Biodiversity

Model Answers 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Biodiversity, evolution and disease
Topic	Biodiversity
Booklet	Model Answers 2

Time allowed: **63 minutes**

Score: **/47**

Percentage: **/100**

Grade Boundaries:

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

Question 1

Two different fields, field **G** and **H**, were sampled for three common species of wildflower. The results are shown below.

	Number of individuals	
Species	**Field G**	**Field H**
Daisy	300	20
Dandelion	335	49
Buttercup	365	931
Total	1000	1000

Which of the options, **A** to **D**, is correct?

A. Field **G** will have a greater Simpson's diversity index.

B. Field **H** has greater species evenness.

C. Field **H** will have a greater Simpson's diversity index.

D. Field **G** has greater species richness. **[1]**

Field G has more individuals of each species so it's evenness is higher. The number of species is the same in G and H which is 4. A greater evenness leads to higher Simpson's Diversity

Question 2

Turtle doves, *Streptopelia turtur*, were once common in farmland in the UK but their numbers have recently been in decline.

Farmers can claim money from the UK government if they farm in ways that encourage the survival of species such as the turtle dove.

Which of the following agreements is/are relevant to the example described above?

1 The Convention on International Trade in Endangered Species (CITES)

2 The Rio Convention on Biological Diversity (CBD)

3 The Countryside Stewardship Scheme (CSS)

A. 1, 2 and 3

B. Only 1 and 2

C. Only 2 and 3

D Only 1 **[1]**

The doves numbers have not declined as a result of trade in them or their products

Question 3

Select the most appropriate term from the list below to complete the table.

abundance	**habitat**	**Simpson's diversity index**
biodiversity	**percentage cover**	**species evenness**
biased	**quadrat**	**species richness**
community	**quantitative**	**systematic**
dichotomous	**random**	**taxon**
ecosystem	**sample**	**transect**

definition	term
sampling in which the observer does not decide when and where to take measurements	random
a representative group of organisms that are selected from a population	sample
an area in which an organism lives	habitat
a measure of the relative numbers of individuals in each species	Species evenness
the frequency of occurrence of plants in a particular area	abundance
the number of species present in a particular area	Species richness

[6]

[Total: 6]

Question 4

(a) The black poplar was once a common tree throughout southern Britain. Its numbers have decreased by 94% since 1942 and it is in danger of becoming extinct in the wild.

There are thought to be approximately 2500 black poplars surviving in Britain today. Use the information above to calculate the original number of black poplar trees in 1942.

Show your working. **[2]**

- 41667

If it had decreased by 94% then it must originally have been 2500 X 100 ÷ 6

(b) Species such as the black poplar contribute to the biodiversity of the UK.

Suggest **three** reasons why the conservation of the black poplar is important. **[3]**

- Conservation of this tree is important as it forms part of an ecosystem and will be a habitat for other organisms
- It is part of the food chain or food web
- The wood might be useful for specific purposes, such as furniture
- All plants could be a source of medicine
- The tree could be a genetic resource or form part of a bank of genes
- Trees give pleasure to tourists and therefore have an aesthetic value
- It is our moral responsibility to preserve species
- The trees could provide resources for scientific research

Most of this answer could be used to justify conservation for virtually any species, whether it is animal or plant so it is worth remembering.

(c) Botanic gardens are important in the conservation of plant species.

(i) State why the conservation of a species in a botanic garden is described as *ex situ*. **[1]**

- Ex situ conservation takes place outside its natural environment

Ex situ examples are zoos, safari parks, botanical gardens and arboretums

(ii) Many botanic gardens use seed banks as a method of plant conservation.

Outline the **advantages** of using a seed bank, as opposed to adult plants, in order to conserve an endangered plant species. **[4]**

Advantages of using seeds to conserve plants include:

- Most plants produce an excess of seeds so availability is high
- They can be collected from the wild without damaging the habitat
- Seeds take up very little space
- Large numbers and more species can be stored
- They are cheaper to store and transport than whole plants
- Seeds remain viable for long periods of time
- Seeds are less susceptible to diseases

Whole plants need different conditions when they are stored, whereas storing seeds simply requires them all to be stored in dry and cold conditions. Cold temperatures reduce enzyme activity and the lack of water prevents hydrolysis of the food reserves.

(iii) Suggest why it is important to ensure that, for each species, the seeds in a seed bank have been collected from several different sites in the wild. **[3]**

- Collecting the seeds from different sites will increase genetic variation and with it a larger gene pool
- More genetic variation reduces the chances of disease affecting the whole population
- A large gene pool also reduces the chance of inbreeding

Greater genetic variation enables a species to be able to adapt to change whereas a small gene pool can result in the species becoming extinct when they are less able to adapt to changes in selection pressures

[Total: 13]

Question 5

Part of the Cairngorms National Park in the Scottish Highlands is at an altitude of approximately 1000 metres. It presently supports a range of plants and animals including some that are normally found in sub-arctic conditions.

Table 3.1 shows the breeding success of a number of bird species between 1970 and 2000. Specialist sub-arctic species are marked with an asterisk *.

Table 3.1

species	number of young raised per year			
	1970	1980	1990	2000
snow bunting *	78	69	36	2
Lapland bunting *	7	3	0	0
ptarmigan *	1280	1134	960	876
red grouse	890	920	933	962
wheatear	209	240	190	231
meadow pipit	23	45	48	82
ring ouzel	23	21	29	26
dotterel *	45	43	39	35

* = specialist sub-arctic species

(a) **(i)** Using the data in Table 3.1, compare the breeding success of the sub-arctic species and the non sub-arctic species between 1970 and 2000. **[3]**

- All the sub-Arctic species showed a decrease between 1970 and 2000
- The other species of non-sub-Arctic birds showed no change
- The was a greater change in breeding success in the Arctic than in non-sub Arctic species
- For example the number of ptarmigan changed by 504 between 1970 and 2000 compared to the red grouse which only changed by 72 in the same time period

Exam tip: Data in tables

Examiners go to great lengths to give the best students the opportunity to make a difference to their grade. If there is an obvious trend in the results it is there to be recognised. Always carry out simple calculations such as overall changes rather than just quoting figures as was the case with this question

(ii) Suggest **two** reasons for the trends described. **[2]**

- Possible reasons for the trends include the following
- Climate change or global warming
- Global warming changed the food supply such as insects and plants which they depended on
- That could have been a disease that affected sub-Arctic species more than others
- Sub-Arctic species could be less well adapted and have been outcompeted

Note that at the start of the question you are told that this part of the National Park is at a high altitude and the range of plants and animals include some that are normally found in Arctic conditions. These conditions will obviously support the sub-Arctic species.

(b) A study of insects was carried out in the same area of the Cairngorms National Park to determine species richness.

(i) What is meant by species richness? **[1]**

- Species richness is the number of different species present in a habitat

(ii) The insects were sampled using a sweep net method. Fig. 3.1 shows a sweep net being used. With this method, a net is swept through the vegetation. Insects are removed, identified and counted.

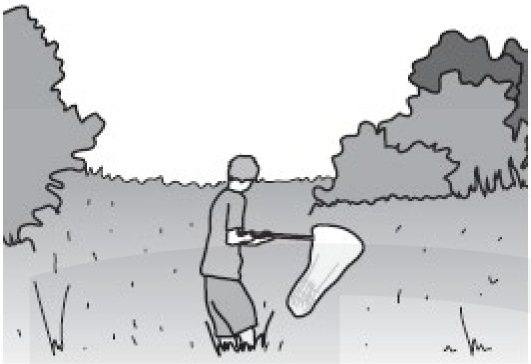
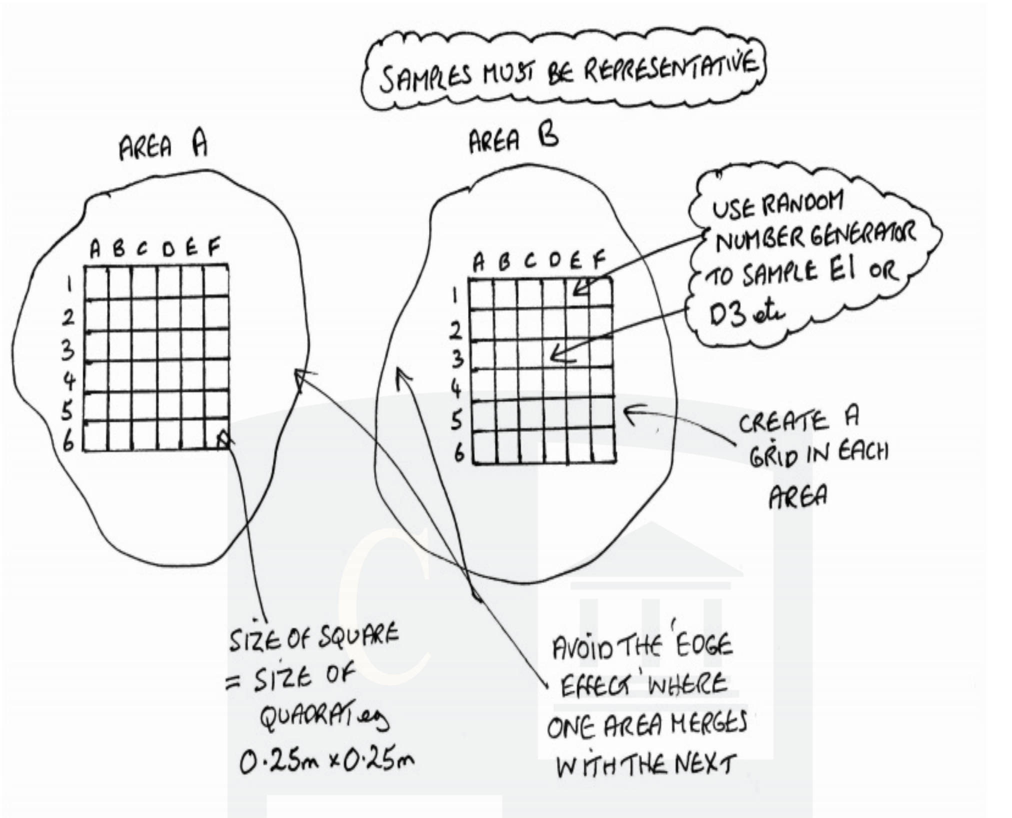


Fig. 3.1

Describe **three** ways in which the sampling procedure could be designed to try to make sure that a representative sample was obtained. **[3]**

- The sampling area should have used a method to make sure the areas chosen were unbiased
- The sampling should have been repeated several times to be able to calculate a mean
- The sweeping procedure should have been standardised, such as the number of sweeps and which height they were performed at
- A method should have been applied to prevent recounting, such as photographing the insects
- The sampling should also have been carried out at different times of the day, year and different weather conditions

Whenever sampling is carried out methods should be used to make sure the results are reliable so repeats should be included, these allow a mean to be calculated, any anomalies are highlighted and a statistical test can be carried out. To randomise the sampling area a grid could be mapped out and random coordinates assigned to the sampling method



(iii) Species evenness also contributes to the measurement of biodiversity.

Explain the importance of species evenness in determining the biodiversity in a habitat. **[3]**

- Species evenness is the abundance or numbers of individuals in each species
- Species evenness is more quantitative than species richness
- High species evenness indicates a greater biodiversity
- A low species evenness indicate a dominant species
- Species evenness is combined with species richness to calculate Simpson's index of diversity

If you have a lawn with grass, daisies, dandelions, buttercups, thistles, moss and clover there are 7 different species. You might think this species richness of 7 is high, but the lawn will be predominantly grass, so the species evenness will be low as there is one dominant species.

[Total: 12]

Question 6

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

(i) Give **one** aim of CITES. **[1]**

CITES is to protect or conserve species which are endangered by trading activities or to prevent the trade of species endangered or to regulate trade at cross border controls

(ii) Between 1913 and 2013 the approximate worldwide population of living elephants dropped from 10 000 000 to 500 000.

Calculate how many orders of magnitude smaller the elephant population is likely to be in 2213 compared to 1913.

Assume that the elephant population continues to decline at the same rate each 100 years.

Show your working. **[2]**

- This is a 95% decrease from 1913 to 2013
- In 2213 there will be 1250 left or 4 orders of magnitude

10,000,000 is 10^7 whereas 1250 is 10^3 which is 10^4 or four orders of magnitude greater

(b) Fig. 5 shows the approximate percentages of elephants that were killed illegally in three different regions of Africa.

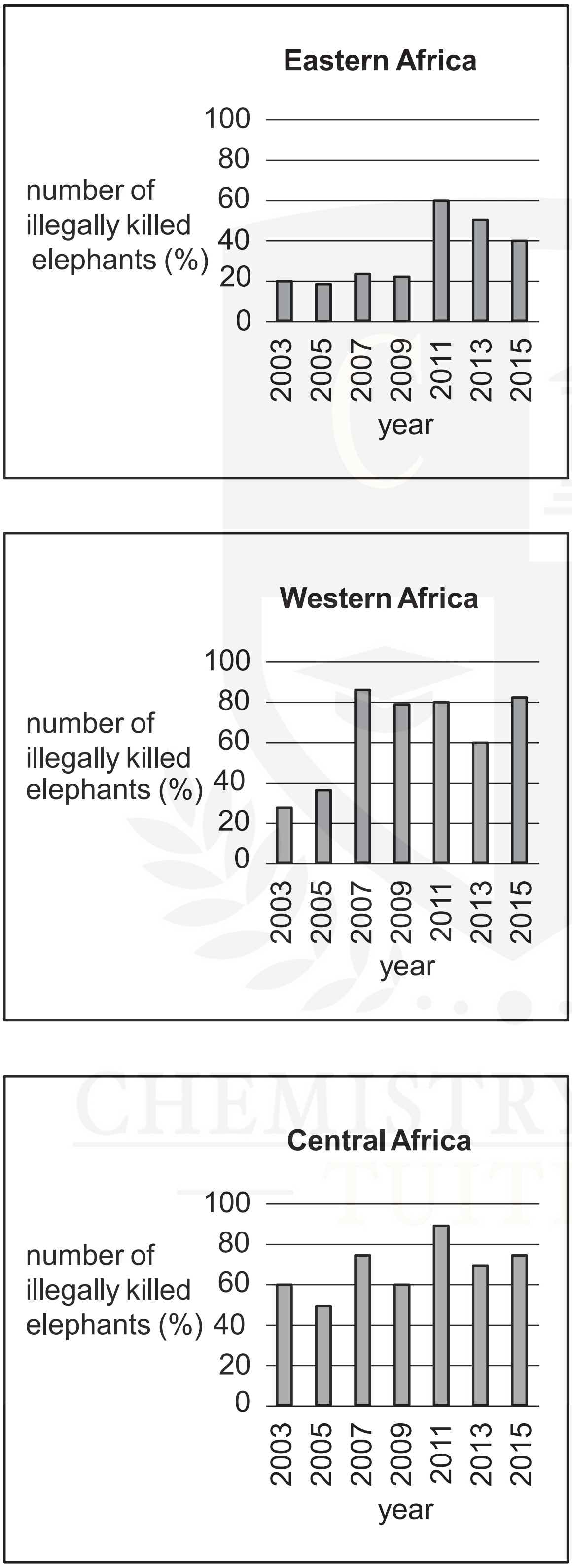


Fig. 5

John Scanlon, the Secretary-General of CITES in 2015, made the following statement:

> "African elephant populations continue to face an immediate threat to their survival from unacceptably high-levels of poaching for their ivory, especially in Central and West Africa where high levels of poaching are still evident. There are some encouraging signs, including in certain parts of Eastern Africa... showing us all what is possible through a sustained and collective effort..."

Give two pieces of evidence to show how the data in Fig. 5 support the statement made by John Scanlon.

Evidence 1 **[2]**

The numbers of elephants killed in Eastern Africa is lower than central Africa (below 60)

Evidence 2

- Since 2011 the numbers killed in Eastern Africa is dropping steadily or
- In 2011 it was 60 and dropped to 40 (use of figures)

This question actually tells you about the trend in elephant killings in the statement so the marks are for interpreting the graphs and backing this up with data. Remember quote AND manipulate data

[Total: 5]

Question 7

On a biology field trip, a pair of students collected some data about plant species in an area of ash woodland. Their results are shown in Table 4.1.

Species	**Number of individuals (n)**	**n/N**	**$(n/N)^2$**
Dog's mercury	40	0.40	0.1600
Wild strawberry	13	0.13	0.0169
Common avens	43	0.43	0.1849
Wood sorrel	4	0.04	0.0016
	$N =$ 100		$\Sigma(n/N)^2 =$ 0.3634
			$1-(\Sigma(n/N)^2) =$ 0.6366

Table 4.1

(a) (i) Use the information in the table to work out the Simpson's Index of Diversity (D) for the area of woodland sampled using the formula:

$$D = 1-(\Sigma(n/N)^2)$$

Where: n = number of individuals of a particular species.
N = total number of individuals in all species.
Σ = sum of.

Complete Table 4.1.

You may use the space below for your working. **[3]**

Yes, 0.4 x 0.4 is 0.16. You can multiply two numbers together and get a lower number.

Simpson's Diversity is a useful measure of biodiversity as it combines species richness and species evenness. The values though are not easy to interpret, so is 0.63 high or low? It does not have an obvious scale.

(ii) Simpson's Index of Diversity takes into account both species richness and species evenness.

In a school exercise book a student wrote the following definitions:

Species richness is a measure of the amount of species in an area.
Species evenness shows how many individuals there are of a species in an area.

The teacher did not award a mark for either of these statements.

Suggest how each statement could be improved.

Species richness

Species evenness **[2]**

- Species richness is the number of different species in one area or habitat
- Species evenness is how many individuals there are of each species in an area or habitat

In a lawn could be grass, dandelion, buttercup, moss, clover and thistle. Its species richness would be 6. However the numbers of each species will show predominantly grass so its evenness will be low as there is one dominant species

(iii) If the value for Simpson's Index of Diversity is high, this indicates that the biodiversity of the habitat is high.

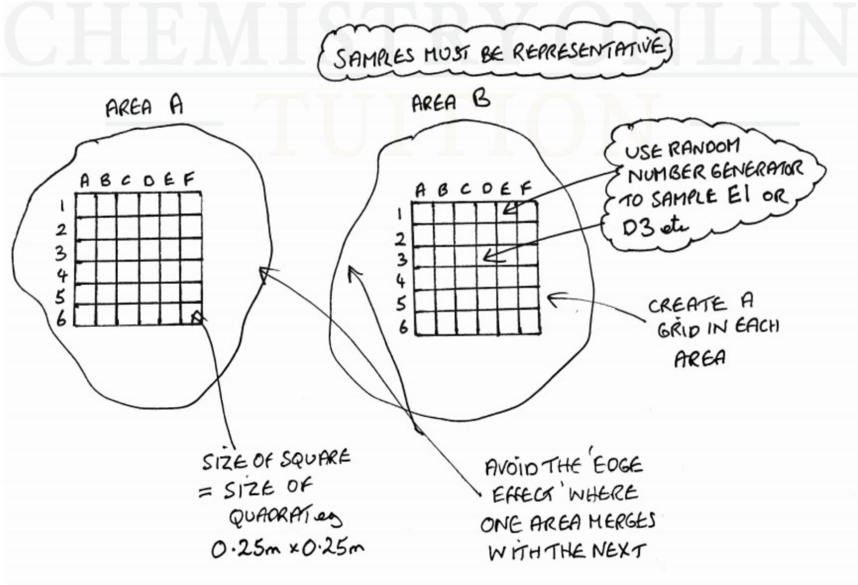
Outline the **implications** for a habitat if the Simpson's Index of Diversity is **low**. **[2]**

- A low diversity index suggests that the habitat is dominated by one species
- The change in one species is likely to affect the whole habitat
- The community or ecosystem is less able to tolerate change if biodiversity is low

(b) When collecting data on the field trip, the students placed quadrats in 15 locations and calculated a mean number of plants for each species.

Suggest two **other** steps they could have taken to ensure that their value for Simpson's Index of Diversity was as accurate as possible. **[2]**

- The data should have been collected by random sampling
- Grids should be marked out and sampled using random number tables
- Keys should be used to identify species
- The survey should have been carried out at different times of the year/seasons
- The data should have included larger species such as trees



[Total: 9]