with younger trees, older coniferous trees have a much higher proportion of tree stem, branches and roots and a lower proportion of leaves.

The following factors were monitored:

- plant biomass
- NPP
- mineral ion content of soil
- index of diversity of animals

The line graphs show the trends that happened over fifty years for each of the factors.



Key

– – – plant biomass

—— NPP

------ mineral ion content of soil

—·— index of diversity of animals

Analyse the data to explain how succession is linked to the changes in this abandoned field.

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(Total for question = 6 marks)

Q11.

The biodiversity of plant species on Guam has decreased.

(i) Give two reasons why changes in the number of bird species have led to this decrease in biodiversity of plant species.

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(ii) Scientists are using seed banks to conserve the biodiversity of plants.

Describe how seed banks are used as a method of conservation.

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(Total for question = 6 marks)

Q12.

Chester Zoo has 10 black rhinoceros. The black rhinoceros is critically endangered due to being hunted for its horns.

One kilogram of rhinoceros horn can sell for more than £50 000.

The photograph shows a black rhinoceros.



The number of black rhinoceros fell from 70 000 in 1960 to 15 000 in the late 1970s.

All trade in black rhinoceros horn was prohibited under CITES in 1977.

However, hunting continued and fewer than 2 500 black rhinoceros were left by the year 2000.

(i) Explain why hunting continued after the black rhinoceros was listed in CITES.

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(ii) Explain why the genetic diversity of the black rhinoceros has decreased between 1960 and 2000.

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Q13.

Biodiversity is monitored by conservationists.

Biodiversity can be calculated using the formula

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

Give the symbol in this formula that represents the total number of organisms of all species.

(1)

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(Total for question = 1 mark)

Q14.

The Eurasian lynx is the largest native European cat species.

It was once widespread across Europe but is now restricted to small areas of national parks.



Ex-situ and *in-situ* conservation measures were used in the 1970s to increase biodiversity.

- Lynx were bred in zoos and 10 were reintroduced into an area of protected forest where the lynx had become extinct.
- Existing wild lynx were protected in an area of forest where they had not become extinct.

In 2016 scientists estimated the population sizes and genetic biodiversity of the lynx in these two areas of forest.

They found that the population and genetic biodiversity of the lynx in the area where they had been reintroduced were much lower than in the protected area.

(i) State what is meant by the term **biodiversity**.

(1)

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(ii) Explain why, in 2016, the genetic biodiversity of the lynx population in the area where they had been reintroduced was much lower than in the protected area.

(2)

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(Total for question = 3 marks)

Q15.

The Eurasian lynx is the largest native European cat species.

It was once widespread across Europe but is now restricted to small areas of national parks.



Ex-situ and *in-situ* conservation measures were used in the 1970s to increase biodiversity.

- Lynx were bred in zoos and 10 were reintroduced into an area of protected forest where the lynx had become extinct.
- Existing wild lynx were protected in an area of forest where they had not become extinct.

In 2016 scientists estimated the population sizes and genetic biodiversity of the lynx in these two areas of forest.

They found that the population and genetic biodiversity of the lynx in the area where they had been reintroduced were much lower than in the protected area.

Explain the principles and issues associated with *ex-situ* conservation methods.

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(Total for question = 4 marks)