

Biodiversity

Model Answers 1

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Biodiversity, evolution and disease
Topic	Biodiversity
Booklet	Model Answers 1

Time allowed: 59 minutes

Score: /44

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

The Millennium Seed Bank has over two billion seeds in storage.

Which of the options, **A** to **D**, describes the type of conservation carried out at the Millennium Seed Bank?

A in-situ conservation of species biodiversity

B in-situ conservation of habitat biodiversity

C ex-situ conservation of species biodiversity

D ex-situ conservation of habitat biodiversity

[1]

Ex situ is when conservation is outside the natural habitat and we are trying to conserve species

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Question 2

The genetic diversity of a population can be estimated using the following formula:

$$\text{proportion of polymorphic gene loci} = \frac{\text{number of polymorphic gene loci}}{\text{total number of loci}}$$

In 1992 a study estimated the genetic diversity of four isolated populations of lions. They recorded the number of gene variants at a selection of gene loci in each population.

Which of the following populations of lions has the greatest proportion of polymorphic gene loci?

- A. Asiatic Lion: 73 polymorphic loci out of 1927.
- B. Transvaal Lion: 1110 polymorphic loci out of 2156.
- C. Masai Lion: 1030 polymorphic loci out of 2315.
- D. West African Lion: 1004 polymorphic loci out of 2008.

[1]

38% of A are polymorphic, 51% of B, 44% of C and 50% of D

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Question 3

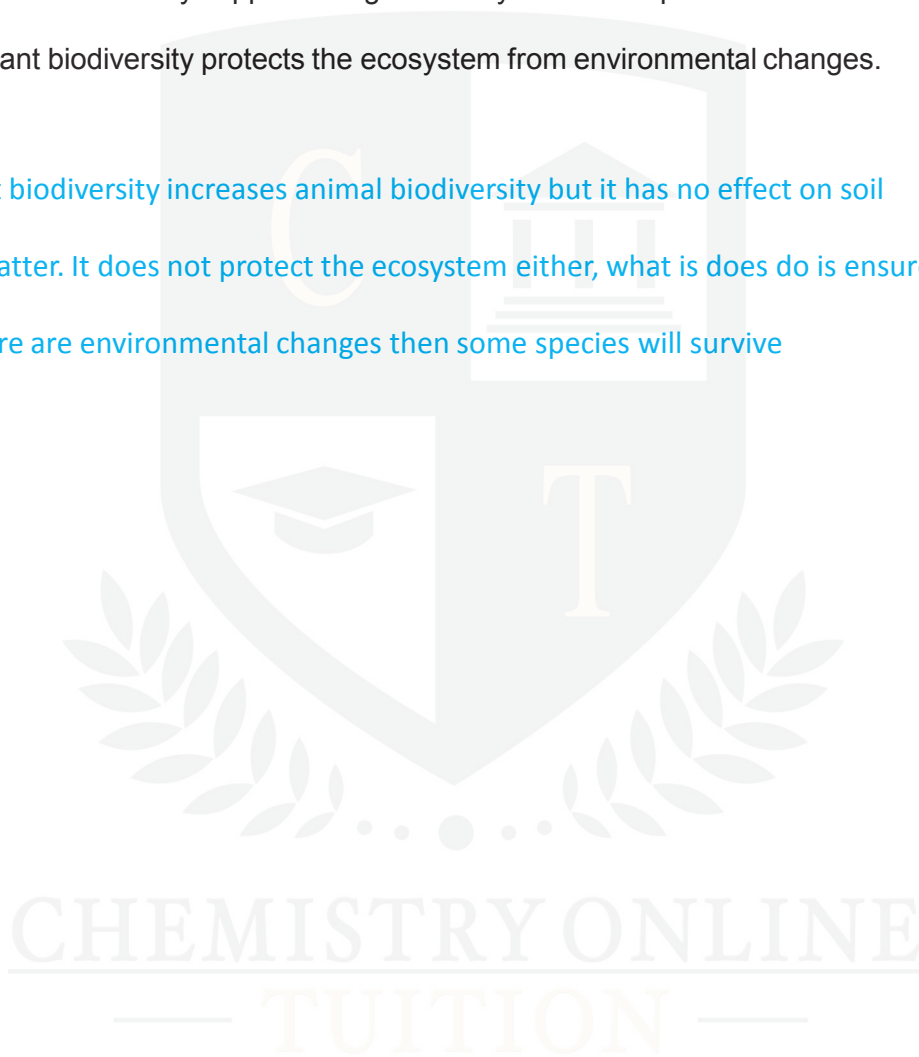
Tropical rainforests have a very high biodiversity of plant species.

Which of the statements, **A** to **D**, is an economic benefit of high biodiversity?

- A** High plant biodiversity decreases the animal biodiversity in the rainforest.
- B** High plant biodiversity increases the organic matter in rainforest soils.
- C** High plant biodiversity supports drug discovery and development.
- D** High plant biodiversity protects the ecosystem from environmental changes.

[1]

High plant biodiversity increases animal biodiversity but it has no effect on soil organic matter. It does not protect the ecosystem either, what it does do is ensure that if there are environmental changes then some species will survive



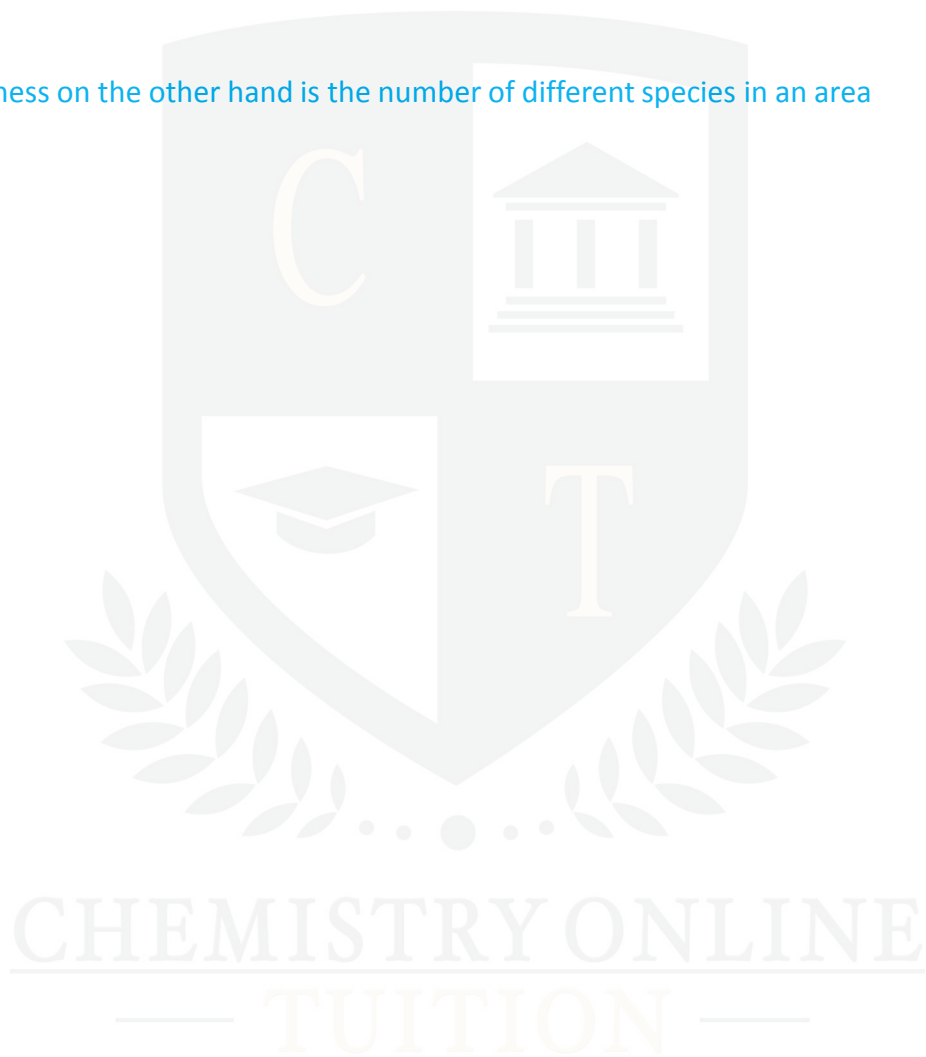
Question 4

Which of the statements, **A** to **D**, best defines the term *species evenness*?

- A. the number of species in an area
- ☒ B. the relative abundance of each species in an area
- C. the relative number of individuals of a species in an area
- D. the spread of species over an area

[1]

Species richness on the other hand is the number of different species in an area



Question 5

- (a) The cassowary is a large, flightless bird found in the rainforest in parts of Australia. It feeds mainly on fruit. The seeds of the fruit are deposited on the rainforest floor.

- (i) The cassowary is known as a *keystone species*. This means it is important for the survival of other species.

Suggest what role the cassowary plays in the survival of other species.

[1]

It disperses seeds

The question states specifically that the cassowary deposits seeds on the forest floor

- (ii) The cassowary needs to be conserved for ecological reasons.
State **two** other reasons for maintaining biodiversity.

[2]

- Certain species might be a future source of drugs / medicines
- Species may have an aesthetic value

Biodiversity is the variety of species, habitats and genetic diversity

- (b) The mountain gorilla is an endangered species with as few as 880 individuals surviving in the wild. Many of the animals have been 'habituated' to human contact. The health of these animals is monitored and medical assistance is given when necessary. Animals that are not habituated are rarely visited.

- (i) Suggest one advantage **and** one disadvantage of keeping some gorilla families that have not been habituated.

[2]

- A disadvantage is they are more likely to be poached
- An advantage is that they are less likely to catch diseases from humans
and they will exhibit natural behaviour

- (ii) The gorilla population in one area, Virunga, has been regularly monitored (**Table 24.1**). The data have been collected by indirect methods such as collecting dung samples at nest sites. However, DNA analysis of another gorilla population suggests that estimates made by these indirect methods may be up to 6% inaccurate.

Year	Population in Virunga
1981	254
1989	320
2003	380
2010	480

Table 24.1

Calculate the mean annual percentage rate of growth of the gorilla population in Virunga between 1981 and 2010.

3.1%

[2]

254 to 480 is a rise of 226 divided by the original 254 = 89%

This is divided by the 29 years from 1981 to 2010 = 3.1%

- (iii) In 1993 the Rio Convention on Biodiversity came into force. In 2010, one conservationist commented that the Rio Convention had had a real effect on the gorilla population. Use the information above to evaluate the effect that the Rio Convention on Biodiversity has had on the gorillas in Virunga. [3]

- This a correlation and not a causal reason
- The data may be inaccurate as unhabituated gorillas are hard to find
- The growth rate is 3.1% before 1993 and 3.8% after 1993 which supports this
- Collecting dung samples may be inaccurate

The statement that collecting dung samples is use to estimate populations is so unusual that it must have some bearing on your answer. Remember to manipulate figures to support your answer

[Total: 10]

Question 6

The Royal Botanic Gardens at Kew plays an important role in plant conservation. One plant that has been conserved at Kew is the world's smallest water lily, the thermal lily, *Nymphaea thermarum*.

In its natural habitat, the thermal lily grows in hot water springs in central Africa.

(a) State the genus to which the thermal lily belongs.

[1]

The genus name is:

- *Nymphaea*

The genus name is the first of the two in a scientific binomial name. It should be written with a capital letter for the first letter, followed by the rest in lower case. It should also be underlined (or in italics if typed).

(b) Explain why it is sometimes necessary to conserve a plant species, such as *N. thermarum*, outside its natural habitat (*ex situ*).

[3]

It is sometimes necessary to conserve a plant *ex-situ* because:

- Their natural habitat is lost due to climate change or human activity
- The population is very low
- in the wild, sexual reproduction is difficult if numbers are low
- breeding *ex situ* can maintain the gene pool
- it also allows protection from grazers and competing species
- and protection from disease

- (b) The Royal Botanic Gardens also manages the Millennium Seed Bank, which aims to store seeds from one quarter of all plant species.

Give **three** advantages of conserving plant species as seeds and **not** as adult plants. **[3]**

Advantages of using seeds in conservation are (any three from):

- seeds can be collected with minimal damage to wild population
- they take up little space so larger numbers can be stored
- can store greater genetic diversity
- lower maintenance
- easy to transport
- remain viable for long periods
- less vulnerable to disease and environmental change

prevents fertilisation by undesired pollen

- (d) When measuring the biodiversity of a habitat, it is difficult to count every organism. It is therefore necessary to sample a proportion of the habitat. The sampling process must not be biased.

Outline an unbiased sampling method that can be used to measure the biodiversity of plant species in grassland. **[4]**

An unbiased sampling method would involve:

- the use of a quadrat
- using random sampling
- by placing measuring tapes at right angles

OR

- use of transect
- quadrat placed at regular intervals
- use of identification key
- count the number of individuals
- repeat many times
- sample at different times of year

(e) Scientists try to estimate the total number of species on Earth.

Suggest **three** reasons why such estimates are not likely to be accurate.

[3]

Such estimates are likely to not be accurate because:

- not all species can be found as some are in hard to reach places
- some species may have become extinct since recording
- evolution is on-going
- some species are difficult to distinguish

[Total: 14]



Question 7

The population of the white-backed vulture, *Gyps bengalensis*, in India has fallen by 97% to an estimated 4 000 vultures. This vulture is now considered to be 'critically endangered'. Reasons for the decline in numbers include:

- vultures feed on carcasses including those from farm animals.
- these farm animals may have been treated with a pain killer. This particular pain killer causes kidney failure in the vultures.
- the use of this pain killer is being phased out. However, many farmers continue to use up their stocks of the drug.
- this pain killer is not easily biodegradable and will remain in the environment for many years.

(a) (i) Suggest what is meant by *critically endangered*.

[1]

- If something is critically endangered it means it is likely to become extinct because its numbers are not sustainable

If numbers drop below 10% of the original population they are too low for the survival of a species. The gene pool is too small and genetic diversity is so low that any change in selection pressure will mean that none of the individuals in the population will be able to adapt to the change

(ii) Calculate the **original** population of the white-backed vulture.

Show your working.

[2]

- $(4000 \times 100) \div 3$
- $= 133,333$

- (b) A captive breeding programme has been set up in an effort to save the white-backed vulture.

Three centres in India have been built, each housing up to 40 individuals. These vultures have been collected from different areas of the Indian subcontinent.

- (i) Explain why the decision was made to conserve the species in captivity (*ex situ*) rather than in the wild (*in situ*). [4]

- The decision to conserve the species in a captive breeding program is because the painkiller is still being used by the farmers
- In captivity they can be fed uncontaminated food
- The health of the individuals can be monitored
- Eggs can be incubated
- They can be protected from hunting or predation
- There is reduced mortality of the young
- Competition is reduced between individuals of the same species and between different species

- (ii) Explain why the white-backed vultures in the captive breeding programme were,
- collected from several different areas
 - housed in three separate centres.

[3]

The vultures were collected from different areas to:

- Increase the size of the gene pool and improve genetic variation
- This also reduced the risk of inbreeding between related birds
- It was less likely that they were all contaminated with painkillers
- They were housed separately to reduce the risk of losing all the vultures due to disease or human activity

(c) Outline **three** reasons why the conservation of the white-backed vulture is important.

[3]

Conservation of the vulture is important for the following reasons:

- To maintain biodiversity
- They are part of the food chain
- Every living thing has the right to exist
- They have an aesthetic value
- They could create revenue by eco-tourism
- They could be a source of medicine or used for medical research
- They are a genetic resource or a bank of genes
- They prevent disease by removing the carcasses

There is a standard answer to any question that refers to the reasons why the conservation of a particular organism is important

To maintain biodiversity

They have an aesthetic value

They are a bank of genes

They could be a source of medicine or drugs

As humans we have a moral right to conserve species and prevent their extinction

(d) Once the captive bred individuals have been released into the wild, suggest **three** measures that could be taken **in the long term** to preserve the numbers of white-backed vultures. [3]

To preserve the numbers of the white backed vultures the following measures could be taken:

- Make the use of this painkiller illegal
- Provide alternative painkillers do not have the same effect
- Ban hunting and legally protect the white backed vultures
- Create protected areas or sanctuaries
- Prevent the destruction of the habitat
- Monitor the population of vultures and their movement by tagging
- Provide a feeding program for the birds
- Educate locals
- Promote eco-tourism

[Total: 16]

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