Teacher Resource Bank

Environmental Studies

ENVS1 Sample Questions and Mark Schemes

Topic 1: Conditions for Life on Earth

1 Suggest how the evolution of green plants may have led to a reduction in the amount of solar radiation reaching the Earth's surface.

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(3 marks)

3

2 Explain why the temperature range found on Earth is suitable for the survival of living organisms.

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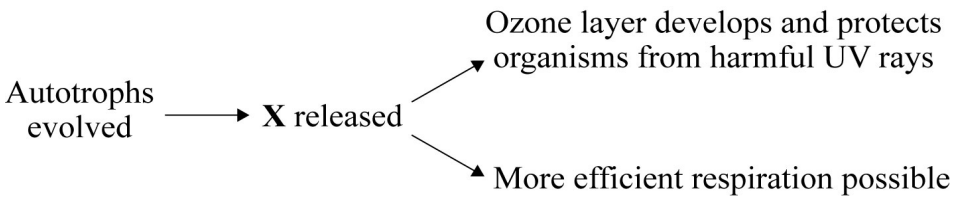
(2 marks)

2

3 The diagram shows some of the early stages in the development of life on Earth.



3 (a) What gas is represented by **X**?

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(1 mark)

3 (b) Explain why *more efficient respiration* was possible.

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(2 marks)

3 (c) Explain why ultraviolet (UV) radiation is harmful to organisms.

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(1 mark)

3 (d) Other than suitable ambient gases and types of radiation, state and explain **one** other condition on Earth that permits the existence and continued support of living organisms.

Condition .....

Explanation .....

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(2 marks)

6

4 Describe how the conditions found on Earth permit the existence and continued support of living organisms.

Quality of Written Communication will be assessed in this answer.

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(7 marks)

7

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Mark scheme – Topic 1: Conditions for Life on Earth

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

Increased oxygen by-product**;**
ozone formation/O_3**;**
ozone utilises UV radiation**;**
[**R** shields/blocks/reflects]
[**R** ref to GHE] 3

Total marks = 3

Question 2

Allows efficient enzyme activity/speed of chemical reactions**;**
high temperatures denature/deactivate enzymes**;**
[**R** 'kill' enzymes]
temperature range allows water in liquid state**;** MAX 2

Total marks = 2

Question 3

3 (a) Oxygen/O_2**;** 1

3 (b) Oxygen enables aerobic respiration**;**
complete breakdown of glucose/sugar/food (to CO_2 and H_2O)**;**
[**A** equation]
more energy released/ATP produced than without oxygen/
anaerobic respiration**;** MAX 2
[**A** ref to less enzyme damage linked to presence of ozone layer]

3 (c) Causes chemical change/mutation/change in DNA/genetic material/
skin cancer/sunburn/radiation blindness/cataracts**;** 1
[**A** reference to reduction in plant productivity/photosynthesis]
[**R** damage unqualified]

3 (d) (Liquid) water**;**
solvent for all metabolic reactions/habitat for aquatic organisms/
metabolite for named process/photosynthesis/transport medium**;**
[**A** water as a major component of organisms]
OR
suitable temperature (range)**;**
enables enzyme activity/optimum temperature for biological
processes/metabolic reactions/presence of liquid water**;**
OR
presence of gravity**;**
holds atmosphere**;** MAX 2

Total marks = 6

Question 4

Quality of Written Communication is assessed in this answer.

(Visible) light needed for photosynthesis**;**
details of suitable wavelengths/colours**;**
appropriate temperature range for metabolic/chemical/enzyme activity**;**
[**A** named process]
details of temperature range/average temperature on Earth**;**
denaturation of enzymes/>40 °C/at high temperatures**;**
CO_2 needed for photosynthesis**;**
O_2 needed for respiration**;**
O_3 layer shields organisms from damaging UV/prevents mutations/harm to organisms**;**
presence of (large amounts) of water in liquid state**;**
water needed as solvent for all metabolic reactions/transport medium**;**
water as habitat**;**
suitable comparative comment for Venus (too hot/large GHE/no water)**;**
suitable comparative comment for Mars (too cold/little atmosphere/no liquid water)**;**
[**A** temperature dependant on suitable distance from sun]
Earth's temperature permits H_2, O_2, N_2 and CO_2 to exist as gases**;**
wide range of minerals and essential elements present/carbon as basis of organic molecules (or other example)**;**
Earth's gravity holds atmosphere**;**
qualified reference to rock cycle**;**
greenhouse gases/CO_2/CH_4 retain heat/warm atmosphere**;** MAX 5

Quality of Written Communication

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 7

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Topic 2: Rationale for Wildlife Conservation

1 The golden lion tamarin (*Leontopithecus rosalia*) is a small monkey living in coastal tropical rain forests in Brazil. Loss of habitat led to it becoming an endangered species. Following successful captive breeding, it is now being reintroduced into the wild.
Explain what is meant by endangered species.

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(1 mark)

1

2 Hedgerows are a prominent feature of the UK countryside and are an important habitat for wildlife.
Suggest why hedgerows are important for wildlife.

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(2 marks)

2

3 Explain the need to conserve habitats, such as meadows for:

3 (a) an ethical reason

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(1 mark)

3 (b) an aesthetic reason.

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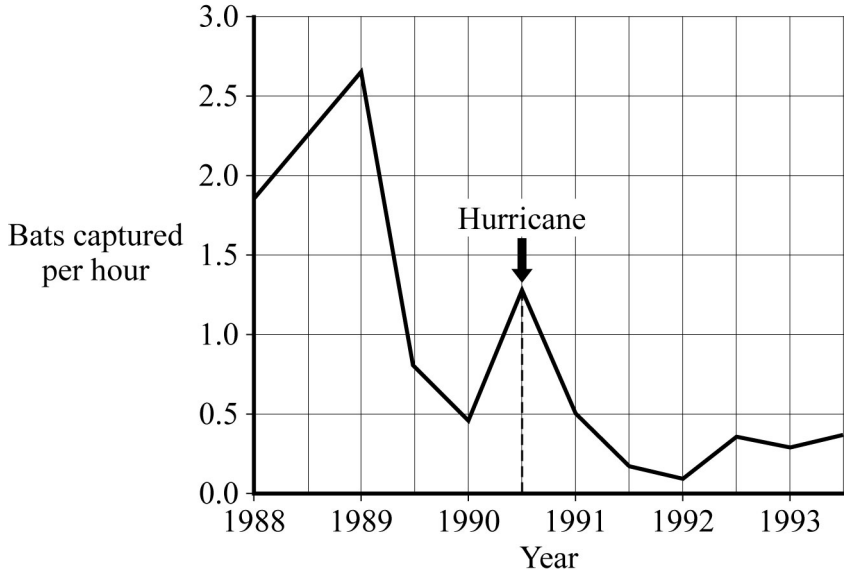
(1 mark)

2

4 The graph shows the population data for a fruit-eating bat whose habitat, the Puerto Rican Rainforest, was devastated by Hurricane Hugo in 1990.



Suggest how the bat, despite its small numbers, played a major role in the recovery of the rainforest after the hurricane.

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(2 marks)

2

5 Concern that the rate of extinction of species is increasing has prompted politicians from many countries to sign conventions in an attempt to conserve biodiversity and to maintain the gene pool.

5 (a) Explain the meaning of the terms:

5 (a) (i) *biodiversity*

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(1 mark)

5 (a) (ii) *gene pool.*

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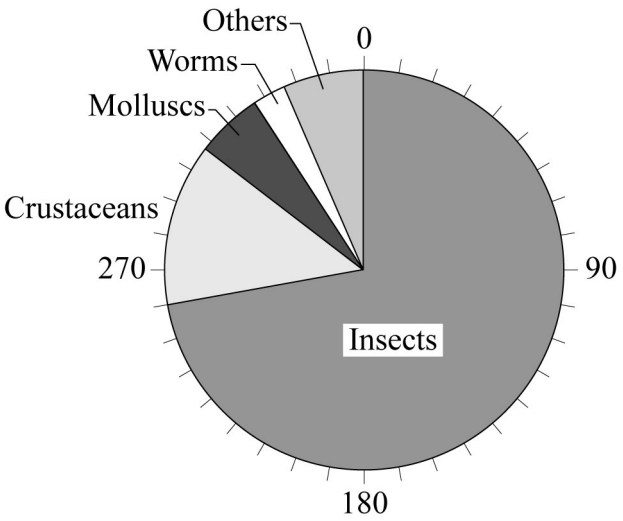
(1 mark)

5 (b) The graph shows the number of species of invertebrates (animals without backbones) known at the present time.
The total number of known invertebrate species is 1 080 000.



5 (b) (i) Use the graph to calculate the number of known species of insects.
Show your working.

Answer…… species
(1 mark)

5 (b) (ii) Suggest **three** ways by which humans may have caused the extinction of some invertebrate species.

1 .....

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2 .....

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3 .....

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(3 marks)

6

6 A community contains many different types of organisms which are interdependent.

Suggest ways in which:

6 (a) animals depend on green plants

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(2 marks)

6 (b) green plants depend on animals

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(2 marks)

6 (c) all living organisms depend on decomposers.

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(2 marks)

6

7 Using examples, discuss reasons for conserving species.

Quality of written communication will be assessed in this answer.

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(6 marks)

6

Mark scheme – Topic 2: Rationale for Wildlife Conservation

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

(Low numbers) in danger of extinction**;** 1
[**A** very rare]
[**R** threat (unqualified)]

Total marks = 1

Question 2

Food source**;**
breeding space/nesting cover/habitat qualified**;**
migration corridors**;**
shelter**;** MAX 2

Total marks = 2

Question 3

3 (a) Right to existence/stewardship/duty of care**;** 1

3 (b) Beauty/pleasure**;** 1

Total marks = 2

Question 4

Bats distribute seeds/fruit**;**
[**A** reference to pollination]
faeces increase fertility/aids tree reproduction/seed germination**;**
[**A** dead bats only with explanation] 2

Total marks = 2

Question 5

5	(a)	(i)	Measure of the number of (individuals) species/types/ variety of living organisms in a community/area**;**	1
5	(a)	(ii)	The total of all genes/alleles present in a particular population at a given time**;**	1
5	(b)	(i)	$\frac{260}{360} \times 1\,080\,000 = 780\,000$**;**	1
5	(b)	(ii)	Hunting/collecting (eg butterflies)/overfishing (eg crabs)**;** habitat destruction**;** removal of food source**;** pesticide use/elimination of pest species**;** introduction of predator/competitor**;** qualified ref to pollution**;** [**A** correct ref to climate change (anthropogenic)]	MAX 3

Total marks = 6

Question 6

6	(a)	Oxygen**;** food**;** [**A** energy] shelter/nesting sites**;** [**A** nesting materials]	MAX 2
6	(b)	Pollination**;** fruit/seed dispersal**;** removal of competitors**;** [**A** ref to carnivorous plants] [**R** ref to CO_2/fertiliser effect of excreta]	MAX 2
6	(c)	Break down/removal of dead organisms/organic matter**;** release/recycling of nutrients**;**	2

Total marks = 6

Question 7

Quality of Written Communication is assessed in this answer.

Reason and Explanation (1) Example (1)
Maintenance of atmosphere**;**
ecological balance**;**
maintenance of species diversity**;**
use of species for food**;**
use of species for medicine**;**
use of species for raw materials/industrial products**;**
ethical/right of individual to exist**;**
beauty/aesthetic reasons**;**
leisure/recreation/tourism**;**
scientific research/education**;**
benefit of indigenous people**;**
genetic research**;**
moral – duty of care for future generations**;**
(Credit relevant examples throughout – max one per marking point) MAX 4

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MAX 2

Total marks = 6

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Topic 3: How Humans Threaten Wildlife

1 The populations of many species, such as the snow leopard, have been declining in the wild.

Suggest **one** reason why snow leopard numbers have been declining in the wild.

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(1 mark)

1

2 Lowland heaths are ecosystems dominated by heather plants. Since 1800, 84% of lowland heaths in the UK have been lost due to human activity.
Suggest how human activity may have led to the decline of lowland heaths.

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(2 marks)

2

3 Suggest **three** ways by which humans may have caused the extinction of some invertebrate species.

1 .....

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2 .....

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3 .....

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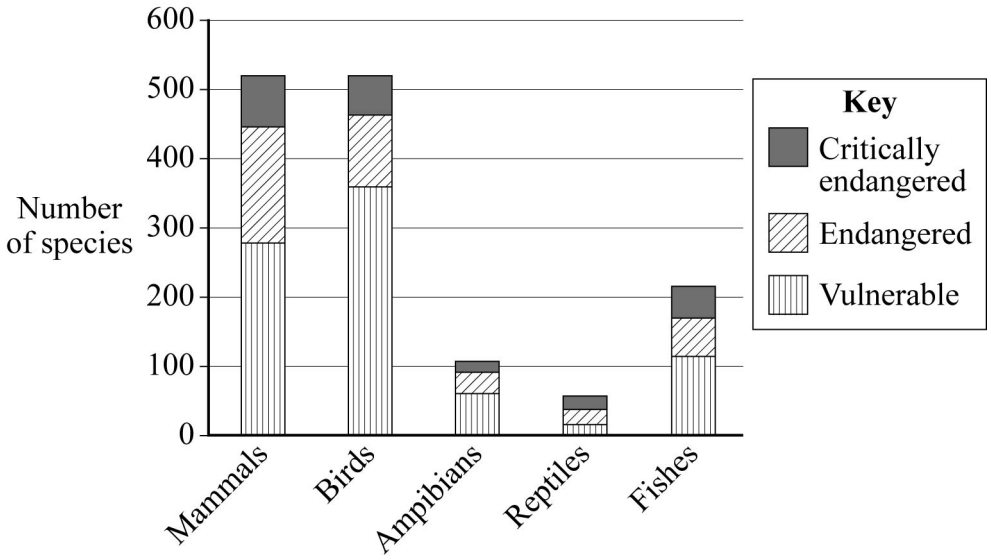
(3 marks)

3

4 The graph shows threatened animal species in Europe and Central Asia.



4 (a) Explain the difference between the terms *vulnerable* and *critically endangered* species.

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(1 mark)

4 (b) Suggest **two** ways in which bird species might become endangered.

1 .....

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2 .....

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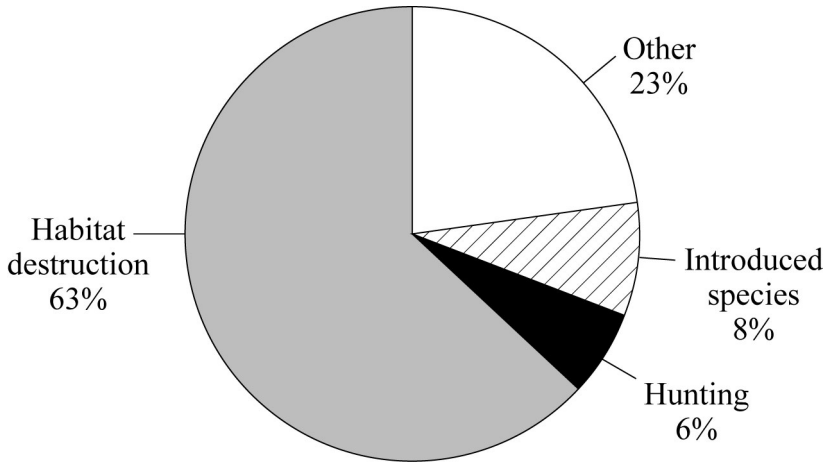
(2 marks)

3

5 The pie chart shows reasons for the decline in bird populations in the U.K.



5 (a) State **two** ways in which an 'introduced species' may reduce bird numbers.

1 .....

2 .....

(2 marks)

5 (b) Outline how habitat loss may directly affect a bird species.

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(1 mark)

5 (c) Suggest **one** reason for the 23 % bird population decline described as 'other'.

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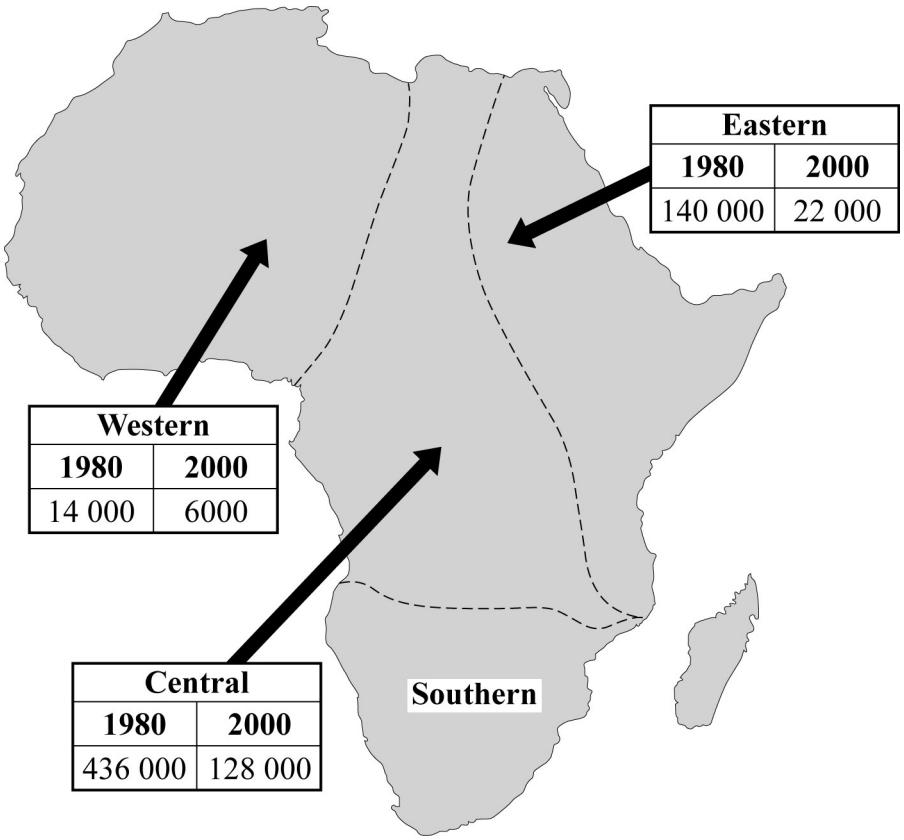
(1 mark)

4

6 The diagram shows the elephant population in three parts of Africa in 1980 and again in 2000.



6 (a) Calculate the percentage population change in elephants in three parts of Africa between 1980 and 2000.
Show your working.

6 (a) (i) Western

Answer .....

6 (a) (ii) Eastern

Answer .....

6 (a) (iii) Central

Answer .....

(3 marks)

6 (b) **Table 1** shows the human population density of parts of Africa in 1980 and 2000.

Table 1

	Approximate number of people per km^2	
	1980	**2000**
East Africa	25.1	49.2
Central Africa	6.1	12.1
West Africa	10.7	23.8

Table 2 shows the average number of days that elephants raid crops in a year.

Table 2

	Average number of days elephants raid crops each year
1981	47
2000	112

Use the data in **Tables 1** and **2** to suggest reasons for the changes in elephant numbers between 1981 and 2000.

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(3 marks)

6

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Mark scheme – Topic 3: How Humans threaten wildlife

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

Increase in predators or hunters/lack of food/no access to mates/
loss of habitat/unable to adapt to changing habitat/disease**;** 1

Total marks = 1

Question 2

Landtake for urbanisation/housing/road building/industry/development qualified**;**
use for agriculture/grazing/cleared for forestry**;**
recreational areas/golf courses/caravan sites**;**
military use**;**
[**R** trampling/pollution] MAX 2

Total marks = 2

Question 3

Hunting/collecting (eg butterflies)/overfishing (eg crabs)**;**
habitat destruction**;**
removal of food source**;**
pesticide use/elimination of pest species**;**
introduction of predator/competitor**;**
qualified ref to pollution**;**
[**A** correct ref to climate change (anthropogenic)] MAX 3

Total marks = 3

Question 4

4 (a) Vulnerable: under threat
critically endangered: is on the edge of extinction**;** 1

4 (b) Habitat destruction/reduction of territory size**;**
loss of food source**;**
direct /indirect pollution/effects of climate change**;**
over-killing/hunting/culling/pet trade/egg collecting**;**
introduction of predator**;**
disease**;** MAX 2

Total marks = 3

Question 5

5 (a) Competition for food**;**
competition for space/nesting sites**;**
predation/eat eggs**;**
toxic plants**;**
introduction of disease**;** MAX 2

5 (b) Loss of nesting space/shelter/loss of food source**;** 1
[**R** unqualified space]

5 (c) Pesticides/or other specific pollutant/disease**;**
Egg collectors/road kill/pylons**;** MAX 1

Total marks = 4

Question 6

6 (a) (i) –57.1%**;**
[**A**–57] 1

6 (a) (ii) –84.3%**;**
[**A**–84] 1

6 (a) (iii) –70.6%**;**
[**A**–71] 1

6 (b) Increase in human population**;**
habitat loss/loss of food sources/increasing farmland**;**
conflict with humans**;**
increased human population leads to increased pollution/
waste/hunting**;** MAX 3

Total marks = 6

Topic 4: Conservation Methods

1 Seed banks may be used to conserve plant species.

Give **two** disadvantages of using seed banks.

1 .....

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2 .....

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(2 marks)

2

2 Suggest **two** problems that may occur when captive breeding techniques are used to conserve and maintain genes.

1 .....

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2 .....

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(2 marks)

2

3 The southern white rhino, a sub species of the African white rhino is now classified as critically endangered. Their horns are still used to make ceremonial dagger handles. The future of the rhino depends on the development and operation of effective conservation strategies.

There are only 25 southern white rhino in the wild. Explain the significance for their survival of such a small population.

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(3 marks)

3

4 Many species of animals in captivity at the Cotswold Wildlife Park are endangered in the wild. Almost all the mammal species bred at the park were part of a worldwide captive breeding programme.

4 (a) Suggest reasons why few of these mammals will ever be released into the wild.

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(3 marks)

4 (b) Explain why captive breeding organisations worldwide keep a computer record or 'stud book' of the mating partners of the animals on their programme.

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(3 marks)

6

5 (a) (i) Describe how a programme of captive breeding may help an endangered animal species population to recover.

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(2 marks)

5 (a) (ii) Explain why seed banks cannot protect all vulnerable plant species.

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(2 marks)

4

6 (a) In order to study the effect of hedgerow management, the population of woodlice living in a hedgerow was estimated using the following method.

- Four pitfall traps were set up at 2 metre intervals and left for 24 hours.
- The woodlice that had fallen into the traps were marked with quick-drying paint and released back into their habitat.
- The next day the traps were checked again and the number of marked and unmarked woodlice were counted.

The results are shown in the table.

	Trap number			
	1	**2**	**3**	**4**
Number of woodlice marked and released	2	28	0	10
Number of marked woodlice in second catch	0	4	0	2
Number of unmarked woodlice in second catch	5	17	3	11

6 (a) (i) Use the formula to estimate the woodlouse population in the area.

Show your working.

Population estimate $\frac{\mathbf{n_1 \times n_2}}{\mathbf{n_m}}$

where $\mathbf{n_1}$ = number caught on the first occasion
$\mathbf{n_2}$ = number caught on the second occasion
$\mathbf{n_m}$ = number of marked individuals in the second catch

Answer .....

(2 marks)

6 (a) (ii) Suggest **three** reasons why it is not possible to make a reliable estimate of the woodlouse population size from these data.

1 .....

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2 .....

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3 .....

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(3 marks)

6 (b) Discuss the roles of zoos and seed banks in the conservation of endangered species.

Quality of Written Communication will be assessed in this answer.

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(8 marks)

13

Mark scheme – Topic 4: Conservation Methods

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

Reduced viability of seed/damaged by storage**;**
cannot be used by all species**;**
small gene pool**;**
no evolution/no ongoing adaptation**;** MAX 2

Total marks = 2

Question 2

Few animals available to choose from for mating**;**
gene pool is small**;**
lack hybrid vigour/risks of inbreeding**;**
failure to breed in captivity**;**
taming results in problems with release/qualified behaviour change**;**
no ongoing adaptation to environmental change**;** MAX 2

Total marks = 2

Question 3

Limited mates/small gene pool**;**
inbreeding occurs**;**
loss of heterosis vigour/genetic defects**;**
increased risk of catastrophic extinction eg diseases/fire/hunting**;** MAX 3

Total marks = 3

Question 4

4 (a) Low resistance to disease**;**
habitat lost**;**
threat still exists**;**
tame/dependant on humans**;**
unable to hunt/or gather food**;**
unable to avoid predators/poachers**;** MAX 3

4 (b) Prevent inbreeding/close related breeding;
which reduces gene pool/small gene pool**;**
leads to genetic weaknesses/reduces heterosis**;** 3
[**A** positive selection for 1 mark]

Total marks = 6

Question 5

Refuge from environmental resistance/predators**;**
chances of breeding increased**;**
release into (protected) wild habitat**;**
increase gene pool**;** MAX 2

Some species recalcitrant/damaged by storage/short term storage only**;**
cannot be used for plants that reproduce vegetatively/do not have seeds**;**
cannot be used for plants that depend upon fungal symbiants/mycorrhizas**;**
habitat may be lost during storage**;** MAX 2

Total marks = 4

Question 6

6 (a) (i) correct answer: 280 (2 marks)**;;**

correct use of data but wrong answer = (1 mark)

$$P = \frac{(40 \times 42)}{6} \textbf{ OR } \frac{1680}{6}$$ 2

[**R** $\frac{40 \times 36}{6}$/240]

6 (a) (ii) Sample too small/too few traps/not enough repeats**;**
too short a time to mix**;**
clumped distribution of animals**;**
factors affecting probability of capture/recapture**;**
birth/death of some woodlice**;**
immigration/emigration**;**
marking method affected woodlouse behaviour/
more obvious to predators**;**
mark removed by moulting**;** MAX 3

6 (b) *Quality of Written Communication is assessed in this answer.*

Zoos:
place of safety/ref to native habitat destruction/continued threat**;**
some species cannot be kept in captivity**;**
captive breeding**;**
problem of inbreeding/reference to gene pool**;**
[**R** interbreeding]
other breeding problems (lack of mates/stress)**;**
release to wild**;**
problems of release/survival in the wild**;**
role in conservation education**;**
generates revenue for conservation from visitors/
sponsorship of animals**;**
allows research in endangered species**;**
qualified research in endangered species**;** Max 4

Seed banks:
not all plant species suitable**;**
example of unsuitable species/ref to recalcitrant species**;**
take up less space than growing plants**;**
seeds dehydrated/moisture content reduced**;**
seeds cooled/frozen**;**
problems of viability/controlled germination to check
viability or get more seeds**;**
maintain (genetic) diversity for future use**;**
ref to Millennium Seed Bank/other named example**;**
reference to native habitat loss if not credited in zoos**;**
qualified research in endangered species if not
credited in zoos**;** Max 4

MAX 6

Quality of Written Communication

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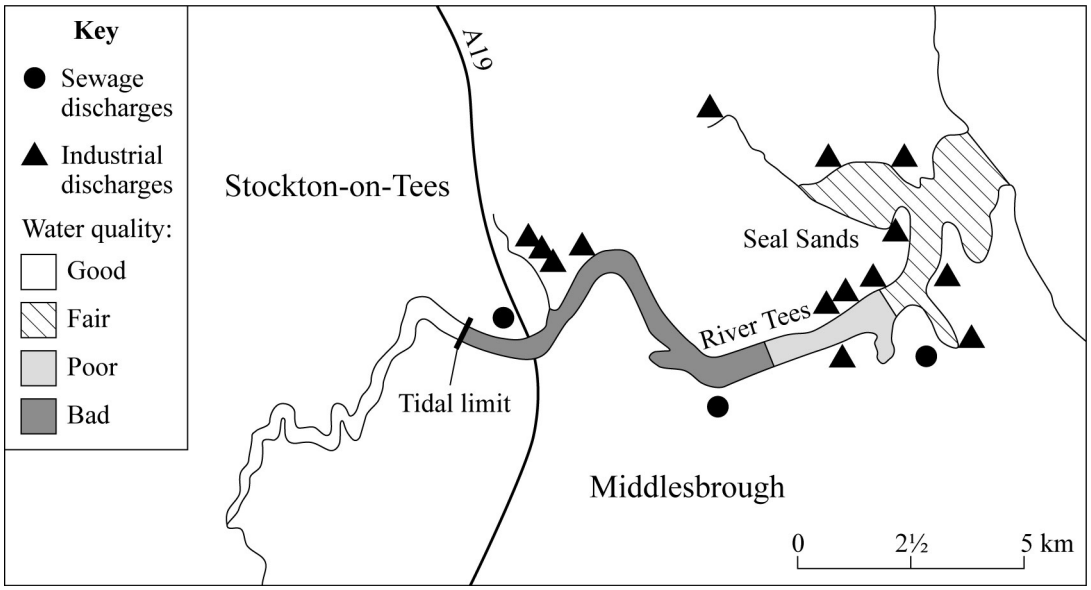
MAX 2

Total marks = 13

Topic 5: UK Conservation

1 The map shows the River Tees Estuary.



1 (a) State why an estuary such as that of the River Tees is designated a Special Protection Area (SPA).

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(1 mark)

1 (b) Seal Sands is designated as an SSSI.

1 (b) (i) What does SSSI stand for?

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.....

(1 mark)

1 (b) (ii) Name an agency responsible for designating SSSIs.

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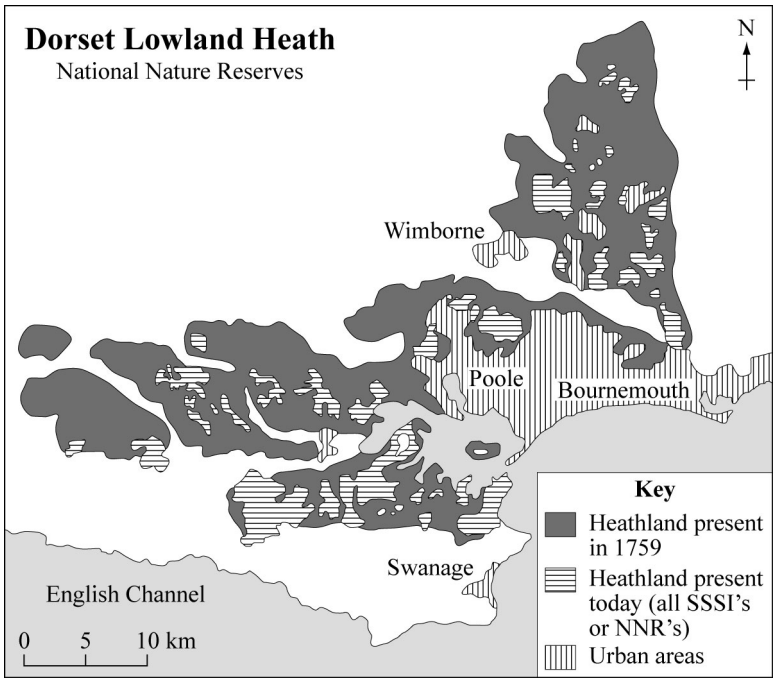
(1 mark)

3

2 The map shows changes in the area of lowland heath in Dorset.



2 (a) (i) Describe **two** changes in lowland heath distribution in Dorset since 1759.

1 .....

2 .....

(2 marks)

2 (a) (ii) Suggest **one** reason to explain the change.

.....

.....

(1 mark)

2 (b) Outline the impact of these changes on native heathland animal species.

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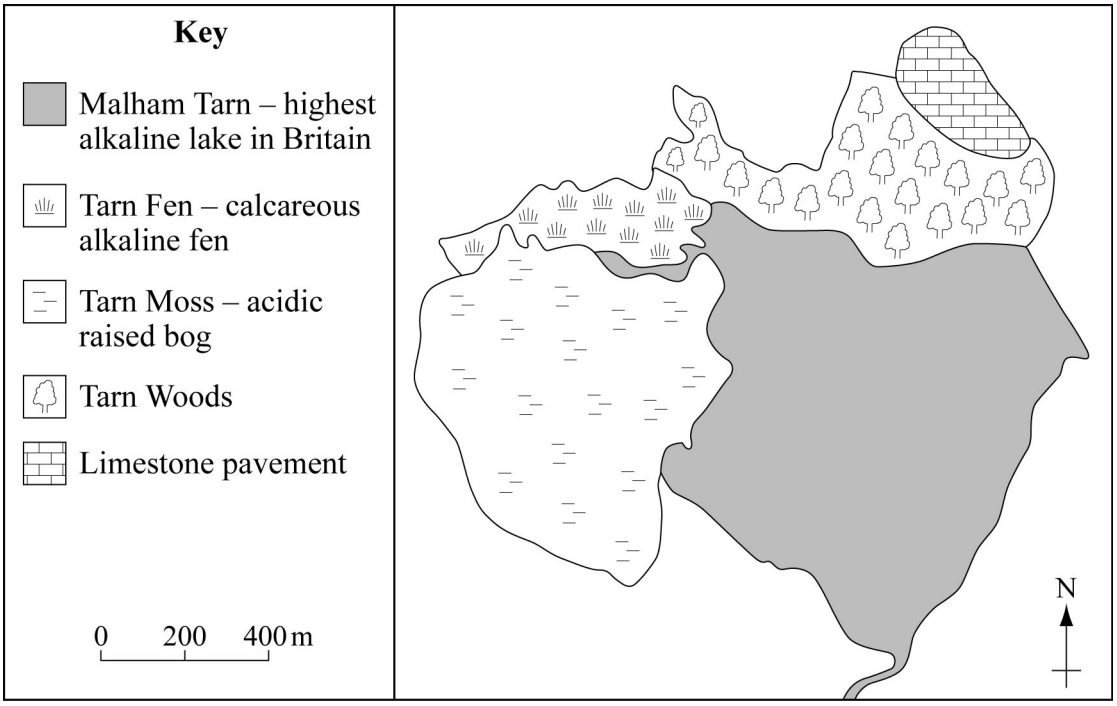
(2 marks)

5

3 The map shows Malham Tarn, a National Nature Reserve (NNR) in Yorkshire.



3 (a) Outline the major purpose of a NNR.

.....

.....

(1 mark)

3 (b) Name another statutory designation that could be used to protect the limestone pavement.

.....

.....

(1 mark)

3 (c) Malham Tarn is a Ramsar site.

Explain what is meant by a Ramsar site.

.....

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.....

.....

(2 marks)

3 (d) Suggest **one** advantage and **one** disadvantage of site designation to a landowner.

Advantage .....

.....

(1 mark)

Disadvantage .....

.....

(1 mark)

6

4 (a) Conservation of rare habitats and species relies on protection through various designations. These restrict potentially damaging operations which may endanger fragile ecosystems.

Designations

A National and Local Nature Reserves (NNR and LNR)
B Sites of Special Scientific Interest (SSSI)
C Environmentally Sensitive Areas (ESA)
D Ramsar sites
E Special Protection Areas (SPA)
F Special Areas of Conservation (SAC)

Complete the table using the letter for the appropriate designation from the list.

Description	Designation
Specially protected wetland sites for the conservation of wildfowl habitats	
Sites containing biological (rare species and habitats), geological (eg fossils) or physiographic (physical geography) features of importance	
Areas of high landscape or wildlife value which are given grants to maintain traditional farming practices	
Areas important for rare and migratory birds designated under the 1979 *'Birds Directive'* of the European Union.	

(4 marks)

4 (b) The Royal Society for the Protection of Birds (RSPB) is the largest voluntary conservation organisation in Europe. It owns and manages over 150 nature reserves in the UK, covering nearly 100 000 hectares.

4 (b) (i) Explain the main difference in funding between a voluntary organisation and a statutory (governmental) organisation.

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(2 marks)

4 (b) (ii) Name a UK government body whose major responsibility is wildlife conservation.

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(1 mark)

4 (c) Northward Hill is a National Nature Reserve (NNR) managed by the RSBP. It forms part of a proposed site for a new international airport.

4 (c) (i) Explain how an environmental pressure group, such as the RSPB, tries to prevent such developments which are detrimental to wildlife.

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(2 marks)

4 (c) (ii) Suggest why designating an area may not protect it from development.

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(1 mark)

10

5 (a) State the purpose of **each** of the following designations.

5 (a) (i) Special Area of Conservation (SAC)

.....

.....

(1 mark)

5 (a) (ii) Site of Special Scientific Interest (SSSI)

.....

.....

(1 mark)

5 (a) (iii) Special Protection Area (SPA).

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(1 mark)

5 (b) Explain why designating a site could be both an advantage and disadvantage to a landowner.

Advantage.....

.....

Disadvantage .....

.....

(2 marks)

5 (c) Outline the problems of conserving **one** UK habitat and describe the methods used to overcome these problems.

Quality of Written Communication will be assessed in this answer.

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(7 marks)

12

6 Discuss the role of named designations of areas in protecting sites of ecological importance.

Quality of Written Communication will be assessed in this answer.

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(6 marks)

6

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Mark scheme – Topic 5: UK Conservation

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

1	(a)		Recognised as an important habitat for (rare or migratory) <u>birds</u>**;**	1
1	(b)	(i)	Site of Special Scientific Interest**;**	1
1	(b)	(ii)	English Nature/Countryside Council for Wales/CCW/ Scottish National Heritage/ Department of Environment for Northern Ireland**;**	1

Total marks = 3

Question 2

2	(a)	(i)	Reduction in size**;** fragmentation/islandisation**;**	2
2	(a)	(ii)	Recreation pressure**;** agricultural changes**;** urbanisation/infrastructure**;** [**R** unqualified pop. increase, just road building]	MAX 1
2	(b)		Loss of habitat/adapted to new habitat**;** loss of species diversity**;** increased competition**;** loss of food supply**;** reduced viability of populations due to fragmentation**;**	MAX 2

Total marks = 5

Question 3

3 (a) To protect areas of natural or semi-natural vegetation/ rare habitats/rare species**;** 1
[**A** native ssp] [**R** ref to landscape]

3 (b) SSSI/limestone pavement order/SAC**;** 1

3 (c) Protected wetland habitat**;**
Of wildfowl importance/important for birds**;** 2

3 (d) Advantage**;**
Subsidy/compensation**;** 1
Disadvantage**;**
Reduced profit/reduced land use/reduced flexibility**;** 1

Total marks = 6

Question 4

4 (a)

Designation
D (Ramsar site)**;**
B (Sites of Special Scientific Interest/SSSI)**;**
C (Environmentally Sensitive Areas/ESA)**;**
E (Special Protection Areas/SPA)**;**

4

4 (b) (i) Voluntary organisations rely on membership subscriptions/ merchandising/legacies/donations**;**
statutory organisations funded by taxes (or implication)**;** 2
[**R** funded by government if unqualified]

4 (b) (ii) English Nature/Countryside Council for Wales/ Scottish Natural Heritage/ Dept of the Environment for Northern Ireland**;** 1

4 (c) (i) Political lobbying/petitions**;**
direct intervention/protests**;**
fundraising (qualified)**;**
campaigns**;**
raise public awareness/education**;** MAX 2

4 (c) (ii) Ref to development in national interest (eg military)/ overridden by government**;** 1

Total marks = 10

Question 5

5 (a) (i) SAC – protection of rare/internationally important <u>habitats</u>**;** 1
[**R** landscape]

5 (a) (ii) SSSI – conservation of rare or scientifically important species/ geological/physiographic features**;** 1

5 (a) (iii) SPA – conservation of important areas for <u>birds</u>**;** 1

5 (b) Advantage – grants/subsidies/compensation available**;**
disadvantage – restricts use/reduces profit/public access allowed**;** 2

5 (c) *Quality of Written Communication is assessed in this answer.*

Problems:
habitat loss**;**
reduction in species diversity**;**
increase in rare/endangered species/ref to possible extinctions**;**
presence of non-native competitors/increase in competition**;**
named human activity (e.g. spray drift from agriculture/ trampling/fires)**;**
correct reference to natural change (e.g. succession/erosion/ flooding)**;**
pollution <u>qualified</u>**;**
[**R** littering]
lack of funding for conservation**;** Max 3

Solutions:
legal protection/designations/named designation**;**
restricted access areas/visitor management**;**
habitat restoration/reduction in agrochemical use/ reduction in other named damaging operation**;**
habitat management eg drainage/coppicing/burning/ grazing/mowing**;**
management of succession**;**
removal of invasive species/biological control**;**
raising public awareness/education**;** Max 3

raising money <u>for conservation</u>/giving grants for conservation; MAX 5

[**A** extra expansion or relevant examples for additional marks for each problem or solution]

Quality of Written Communication

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 12

Question 6

Quality of Written Communication is assessed in this answer.

Name (1 mark)	Role (1 mark)
NNR	[**A** Local NR] to protect, restore and enhance semi or natural vegetation
SSSI	protects most important habitats and their plant and animal species (together with geological and geomorphological sites)
ESA	areas receive grants to allow them to be farmed in environmentally friendly way – to maintain or improve environment
RAMSAR	wetlands protected as waterfowl habitat
SPA	for protection of habitats important for rare and migratory birds
SAC	to ensure biodiversity through protection of natural habitats and wild Fauna and flora

MAX 4

Quality of Written Communication

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 6

Topic 6: Conservation Abroad

1 (a) Coral reefs are delicate ecosystems which are threatened by many human activities.

Explain how rising sea temperatures may increase the productivity of a coral reef.

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(2 marks)

1 (b) Suggest **three** ways in which tourism may affect a coral reef ecosystem.

1 .....

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2 .....

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3 .....

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(3 marks)

5

2 (a) The diagram shows a vertical section through an area of tropical rain forest in Brazil.

Suggest why:

2 (a) (i) the concentration of carbon dioxide over a 24 hour period is greater at point **B** than at point **A;**

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(2 marks)

2 (a) (ii) there is little vegetation at ground level in a tropical rain forest.

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(1 mark)

2 (b) Cutting down tropical rain forests will reduce the diversity of animals

Suggest why this may lead to a reduction in plant species diversity.

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(2 marks)

2 (c) The table shows the mean annual Net Primary Productivity (NPP) for a tropical rain forest ecosystem compared with the temperate grassland ecosystem.

Ecosystem	**Mean annual NPP / kg m^{-2} yr^{-1}**
Tropical rain forest	2.20
Temperate grassland	0.60

2 (c) (i) Explain what is meant by *Net Primary Productivity*.

.....

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(1 mark)

2 (c) (ii) Explain why the Net Primary Productivity of tropical rain forests is much higher than that of temperate grassland.

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(4 marks)

10

3 Rain forests are the richest, most productive and most complex ecosystems on Earth yet they cover less than 2 % of the Earth's surface. They are currently being destroyed at the rate of 2 football fields per second. If forest clearance continues at the current rate, scientists estimate that nearly all tropical forest ecosystems will be destroyed by 2030.

3 (a) Describe **three** activities which result in the loss of tropical rain forest.

1.....

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2.....

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3.....

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(3 marks)

3 (b) Outline the reasons why tropical rain forests should be conserved.

Quality of Written Communication will be assessed in this answer.

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(7 marks)

10

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Mark scheme – Topic 6: Conservation Abroad

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1 (a) Increased enzyme activity/metabolic activity/decomposition**;** 1
increased rate of photosynthesis/growth/availability of nutrients**;** 1

1 (b) Oil/diesel/petrol pollution from boats;
[**R** 'pollution' unqualified]
increased sewage/litter/noise/qualified disturbance from tourists**;**
physical damage from boats/damage or removal by tourists**;**
increased revenue for conservation**;** MAX 3

Total marks = 5

Question 2

2 (a) (i) Point **B** has less photosynthesis**;**
less CO_2 removed from atmosphere**;**
[**A** converse]
OR
more decomposition at point **B**/ground level**;**
more CO_2 produced**;** 2
[**R** ref. to wind/CO_2 being trapped]

2 (a) (ii) Insufficient light (for photosynthesis); 1

2 (b) Less pollination**;**
less seed/fruit dispersal**;**
less detritivore activity/decomposition/nutrient cycling/
faeces provide nutrients**;** MAX 2

2 (c) (i) Total organic molecules synthesised by green plants less that used in respiration/NPP = GPP-R**;** 1
[**A** energy available to 1° consumer/herbivore]

2 (c) (ii) Greater light intensity in tropics**;**
no water shortage in TRF**;**
biomass of TRF greater/stratified/dense vegetation/
high species diversity**;**
warmer temperatures in tropics**;**
increased rate of photosynthesis/growth/enzyme activity**;**
longer growing season in tropics/no seasonal growth/
growth all year**;**
faster recycling of nutrients/decomposition**;** MAX 4
[**R** more nutrients]

Total marks = 10

Question 3

3 (a) Logging/timber trade fuelwood**;**
agriculture/crops/subsistence farming**;**
plantations/cash crops**;**
cattle ranching**;**
cleared for road building/transport**;**
mining/quarrying/oil extraction**;**
HEP**;**
cleared for urbanisation /resettlement/housing**;**
forest (ie natural) fires**;**
[**A** infrastructure]
[**R** development/deforestation/construction/
flooding(if unqualified)/flooding] MAX 3

3 (b) *Quality of Written Communication is assessed in this answer.*

High biodiversity/rare species/prevents extinction of endangered species**;**
(economic benefits) - food source (for man)**;**
medicines**;**
industrial products**;**
timber**;**
ecological stability/no disruption to food chains/web**;**
maintain gene pool/genetic diversity/genetic resource**;**
regulation of atmospheric gases/CO_2:O_2 balance/produces O_2/
reduces CO_2**;**
prevention of global climate change/global warming/
temperature increase**;**
regulation of water cycle**;**
prevention of soil erosion/mud slides**;**
ref. to indigenous people**;**
ref. to ecotourism**;**
aesthetic/beauty/pleasure**;**
scientific research/education (other than linked to medicines)**;**
stewardship/moral/ethical**;** MAX 5

Quality of Written Communication

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 10

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Topic 7: Adaptation to the Environment

1 (a) Explain what is meant by an abiotic factor.

.....

.....

(1 mark)

1 (b) Use an example to explain how an *abiotic factor* exerts a density-independent effect on a population.

Example .....

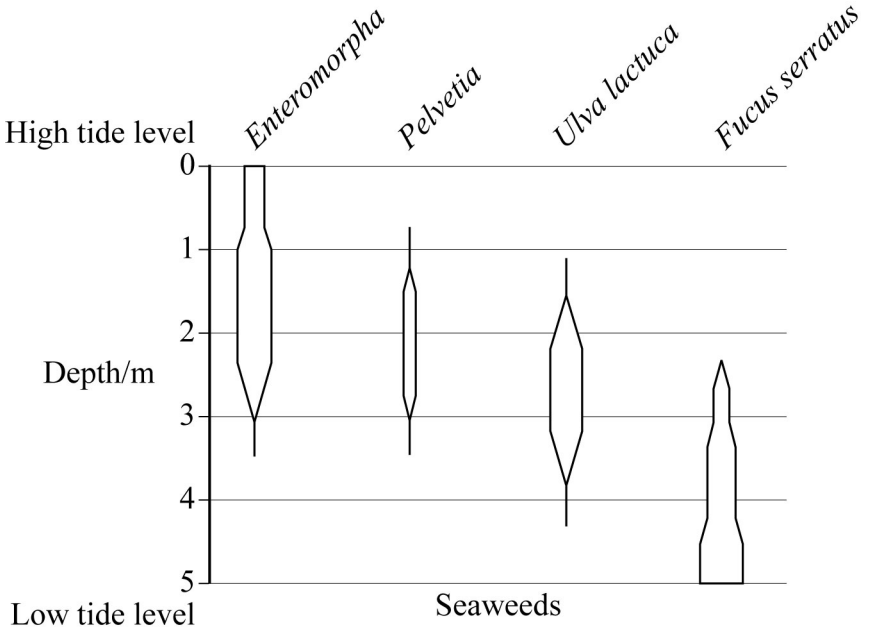
Effect .....

.....

(2 marks)

3

2 In ecosystems, species distribution may be controlled by many factors. The diagram shows the distribution of four species of seaweeds on a rocky shore. The width of the column shows species frequency.



2 (a) Explain why the diagram shows the zonation of seaweeds and not evidence of succession.

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(2 marks)

2 (b) Give the main abiotic factor which controls seaweed distribution on a rocky shore.

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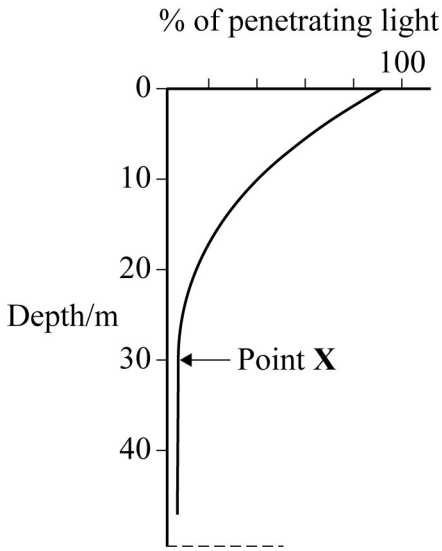
(1 mark)

3

3 The diagram shows the percentage of light penetrating water at different depths.



3 (a) Using the information in the graph explain why phytoplankton do not grow below point **X.**

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(2 marks)

3 (b) Red light is easily absorbed by water. Suggest why deep water seaweeds usually have red photosynthetic pigments.

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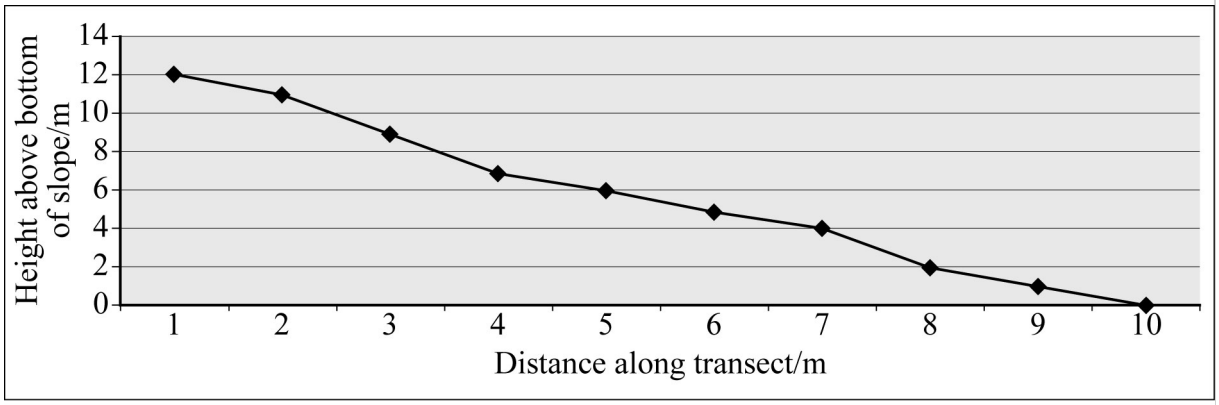
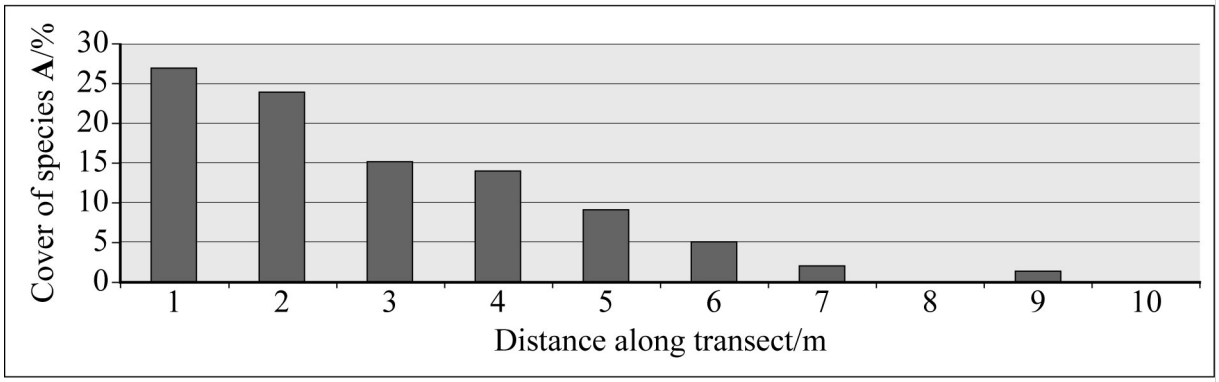
(2 marks)

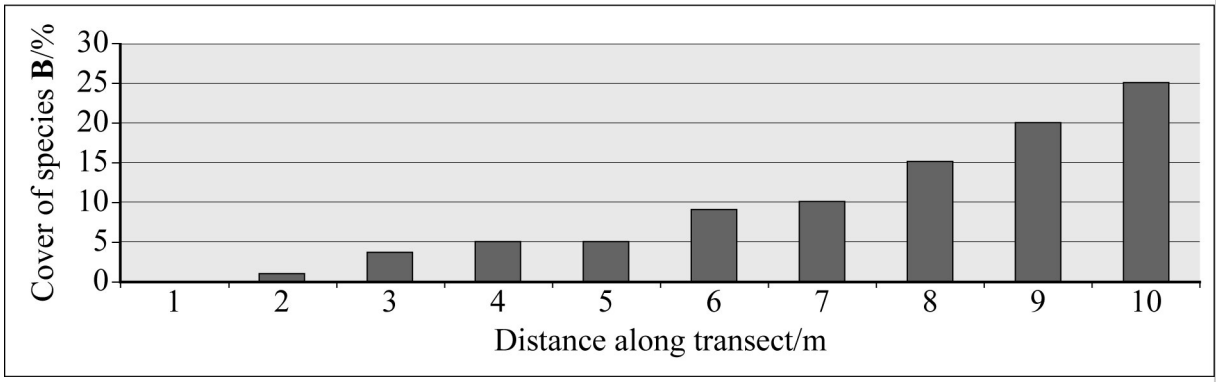
4

4 A student used a belt transect to investigate the distribution of two plant species down a slope. In each quadrat, the student recorded the percentage cover of each species and used these results to calculate the species frequency.

The diagram shows the results of the investigation.







4 (a) A factor possibly affecting the distribution of these two species is light intensity. Explain how light intensity is measured.

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(2 marks)

4 (b) Suggest **two** other factors influencing the distribution of Species **A** and **B**.

1 .....

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2 .....

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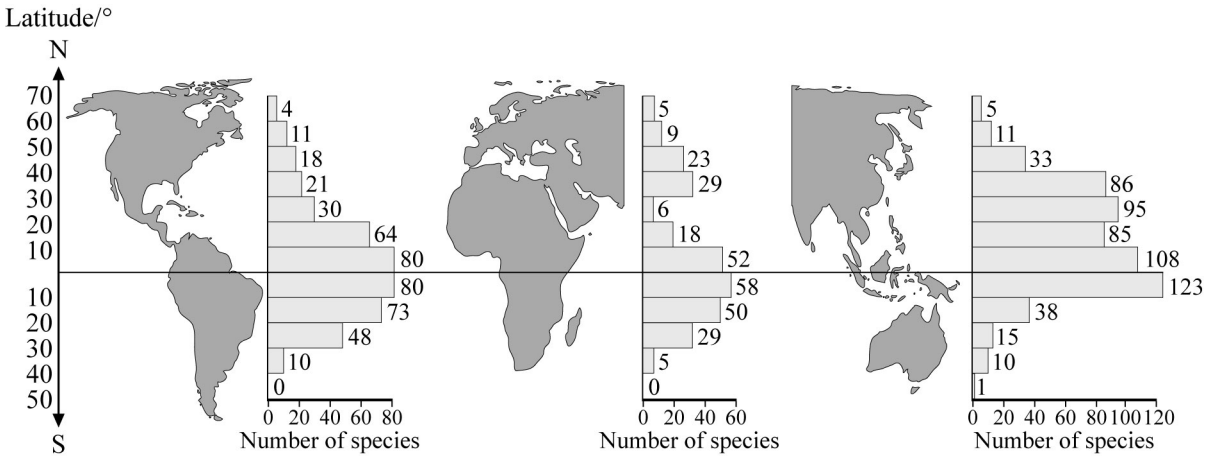
(2 marks)

4

5 The map shows the distribution of different species of Swallowtail butterflies.



5 (a) Describe the distribution by latitude shown by the species of Swallowtail butterflies.

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(2 marks)

5 (b) Suggest **two** reasons which may account for this pattern.

1 .....

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2 .....

.....

(2 marks)

4

6 Scientists carried out a survey of some upland streams in different parts of the UK.

Some of the results are shown in the table.

Stream	pH of stream water	Number of animal species	Number of plant species
1	4.0	5	4
2	7.1	22	19
3	4.4	11	6
4	6.5	20	13
5	5.7	16	9

6 (a) Describe the relationship between the pH of the streams and the number of animal species.

.....

.....

(1 mark)

6 (b) Suggest why stream **2** has the greatest number of plant species.

.....

.....

(1 mark)

6 (c) Which stream would you expect to be the least stable ecosystem?

Explain your answer.

Stream .....

Explanation .....

.....

.....

(3 marks)

6 (d) Outline a method which could be used to measure accurately the pH of the stream water.

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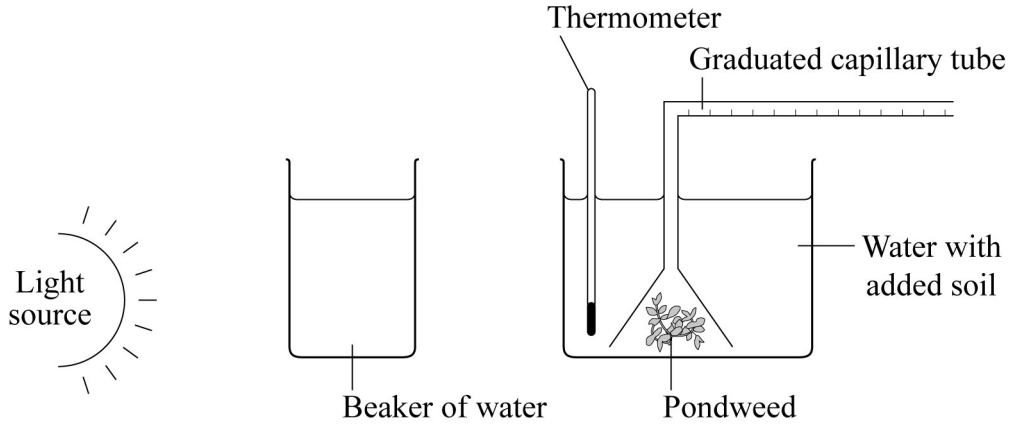
(2 marks)

7

7 As a result of poor farming practices, eroded soil was deposited in a small stream causing the water to become very cloudy.

A student decided to investigate the effect of this increased turbidity on the growth of water plants by measuring the rate of photosynthesis of pondweed in water with different quantities of soil added.

The diagram shows the equipment that the student used.



7 (a) (i) Explain the purpose of the beaker of water.

.....

.....

(1 mark)

7 (a) (ii) What is the main gas that would be collected in the graduated capillary tube?

.....

(1 mark)

7 (a) (iii) Suggest **one** reason why the amount of gas collected would not represent the total amount produced by the pondweed.

.....

.....

(1 mark)

7 (b) State **three** precautions which the student should have taken to ensure a fair test.

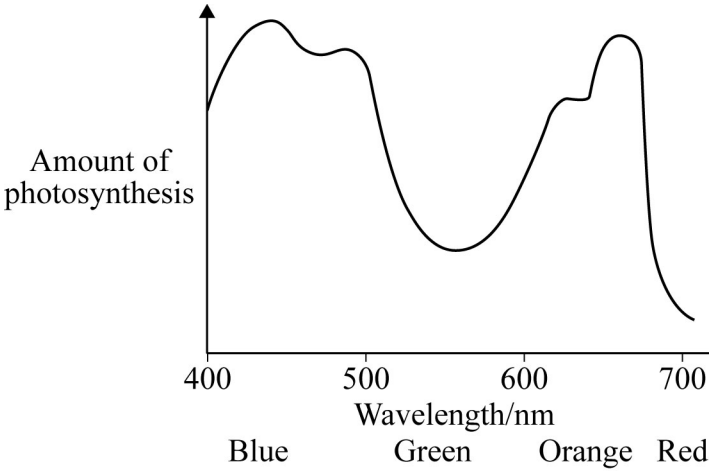
1 .....

2 .....

3 .....

(3 marks)

7 (c) The graph shows the effect of different colours of light on the rate of photosynthesis.



7 (c) (i) Use the graph to state and explain which colours of light are most used for photosynthesis.

Colours.....

Explanation.....

.....

(2 marks)

7 (c) (ii) Suggest what happens to the light reaching the leaf that is not used for photosynthesis.

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(2 marks)

10

Mark scheme – Topic 7: Adaptation to the Environment

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

1	(a)	Non-living/physical/chemical part of environment**;**	1
1	**(**b)	Appropriate example (eg flooding/fire/temperature/rainfall/other suitable factor)**;** specific density independent effect explained**;** [**R** unqualified pollution]	2

Total marks = 3

Question 2

2	(a)	Succession – time/change in one place**;** zonation – spatial/change along an environmental gradient**;**	2
2	(b)	Water coverage/exposure*;*	1

Total marks = 3

Question 3

3	(a)	At **X** little light available**;** photosynthesis cannot take place efficiently/is reduced**;**	2
3	(b)	Red light would not reach deep sea water/other wavelengths penetrate**;** red pigments are able to absorb other wavelengths (for energy)**;** blue end/shorter wavelengths absorbed**;**	MAX 2

Total marks = 4

Question 4

4 (a) Suitable apparatus used – light meter/electronic probe**;**
readings at constant height above ground level/reference to calibration/
repeats/readings at each site**;** 2

4 (b) Difference in soil moisture**;**
[**R** rainfall]
difference in exposure/shading/temperature**;**
difference in soil depth**;**
competition/grazing pressure**;**
variation in nutrient availability/organic matter**;**
pH/salinity**;** MAX 2
[**R** altitude/wind/aspect/steepness]

Total marks = 4

Question 5

5 (a) Number of <u>species</u> greater at equator/in tropics/
correct reference to low latitudes**;**
diversity decrease towards polar regions/
fewer in southern hemisphere**;** 2

5 (b) Greater vegetation at equator/more food**;**
narrow temperature range/stable climatic conditions/
no pronounced seasons around equator**;**
less land area in southern hemisphere**;**
more habitat removal in northern hemisphere**;** MAX 2

Total marks = 4

Question 6

6 (a) Low pH/acidic streams have smaller number of animal species (or converse)**;** 1
[**A** positive correlation]

6 (b) Neutral pH**;** 1
[**R** 'highest pH' unless qualified]

6 (c) Stream **1;** (1)

Explanation
(very) acidic/(very) low pH**;**
lowest number of organisms/lowest (bio)diversity/lowest number of plant species**;**
few nutrients available to plants (at low pH)**;**
plants support fewer animal species/less food for animals/ few producers to establish food chains**;**
fewer alternative food sources if food becomes scarce/greater risk of food chain disruption**;** Max 2 MAX 3
[**R** reference to gene pool]

6 (d) use of electronic probe/pH meter/universal indicator**;**
[**R** litmus paper]
details of use (eg controls/repeats/means/calibration/ comparison with colour standards etc)**;** 2

Total marks = 7

Question 7

7	(a)	(i)	Absorb heat/resist change in temperature**;**	1
7	(a)	(ii)	Oxygen/O_2**;**	1
7	(a)	(iii)	Dissolves in water/trapped in leaves/not collected in funnel/ Sticks to glassware/used by plant (in respiration)**;** [**R** used in photosynthesis]	1
7	(b)		Use equal mass/size of pondweed**;** equal distance from light source/light intensity**;** [**A** same wavelength] same time period**;** same water temperature**;** ensure all bubbles move into tube**;** stir water soil solution**;** allow time for pondweed to adjust at start**;** [**A** same amount of CO_2] [**A** same volume of water] [**R** same equipment/soil type]	MAX 3
7	(c)	(i)	(Red)/orange <u>and blue</u>; (both needed) greatest amount of photosynthesis (when these absorbed)**;**	2
7	(c)	(ii)	Reflected from leaf**;** used to evaporate water**;** falls on non-photosynthetic structures**;** passes through leaf/transmission**;** converted to heat**;**	MAX 2

Total marks = 10

Topic 8: Grouping Organisms

1 What is an ecosystem?

.....

.....

(1 mark)

1

2 Explain what is meant by the term *biome.*

.....

.....

.....

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(2 marks)

2

3 (a) Complete the table.

Term	Definition
	A large area dominated by a major vegetation type associated with a specific climate and/or soil
Population	
	A community of organisms interacting with its abiotic environment

(3 marks)

3 (b) What is the difference between habitat and niche?

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(2 marks)

5

4 (a) In some parts of the country, the population of red squirrels is stable or even increasing. This is because the red squirrels are exploiting a different ecological niche from grey squirrels.

Explain the significance of the *different ecological niche*.

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(2 marks)

4 (b) Describe the methods used for the conservation of endangered animals species.

Quality of Written Communication will be assessed in this answer.

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(6 marks)

8

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Mark scheme – Topic 8: Grouping Organisms

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1 Community of living organisms interdependent with their abiotic environment**;** 1
(needs both components)

Total marks = 1

Question 2

2 Large zones of distinctive vegetation type**;**
Largely determined by climate/latitude**;** 2

Total marks = 2

Question 3

3 (a) Biome**;**
number of organisms of the same species within a given area**;**
ecosystem**;** 3

3 (b) Habitat: the place where an organism lives**;**
Niche: the role of an organism in the community/habitat/ecosystem**;** 2

Total marks = 5

Question 4

4 (a) Enables exploitation of different food source/resource/named resource/ concept of niche separation explained**;**
reduces competition/allows co-existence**;** 2

4 (b) *Quality of Written Communication is assessed in this answer*

Breeding in captivity**;**
release into wild/repopulation**;**
legal protection/banning to prevent killing/hunting/collecting/ habitat change**;**
trade controls/CITES/international agreements**;**
in situ conservation/nature reserves/SPA's/SSSI's/SAC's**;**
[**R** UK National Park]
[A ref to National Parks/game reserves abroad]
qualified habitat management (eg nest boxes/supplementary food)/ qualified habitat creation**;**
methods to increase breeding success (spermbanks/ artificial insemination/frozen embryos)**;;**
education/raise public awareness**;**
remove/cull competitors/predators**;** MAX 4

Quality of Written Communication

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
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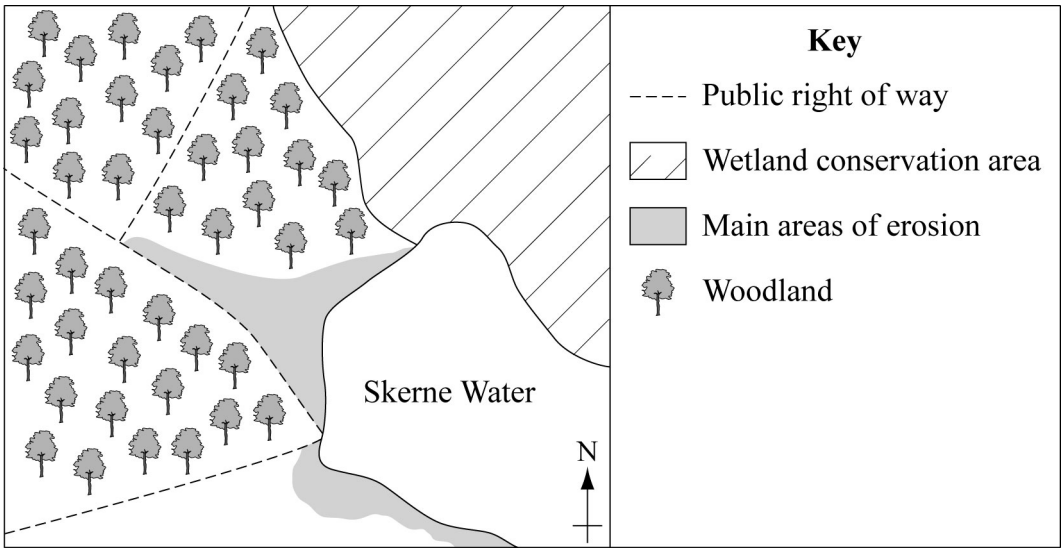
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 8

Topic 9: Changes in Ecosystems

1 Middleham in the north east of England is privately owned land that has been designated as a Site of Special Scientific Interest (SSSI). The diagram shows part of the SSSI.



1 (a) At Middleham, over a period of time, the open water may develop into a wetland area and then into a woodland community. Name this process.

.....

(1 mark)

1 (b) Fenced off areas of erosion are now regenerating naturally. Name this process.

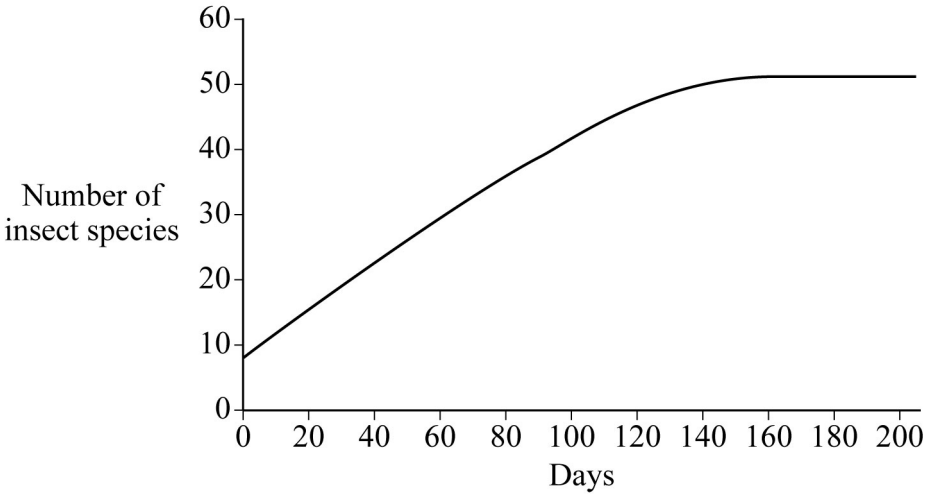
.....

(1 mark)

2

2 In an experiment, an area of grassland, grazed by sheep for hundreds of years, was cleared of sheep. After this clearance, the number of insect species found in the area was estimated every 20 days.

The graph shows the number of insect species present in the area over a period of 200 days.



2 (a) Describe the trends in the number of insect species shown in the graph.

.....

.....

.....

.....

(2 marks)

2 (b) Suggest a reason for the trend in the number of insect species:

2 (b) (i) up to 140 days .....

.....

(1 mark)

2 (b) (ii) from day 140. .....

.....

(1 mark)

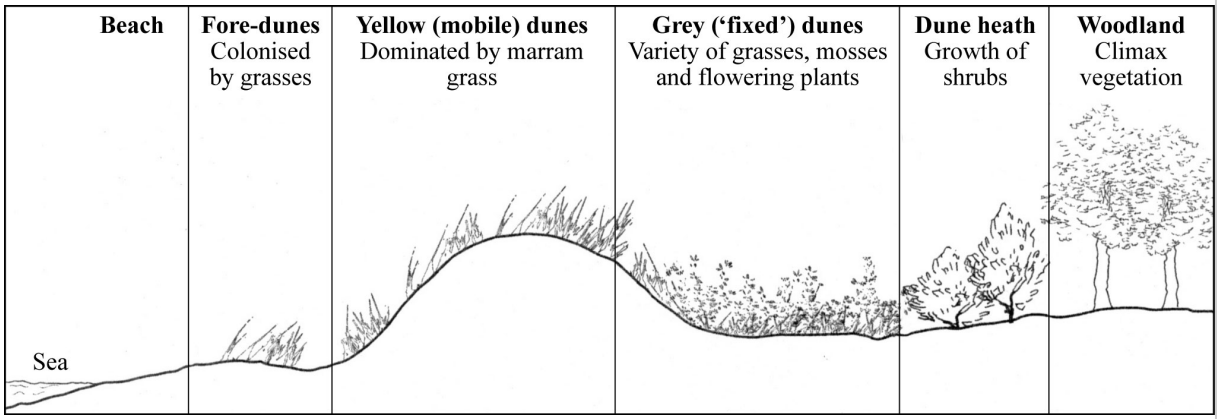
2 (c) Grazed grassland is an example of a deflected succession. What term describes the changes in community structure that occurred with time after the removal of the sheep?

.....

(1 mark)

5

3 The diagram shows zones which exhibit the typical stages of succession for a sand dune ecosystem.



3 (a) Explain what is meant by primary succession.

.....

.....

(2 marks)

3 (b) Explain how successional changes make tree growth possible.

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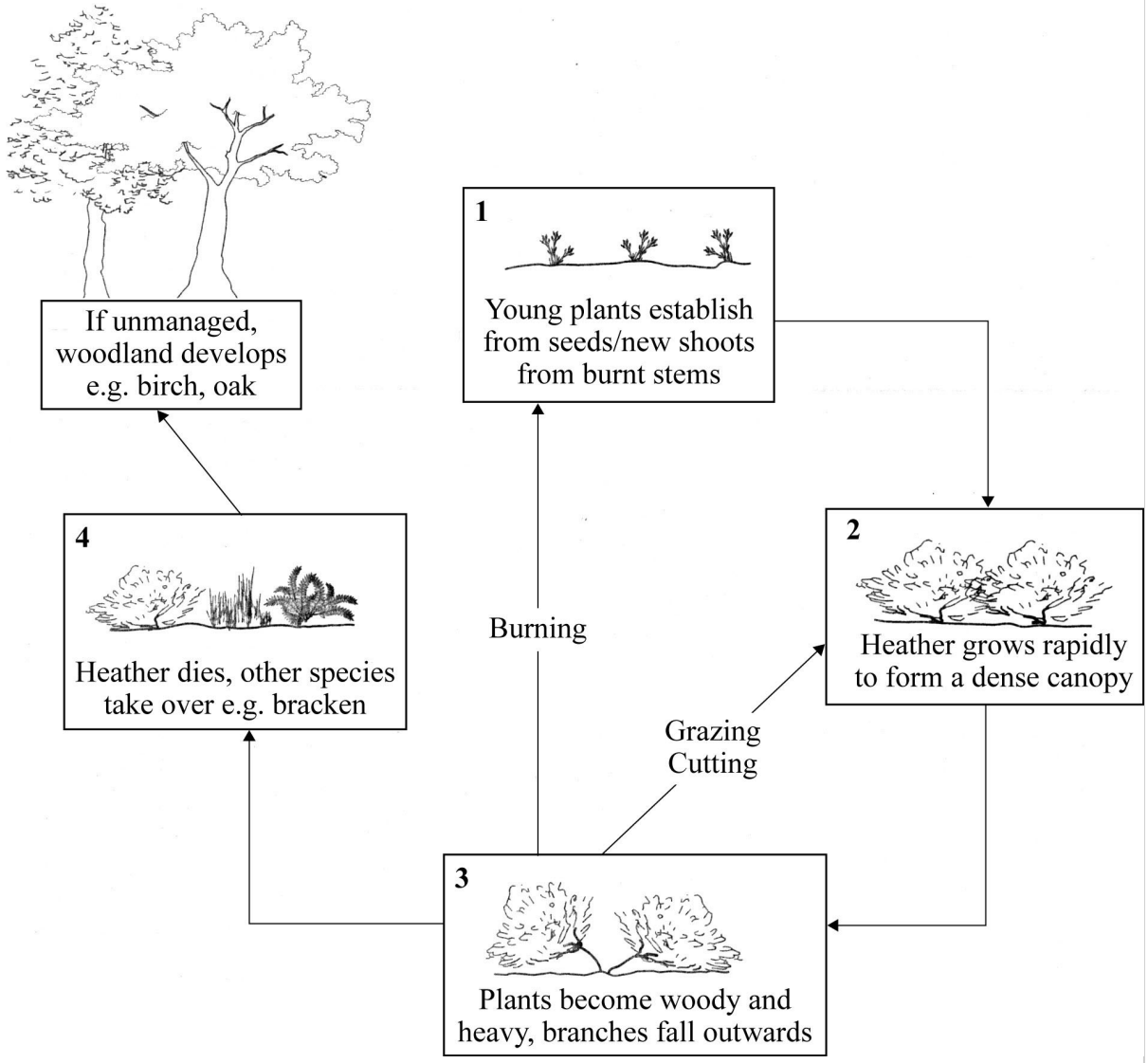
(3 marks)

5

4 Lowland heaths are ecosystems dominated by heather plants. Since 1800, 84% of lowland heaths in the UK have been lost due to human activity.

Heather has a life cycle divided into four stages. The diagram shows how the heather cycle is managed.



4 (a) What term describes:

4 (a) (i) the final stage in succession where mature oak woodland is established

.....

(1 marks)

4 (a) (ii) the heathland community maintained by grazing, cutting or burning?

.....

(1 mark)

4 (b) In areas where heather is managed for sheep grazing, it is burnt every few years to encourage new growth.

4 (b) (i) Suggest why the burning of heather may increase the food available to the sheep.

.....

.....

(1 mark)

4 (b) (ii) After burning, the heath regenerates in a process called secondary succession. Suggest why secondary succession results in the rapid re-establishment of plant and animal populations.

.....

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(3 marks)

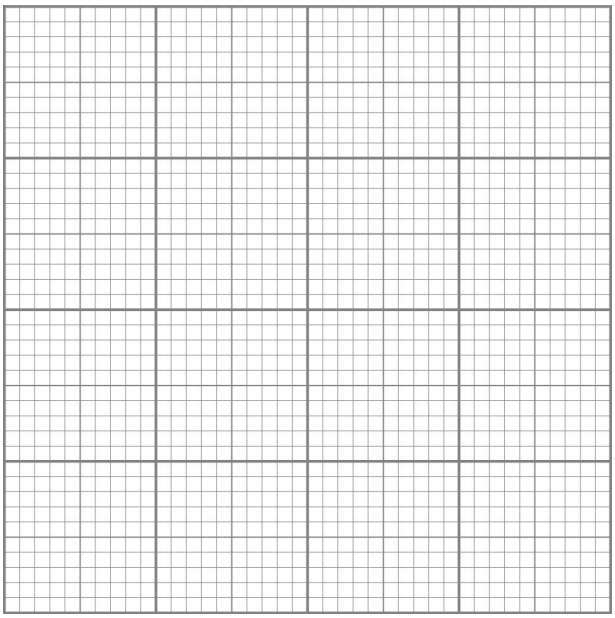
6

5 Sand dunes of different ages have different soil characteristics.

5 (a) The table shows the percentage of organic matter present in the soils of dunes of different ages.

Age of dune/years	Organic matter/%
100	5
150	7
200	9
250	12
300	12

5 (a) (i) Plot the information in the table on a graph using the grid.



(2 marks)

5 (a) (ii) Explain how biotic factors lead to the differences in organic matter content between the young and the old dunes.

.....

.....

.....

.....

(2 marks)

5 (b) Deflected succession has occurred on the 300-year-old dune.

5 (b) (i) State what is meant by *deflected succession*.

.....

.....

(1 mark)

5 (b) (ii) Suggest a cause of deflected succession of a sand dune.

.....

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(1 mark)

5 (c) State the process that would occur if the cause of deflected succession was removed.

.....

.....

(1 mark)

7

6 About 10 000 years ago the glaciers that had covered much of Britain began melting and retreating. The table shows the changes in vegetation over time in the glaciated valleys.

Approximate time from retreat of glacier/years	Vegetation
0 – 4	Bare rock with lichens
5	Mosses and short grasses
25	Taller grasses and hardy flowering plants
100 – 200	Dense growth of shrubs
300 – 500	Shrubs and small trees such as birch
2000	Developing mixed forest
5000 – 10 000	Mature forest

6 (a) (i) What name is given to this type of vegetation change?

.....

(1 mark)

6 (a) (ii) Give **one** other example of a situation where vegetation change occurs in a previously unvegetated area.

.....

(1 mark)

6 (b) What term can be used to describe:

6 (b) (i) the plants establishing in years 0 – 4

.....

(1 mark)

6 (b) (ii) the community that is developing between 5000 and 10 000 years?

.....

(1 mark)

6 (c) Explain how these changes in vegetation have taken place.

.....

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(4 marks)

6 (d) Under what circumstances would you expect further changes in the species composition of the mature forest to occur?

Explain your answer.

.....

.....

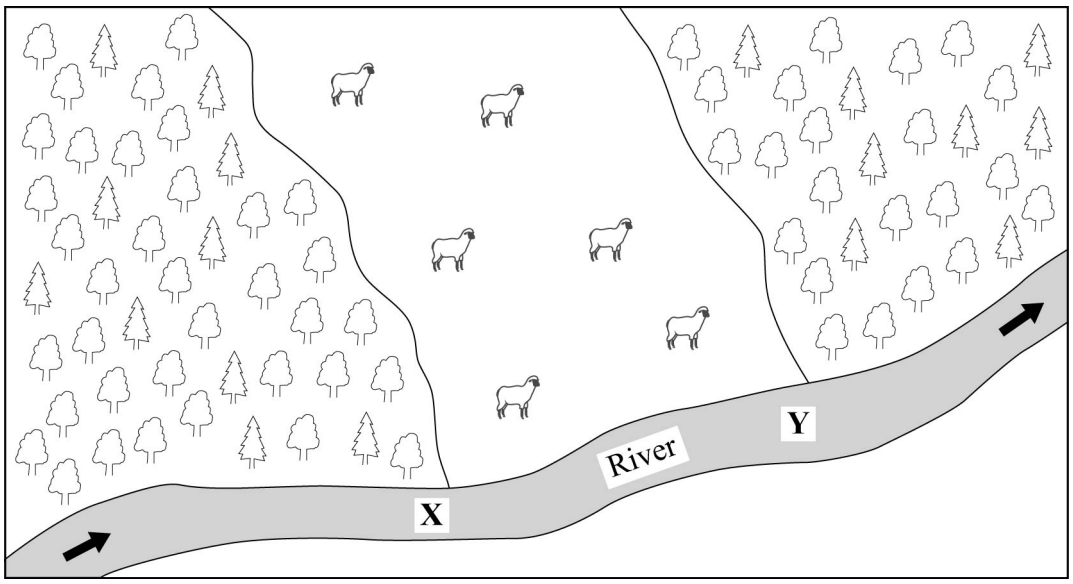
.....

.....

(2 marks)

10

7 The diagram shows an area of climax community woodland next to a river. Part of the woodland has been cleared recently and is now used for grazing sheep.



Describe and explain the abiotic and biotic changes which will take place if the sheep are removed from the cleared land.
Quality of Written Communication will be assessed in this answer

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(7 marks)

7

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Mark scheme – Topic 9: Changes in Ecosystems

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

1 (a) Primary succession**;** 1

1 (b) Secondary succession; 1

Total marks = 3

Question 2

2 (a) (Steady) increase in numbers until day 140/50 species**;**
rate of increase slows down/plateau reached after 140 days/
50 species**;** 2

2 (b) (i) More niches/habitats available/more (types) of food available/
habitat more complex in structure/
less competition from sheep**;** 1
[**R** decreased predation/disease/increased reproduction/
density development factors]

2 (b) (ii) all niches occupied/increased competition for resources/
removal of arresting factor**;** 1
[**R** ref to carrying capacity/environmental resistance/
birth rate = death rate]

2 (c) Secondary succession**;** 1

Total marks = 5

Question 3

3 (a) Change/development of vegetation/species (over time/at one site)**;**
where no vegetation has grown previously**;** 2

3 (b) Vegetation binds/stabilises sand**;**
increased humus/organic content of soil/nutrient content/fertility**;**
soil is created/soil depth increases/structure improves**;**
increased water holding capacity of soil/increased soil moisture**;**
vegetation changes pH/salinity of soil decreases**;** MAX 3

Total marks = 5

Question 4

4	(a)	(i)	Climax (community)	1
4	(a)	(ii)	Deflected succession/plagioclimax/biotic climax/sub climax**;**	1
4	(b)	(i)	New growth more nutritious/easier to eat/allows grass to grow/ woody shrubs/trees harder to eat**;**	1
4	(b)	(ii)	(Fertile) soil already present**;** ash provides nutrients**;** soil contains seeds/spores**;** roots not damaged**;** animals can migrate in (from surrounding areas)/survival of burrowing animals**;**	MAX 3

Total marks = 6

Question 5

5	(a)	(i)	Correct axis and labelled with units**;** 5 correct plots;	1 1
5	(a)	(ii)	Increase in organisms/biomass**;** (increase in organic matter)**;** decomposition**;**	MAX 2
5	(b)	(i)	Natural progression of plant communities interrupted/climax community not reached**;**	1
5	(b)	(ii)	Human recreation**;** climate change**;** rise in sea level/flooding**;** grazing/mowing**;** burning**;** conservation management**;**	MAX 1
5	(c)		Secondary succession**;**	1

Total marks = 7

Question 6

6 (a) (i) Primary succession/lithosere**;** 1

6 (a) (ii) sand dune/salt marsh/volcanic lava flow/newly erupted volcanic island/landslip/drying lake bed/ other suitable example**;** 1
[**A** gravestone]
[**A** names of seres (psammosere/xerosere/halosere/hydrosere)]
[**R** 'rock'/mountains]

6 (b) (i) Pioneers/pioneer community/colonisers**;** 1

6 (b) (ii) Climax (community)**;** 1
[**R** plagioclimax/deflected climax]

6 (c) Formation of soil**;**
increase in organic matter/leaf litter/humus**;**
increase in nutrients/soil fertility**;**
increase in moisture retention**;**
increase in soil depth**;**
roots/plants bind soil**;**
increase in shade/humidity/temperature/shelter from wind/other named abiotic factor/change in microclimate**;**
change in soil pH**;**
concept of new conditions leading to establishment of new species**;**
introduction of new species by dispersal mechanisms**;** MAX 4

6 (d) **Major catastrophic event:**
eg extreme weather/fire/flooding/volcanic ash fall/climate change/ tree fall/human interference (eg deforestation/introduction of non-native species)**;**

Explanation:
dominant species removed/trees removed/conditions more suitable for other species/ref to secondary succession (plagioclimax/deflected succession)/competition from non-native or introduced species**;** 2

Total marks = 10

Question 7

Quality of Written Communication is assessed in this answer

Succession continues/ref to deflected succession/plagioclimax;
[**R** – primary succession]
changes in plant species diversity;
plant size/complexity increases;
climax community/woodland results;
increases niches/habitats available for animals;
animal species diversity increases;
changes to microclimate/light/humidity/temperature;
changes in organic matter/nutrients qualified;
increased depth of soil;
pH change qualified;;
less soil compaction; 5
[**R** – ref to erosion]

Quality of Written Communication

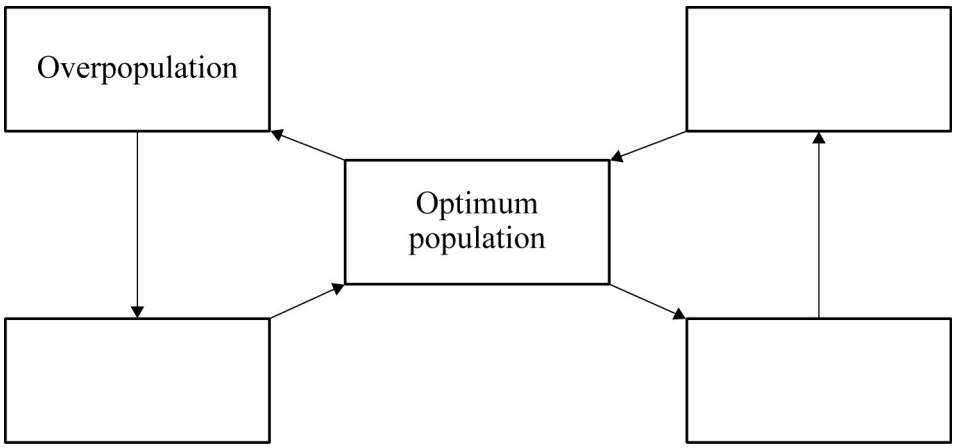
Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 7

Topic 10: Population Dynamics and Regulation

1 The model shows how populations react to environmental pressures by feedback mechanisms.



A = Underpopulation
B = Increased reproduction
C = Decreased survival

1 (a) Complete the model using the letters **A**, **B**, and **C**.

(1 mark)

1 (b) State what is meant by negative feedback.

.....

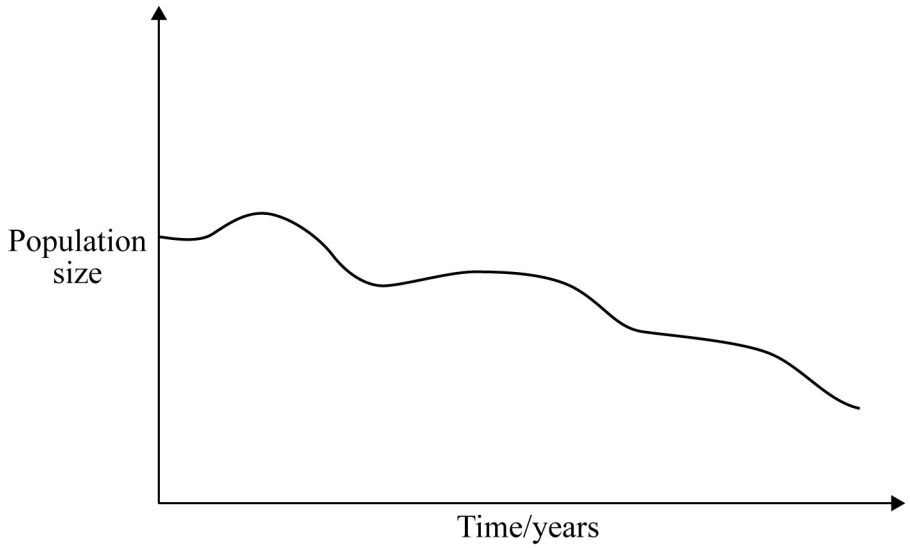
.....

.....

(1 mark)

2

2 The graph shows changes in the population size of breeding adult frogs (*Rana temporaria*) in a nature reserve.



Suggest **three** biotic factors that may account for the variation in population size shown in the graph.

1 .....

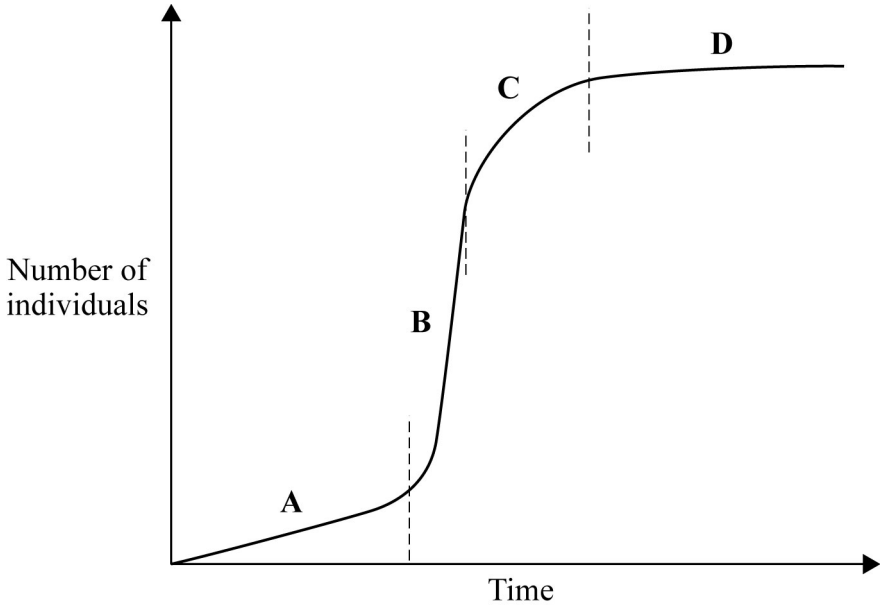
2 .....

3 .....

(3 marks)

3

3 The graph shows a theoretical population growth curve for a species showing the influence of density dependent factors.



Explain why:

3 (a) there is a slow start to population growth at **A**

.....

.....

(1 mark)

3 (b) growth slows down at **C**

.....

.....

.....

.....

(2 marks)

3 (c) the population stabilises at **D**.

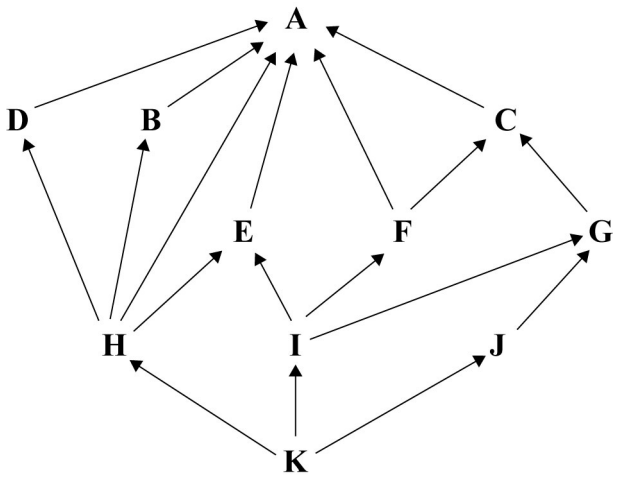
.....

.....

(1 mark)

4

4 The diagram shows part of a food web where letters represent the different organisms present in the ecosystem.



Choose an appropriate letter from the diagram to complete the table. You may use the same letter once, more than once, or not at all.

	Letter
A primary producer	
A secondary consumer	
An organism that feeds at more than one trophic level	
An organism that would be least efficient at converting the energy it receives into new growth	
An organism at the fourth trophic level	

(5 marks)

5

5 (a) Complete the table by selecting the appropriate letter from the list below.

A environmental resistance
B population density
C biotic potential
D carrying capacity
E intraspecific competition
F interspecific competition

Definition	Letter
Competition between different species for resources such as food and space	
The maximum reproductive capacity of a population with unlimited resources	
The sum total of factors that reduce the growth of a population, including predation, disease, competition and unfavourable climate	

(3 marks)

5 (b) Population size is regulated by both density dependent and density independent factors. Using an example, explain the meaning of a *density independent factor*.

.....

.....

.....

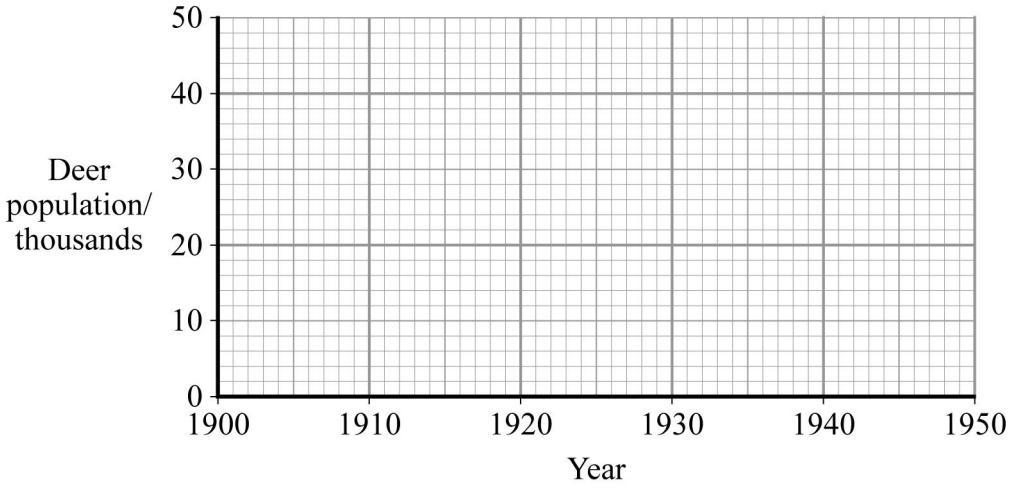
.....

(2 marks)

5

6 Early conservation work often failed because ecosystems were not fully understood. In 1910, an area of the USA was declared a wildlife refuge for 3000 deer. The area had a carrying capacity of 20 000 deer. Predators were exterminated. By 1920, there were 50 000 deer but by 1950, only 8000 deer remained.

6 (a) (i) Construct a graph to show the change in deer population over time.



(1 mark)

6 (a) (ii) Explain what is meant by the *carrying capacity* of an area.

.....

.....

(1 mark)

6 (b) Explain why the population fell below the carrying capacity.

.....

.....

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.....

(3 marks)

6 (c) Suggest a way in which the programme could have been managed more successfully.

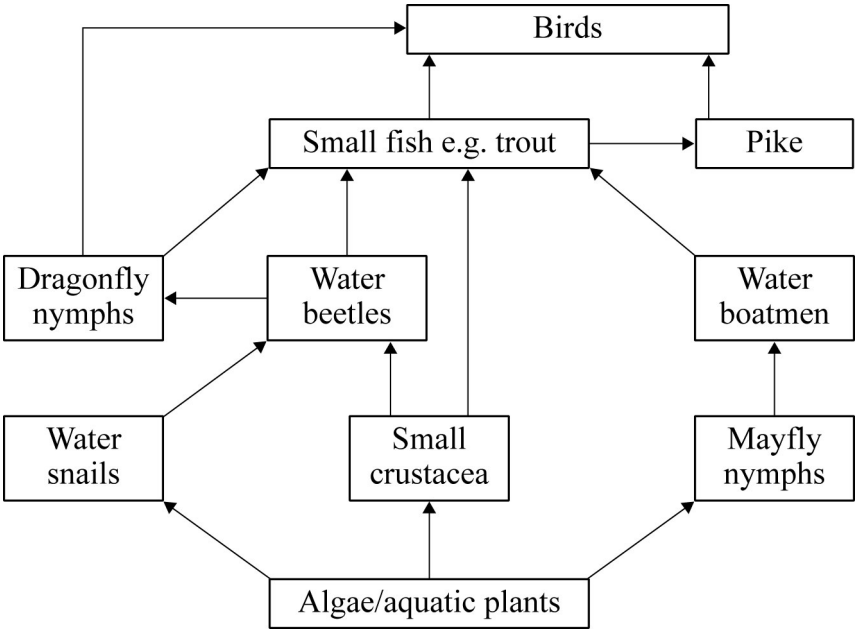
.....

.....

(1 mark)

6

7 The diagram shows a food web from a river.



With reference to the diagram, explain the short term impact of a drop in mayfly numbers on the population of:

7 (a) algae .....

.....

.....

(2 marks)

7 (b) water snails .....

.....

.....

(2 marks)

7 (c) trout. .....

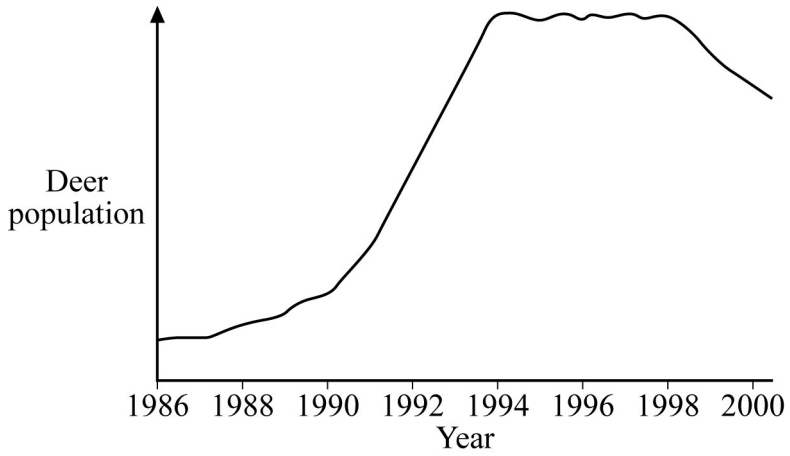
.....

.....

(2 marks)

6

8 In 1986 deer were introduced onto a small island off the coast of Scotland. The island was uninhabited by humans. The results of population counts are shown in the graph.



8 (a) Explain the shape of the graph between 1986 and 1998.

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(3 marks)

8 (b) Outline how a density-dependent factor may have been responsible for the population change between 1998 and 2000.

.....

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.....

(2 marks)

8 (c) Suggest **one** wildlife management strategy that might be used on the island to stabilize the deer population.

.....

.....

(1 mark)

6

9 (a) Complete the equation for population growth by writing the following terms in the correct box.

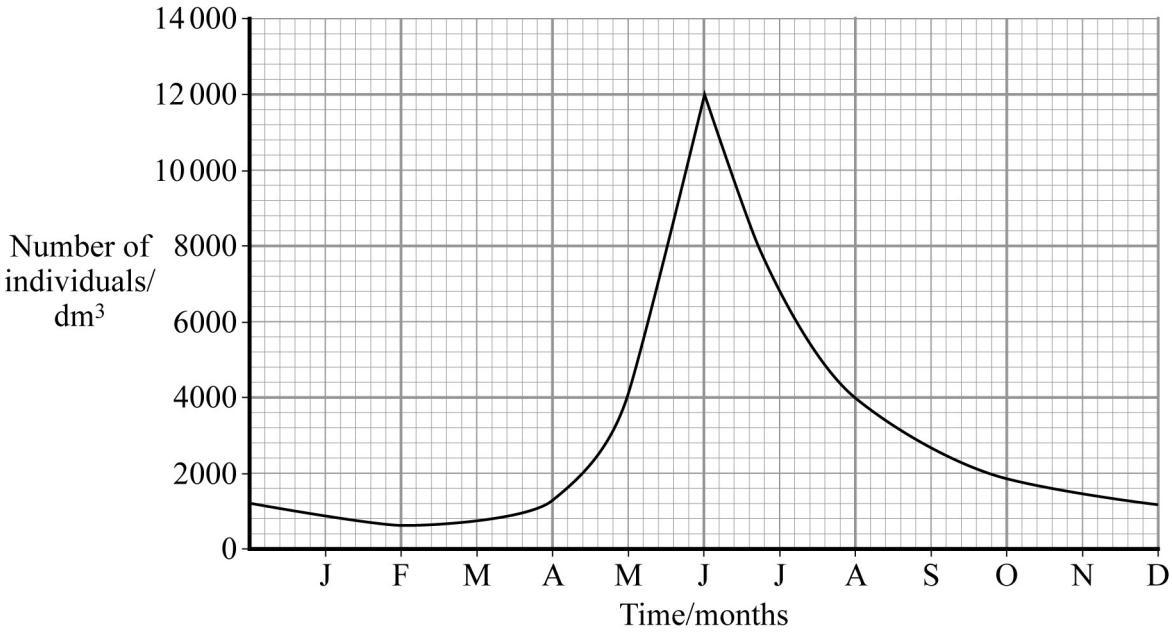
Environmental Resistance **Biotic Potential**

Population growth will only occur if

[ ] is greater than [ ]

(1 mark)

9 (b) The graph shows a density-independent growth curve for a species of freshwater alga.



9 (b) (i) State what is meant by *density-independent growth*.

.....

.....

.....

(1 mark)

9 (b) (ii) Explain the shape of the curve from:

1 May to June .....

.....

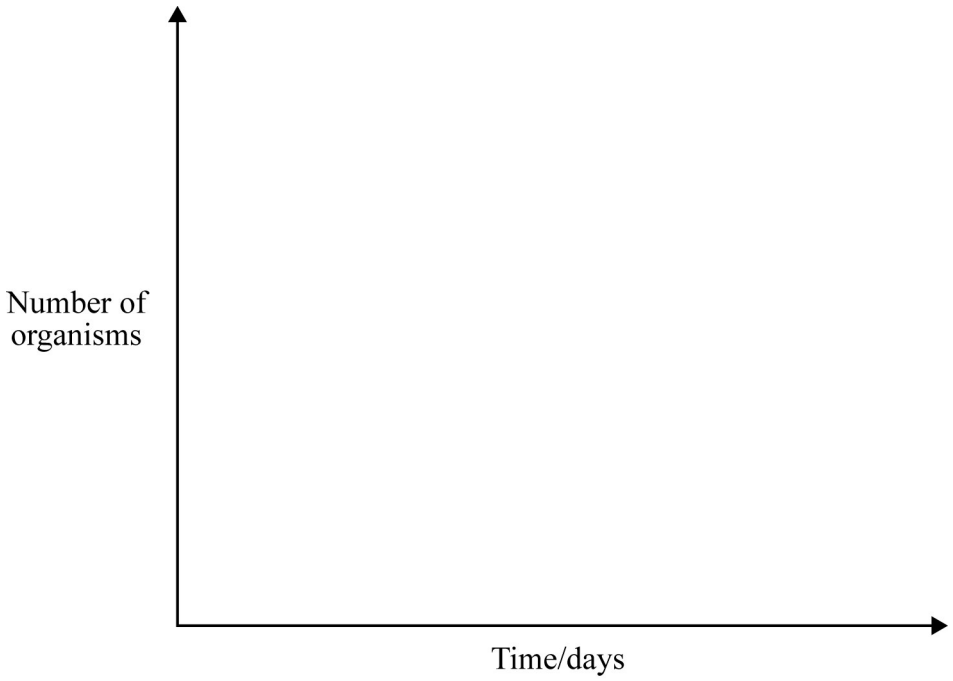
(1 mark)

2 July to September.....

.....

(1 mark)

9 (c) (i) Sketch a curve for density-dependent population growth on the axis below.



(1 mark)

9 (c) (ii) Using a specific example, explain how a density-dependent factor may control population growth.

.....

.....

.....

.....

(2 marks)

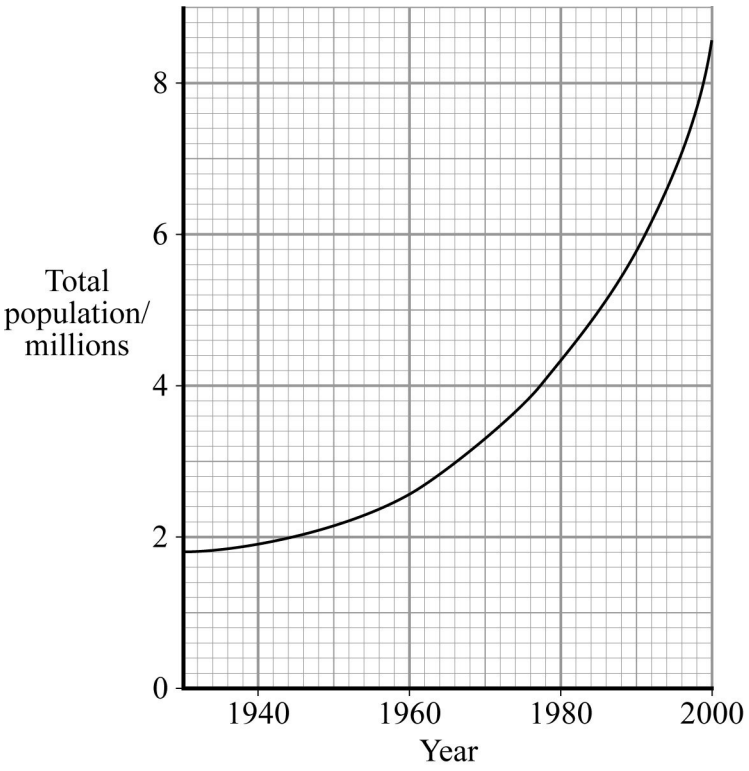
9 (d) Write an equation for human population change using the following words.

EMIGRATION MORTALITY IMMIGRATION

Population change = (FERTILITY + ☐) – (☐ + ☐)

(1 mark)

9 (e) The graph shows the change in population in an African country.



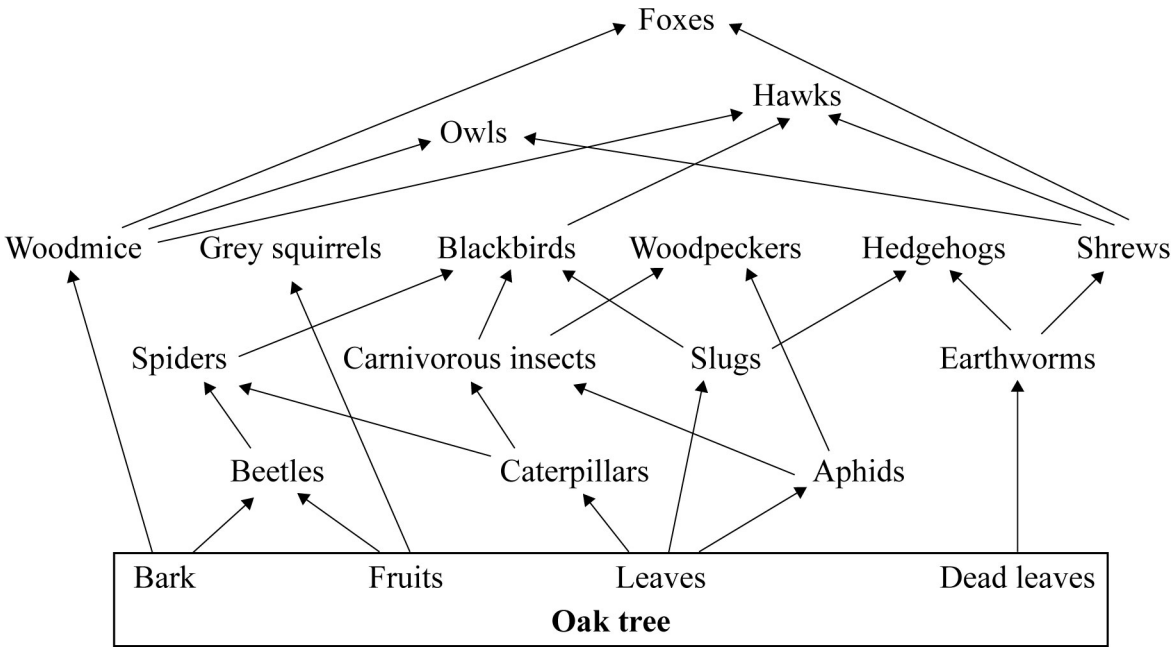
Calculate the percentage increase in population between 1960 and 2000. Show your working.

Answer……

(2 marks)

10

10 The diagram shows part of a food web for oak woodland.



10 (a) Using the diagram, name an organism which is:

10 (a) (i) a primary consumer

.....

(1 mark)

10 (a) (ii) both a secondary and a tertiary consumer.

.....

(1 mark)

10 (b) Explain:

10 (b) (i) how energy from the sun is passed through the food web

.....

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(3 marks)

10 (b) (ii) why less energy is available at each successive trophic level.

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(3 marks)

10 (c) For the first three trophic levels in the woodland ecosystem, draw a labelled sketch to show the shape of:

10 (c) (i) a pyramid of numbers

(1 mark)

10 (c) (ii) a pyramid of biomass.

(1 mark)

10

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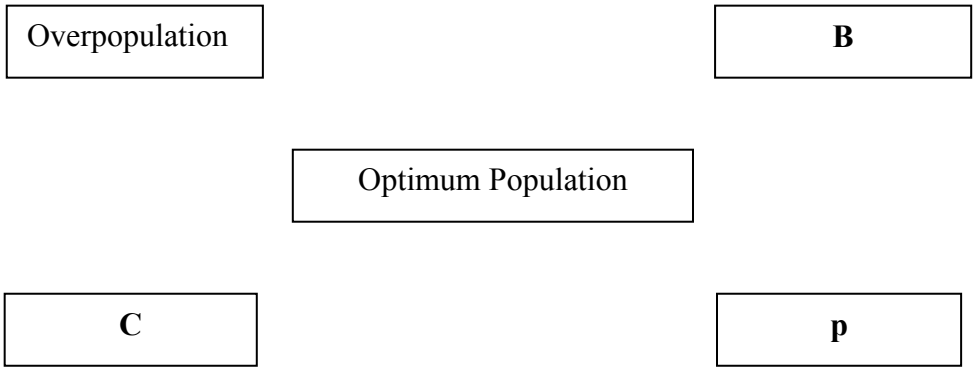
Mark scheme – Topic 10: Population Dynamics and Regulation

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

1 (a) All boxes correct**;**



1

1 (b) Mechanism leading to homeostasis/stability/equilibrium/ return to optimum**;** 1

Total marks = 2

Question 2

Decrease in food supply**;**
increase in competition/competition for mates**;**
increase in predation**;**
increase in disease**;**
qualified human interference**;** MAX 3

Total marks = 3

Question 3

3 (a) Few (reproducing) individuals/time taken to adapt to new surroundings/population establishing**;**
high death rate linked to unstable environment**;**
time to synthesise enzymes (for micro-organisms)**;** MAX 1

3 (b) Increased competition/pressure on vital resources/food/space/water**;**
increased environmental resistance**;**
reduced biotic potential/increased death rate**;**
build up of waste products**;**
increased disease/predation**;** MAX 2

3 (c) Birth rate equals death rate/carrying capacity reached**;** 1

Total marks = 4

Question 4

	Letter
A primary producer	**K;**
A secondary consumer	**B/D/E/F/G;**
An organism that feeds at more than one trophic level	**A;**
An organism that would be least efficient at converting the energy it receives into new growth	**K;**
An organism at the fourth trophic level	**A/C;**

Total marks = 5

Question 5

5	(a)	**F** (interspecific competition)**;** **C** (biotic potential)**;** **A** (environmental resistance)**;**	3
5	(b)	Decrease or increase a population irrespective of population density**;** eg fire/climatic extreme/hurricanes/abiotic factors/named abiotic factor**;** [**R** deforestation/habitat destruction]	2

Total marks = 5

Question 6

6	(a)	(i)	Bar or line graph – all points correct**;**	1
6	(a)	(ii)	Number of organisms an area can support in a sustainable way**;**	1
6	(b)		Overpopulation leading to lack of food/overgrazing**;** overpopulation leading to spread of disease**;** DR exceeds BR/breeding disrupted/high death rate/ population crash**;**	3
6	(c)		Leave or introduce predators/cull population once it reached carrying capacity/birth control/monitoring and removal of population**;**	1

Total marks = 6

Question 7

7 Qualified change for each named population ×3

7 (a) Increased population**;**
reduced grazing/consumption/predation by mayfly**;** 2

7 (b) Increased population**;**
less competition for food/more food available**;** 2

7 (c) Decreased population**;**
less food for its prey – water boatmen**;**
OR
Increased population**;**
more food available**;**
OR
No change**;**
plenty of available food**;** MAX 2

Total marks = 6

Question 8

8 (a) 1986 – 1990 (lag phase) – population becoming established/low reproduction rate/population scattered**;**
1990 – 1994 (log phase – exponential growth) no limiting factors/no environmental resistance/resources freely available**;**
1994 – 1998 stationary ER = BP – deathrate = birthrate/population stable/carrying capacity reached**;** 3

8 (b) Increased competition for food/water/shelter**;**
population decreased/increased mortality/decreased natality**;**
OR
Spread of disease more rapid**;**
population decreases/increased mortality**;**
OR
Lack of space/overcrowding causes stress/fighting**;**
decreased reproduction/increased mortality**;** MAX 2

8 (c) Culling/contraception programme/removal of animals to other islands/ introduction of predators/biological control**;** 1
[**A** sterilization/castration] [**R** kill]

Total marks = 6

Question 9

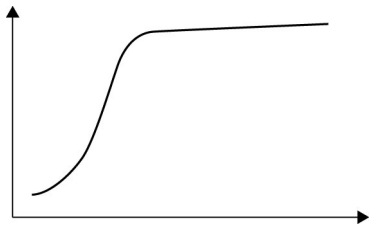
9 (a) Biotic potential is greater than Environmental resistance 1

9 (b) (i) Regulation of population size is not related to density**;** 1

9 (b) (ii) 1 Concept that population increase related to optimal conditions for photosynthesis (light/temp)/no environmental resistance**;** 1

2 population decrease related to limiting factors for photosynthesis/increase in herbivores/short life cycle/ increased ER**;** 1

9 (c) (i)



1

9 (c) (ii) Competition for resources/predation/disease/waste build up**;**
correct effect on population**;**
eg of species illustrating above**;** 2

9 (d) Pop change = (F+I) – (M+E)**;** 1

9 (e) 6/2.6 ×100 = 230.76%; [**A** 231%] 2

Total marks = 10

Question 10

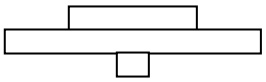
10 (a) (i) Woodmouse/beetle/caterpillar/aphid/grey squirrel/slug**;** 1
[**A** earthworm]

10 (a) (ii) Blackbird/woodpecker/owl/hawk/fox**;** 1

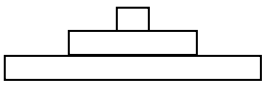
10 (b) (i) Sunlight energy fixed by green plants/ref to photosynthesis**;**
formation of chemical energy/carbohydrates/named carbohydrate lipids/proteins**;**
passed to primary consumers/herbivores/omnivores**;**
carnivores/secondary consumers consume herbivores/ primary consumers**;**
correct reference to decomposers**;** MAX 3

[A named organisms from a single food chain only for MAX 1 mark]

10 (b) (ii) Food chain efficiency approx 10%/approx 10% transferred/ 2nd law of thermodynamics**;**
respiratory/heat losses**;**
loss through inedible parts/not all parts eaten**;**
loss through faeces/excretion**;** MAX 3

10 (c) (i) 

1

10 (c) (ii) 

1

Max 1 for whole part (c) if correct shapes but not labelled
[A inverted pyramids if TL's labelled correctly]
If >3 TL's illustrated – mark bottom 3 levels only <u>if concept correct</u>

Total marks = 10

Topic 11: Land Resources

1 A landowner has been refused planning permission to build and run a café on the banks of a lake which is situated inside a National Park. The landowner has obtained a petition, signed by over 100 visitors to the lake, supporting the idea of developing the café. Arguing that the development of the café is consistent with the purpose of the National Park, the landowner intends to appeal against the decision.

1 (a) Suggest **two** reasons why planning permission has been refused.

1 .....

.....

2 .....

.....

(2 marks)

1 (b) Suggest why the development of the café might be considered consistent with the purpose of the National Park.

.....

.....

.....

(2 marks)

4

2 State:

2 (a) **two** functions of the Green Belt designation

1 .....

.....

2 .....

.....

(2 marks)

2 (b) **two** weaknesses of the Green Belt designation.

1 .....

.....

2 .....

.....

(2 marks)

4

3 A proposal has been made by a cement manufacturer to extend a limestone quarry into a National Park. The cement manufacturer has privately negotiated with the local landowner who now supports the proposal. The local newspaper and the National Park Authority have launched a campaign against the proposal. At a public meeting, representatives of the following are present:

- the National Park Authority
- local residents
- the cement manufacturer
- the local Tourist Association
- the Ramblers Association

3 (a) Suggest **one** line of argument that may be put forward by each of the following:

3 (a) (i) The cement manufacturer

.....

.....

(1 mark)

3 (a) (ii) The National Park Authority

.....

.....

(1 mark)

3 (b) Who is responsible for making the final decision after a Public Inquiry?

.....

(1 mark)

Permission was eventually granted to extend the quarry into the National Park.However, the cement manufacturer was ordered to pay compensation to local shopkeepers.

3 (c) Outline the principle which would be used to calculate the amount of compensation which the shopkeepers would receive.

.....

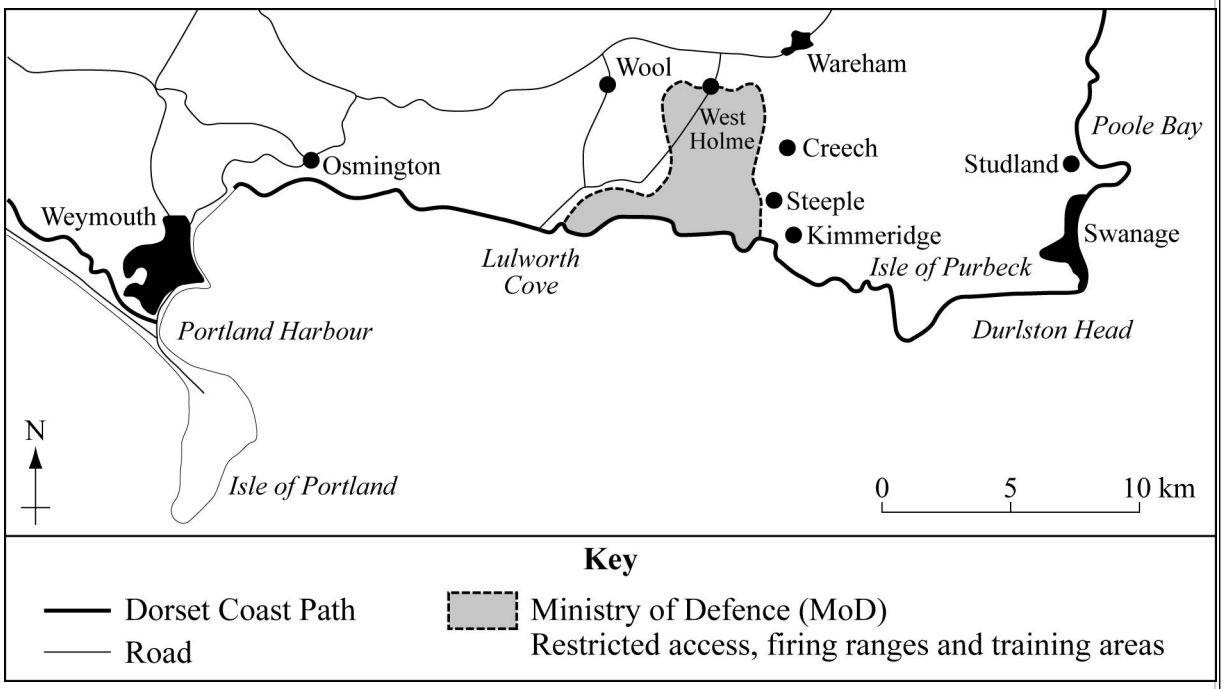
.....

.....

(2 marks)

5

4 The map shows a section of the Dorset Coastal Path. Between Kimmeridge and Lulworth the path runs through a Ministry of Defence (MoD) training area used for shooting ranges and tank training.



4 (a) Suggest an explanation for each of the following

4 (a) (i) The Countryside Agency want the MoD to abandon the area

.....

.....

(2 marks)

4 (a) (ii) Dorset Country Council and local residents regard MoD activity in the area as an advantage

.....

.....

(2 marks)

4 (b) Outline the purposes of the Countryside Stewardship Scheme.

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(2 marks)

6

5 (a) Many proposed land changes have been the subject of public inquiries.

Outline a potential conflict in proposals to:

5 (a) (i) relax the green belt designation

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.....

.....

.....

(2 marks)

5 (a) (ii) route a public footpath across agricultural land.

.....

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.....

(2 marks)

5 (b) State **four** ways in which Country Parks differ from National Parks.

1.....

.....

2.....

.....

3.....

.....

4.....

.....

(4 marks)

8

6 The Yorkshire Dales National Park Action Plan included three proposals. These were that:

1 Charges at some car parks should be doubled

2 An increase in the percentage cover of deciduous woodland in the Park should be encouraged

3 Some of the most popular footpaths should be re-routed for two years.

6 (a) Suggest a benefit of each proposal.

Proposal **1** .....

.....

Proposal **2** .....

.....

Proposal **3** .....

.....

(6 marks)

6 (b) In 2002, a landowner in the Yorkshire Dales National Park put forward a proposal to build a wind farm on his land. The Park Authority conducted an Environmental Impact Assessment which included a pricing mechanism that gave a monetary value to each positive and negative effect of the proposed wind farm.

6 (b) (i) Name the pricing mechanism used.

.....

(1 mark)

6 (b) (ii) Suggest how the monetary value of a picturesque view could be estimated.

.....

.....

(1 mark)

8

7 Discuss why mineral extraction in National Parks causes many environmental problems.

Quality of Written Communication will be assessed in this answer.

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(8 marks)

8

Mark scheme – Topic 11: Land Resources

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

1 (a) Spoil scenery/unsightly**;**
attract crowds/cause congestion/act as honey pot/encourage development/car parks**;**
existing provision**;**
wildlife/habitat disturbance/trampling/waste/water pollution/ litter**;** MAX 2

1 (b) Will generate income for locals/economic purpose of park**;**
reference to recreation/attracting or catering for visitors/amenity**;** 2
[**R** 'will raise money']

Total marks = 4

Question 2

2 (a) Prevent urban sprawl/merging**;**
encourage redevelopment of brownfield sites**;**
protect countryside**;**
preserve historic towns**;** MAX 2

2 (b) Golf courses/cemeteries/roads/domestic waste sites allowed**;**
encourages leapfrogging**;**
agriculture runs down – horsey culture**;**
protects poor quality land/indiscriminate explained**;**
increased commuting**;**
leads to increased house prices**;** MAX 2

Total marks = 4

Question 3

3	(a)	(i)	Importance for local employment/local/national needs for cement**;**	1
3	(a)	(ii)	Noise/visual intrusion/traffic/dust problems/loss of habitat/ rare species**;**	1
3	(b)		Secretary of State for Department of Environment, (Transport and the Regions, Food and Rural areas)**;**	1
3	(c)		Loss of income**;** as a result of fewer visitors**;**	2

Total marks = 5

Question 4

4	(a)	(i)	Countryside Agency responsible for protecting landscape/allow reference to land, natural beauty,aesthetics/MoD damage landscape**;** Countryside Agency develops recreational opportunities/ MoD restricts access for recreation**;**	2
4	(a)	(ii)	Maintains jobs/economic benefit**;** (ignore reference to habitat/wildlife) protects against development**;**	2
4	(b)		Manage/maintain important landscapes/create landscapes/ protect habitat**;** reference to access**;**	2

Total marks = 6

Question 5

5	(a)	(i)	Urban sprawl/building/housing/development would occur/ green belt stops development**;** habitat destruction/loss of amenity/landscape/damage to historic towns**;**	2
5	(a)	(ii)	Access/people increase**;** loss of production/damage to crops/disturbance/erosion/ trampling/litter**;**	2
5	(b)		CP small, NP large/many more CPs than NPs**;** CP near urban area, NP remote**;** NPs are a planning authority, CPs are not/CPs managed by local authority, NPs by others**;** NPs have more owners/are mainly privately owned**;** CPs often on reclaimed land/NP natural landscapes**;** honeypot/CP concentrate visitors/leaves other sites undisturbed/ decreased pressure on NP**;** NP 1949 NP&AC Act/CP 1968CA**;** CP attracts locals/NP large sphere of influence**;** people live in/work in NP**;** [**A** non-comparative answers]	MAX 4

Total marks = 8

Question 6

6	(a)	**1**	Decrease/control visitor numbers/overcrowding**;** prevent carrying capacity being exceeded**;** encourage public transport**;** reduce congestion/NO/N_2O/NO_2/NO_x/VOCs/particulates/ lead/traffic noise**;** money**;** for park management projects or example of**;**	MAX 2
		2	Increase landscape diversity**;** return to natural/original/native/historic landscape/vegetation**;** more money for farmers by diversification**;** enhance amenity/recreation**;** attract/absorb more visitors**;;** create habitats/aid wildlife**;** increase species diversity/biodiversity**;** prevent soil erosion/floods**;** CO_2 sink**;**	MAX 2
		3	Allow vegetation/habitat recovery**;** [R recovery of area/paths] reduce erosion/compaction/trampling**;** reduce disturbance to wildlife**;** repair existing paths**;** reduce psychological carrying capacity**;**	MAX 2
6	(b)	(i)	Cost benefit analysis/CBA**;**	1
6	(b)	(ii)	Ask visitors/people/residents how much they would pay to maintain it/view it**;**	1

Total marks = 8

Question 7

7 *Quality of Written Communication is assessed in this answer*

Parks meant for (quiet) recreation**;**
landscape conservation/land take/amenity**;**
habitat loss/disrupts wildlife**;**
scarring/loss of visual amenity/aesthetic problems/dereliction**;**
noise**;**
accidents/congestion**;**
dust**;**
fumes/air pollution from traffic/lorries/named gases**;**
vibration**;**
sedimentation/turbidity/qualified water pollution/silt**;**
toxic leachate/mine drainage**;**
spoil stability/landslides**;**
subsidence**;**
flooding/ref to water table moving**;**
explosions/blasting**;**
access**;** MAX 6

Quality of Written Communication is assessed in this answer

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 8

Blank Page

Topic 12: Practical Skills

1 Scientists carried out a survey of some upland streams in different parts of the UK.

Some of the results are shown in the table.

Stream	pH of stream water	Number of animal species	Number of plant species
1	4.0	5	4
2	7.1	22	19
3	4.4	11	6
4	6.5	20	13
5	5.7	16	9

Outline a method which could be used to measure accurately the pH of the stream water.

.....

.....

.....

.....

(2 marks)

2

2 The table shows the species diversity calculated using Simpson's Diversity Index for the areas of long grass and short grass.

	Diversity Index
Long grass	5.3
Short grass	2.6

2 (a) Explain the ecological significance of a high species diversity.

.....

.....

.....

.....

(2 marks)

2 (b) Suggest why it is often difficult to collect the data for calculating an index of diversity for grass species.

.....

.....

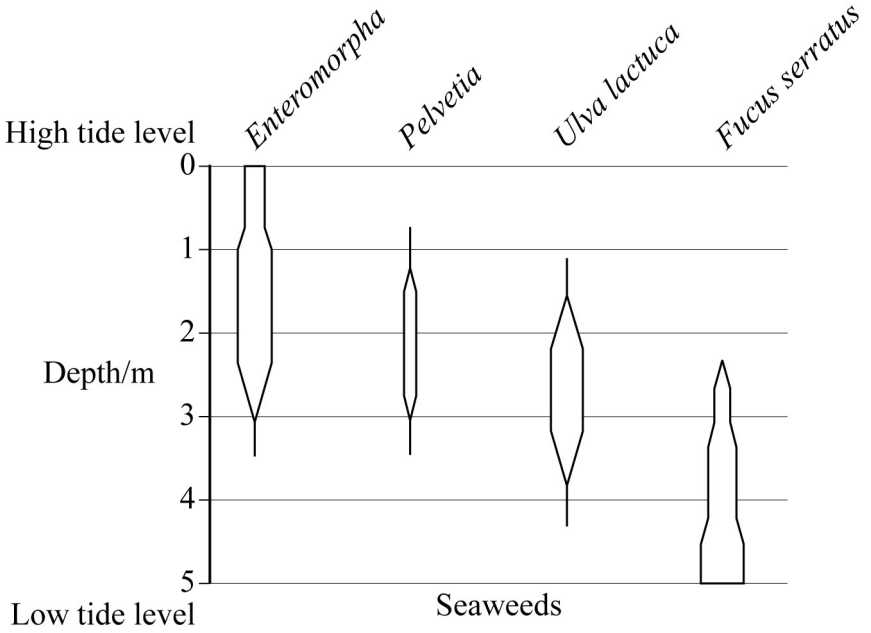
.....

.....

(2 marks)

4

3 In ecosystems, species distribution may be controlled by many factors. The diagram shows the distribution of **four** species of seaweeds on a rocky shore. The width of the column shows species frequency.



Describe a suitable method to gather the data shown in the diagram.

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(5 marks)

5

4 The following methods can be used in fieldwork to sample populations of organisms.

A Kick sampling
B Tüllgren funnel
C Mark-release-recapture (Lincoln Index)
D Pitfall trap
E Belt transect
F Random quadrat sampling
G Abundance scale
H Light trap
I Direct observation

Complete the table to give the letter of an appropriate technique to use in each case. The first one has been done as an example.

	Letter
Estimating the population of snails in a hedgerow	**C**
Sampling bottom dwelling freshwater invertebrates in a stream	
Sampling night-flying moths	
Comparing populations of daisies in two lawns with different weed-control treatments	
Collecting invertebrates in a soil or leaf litter sample	
Investigating the zonation of seaweeds down a rocky shore.	

(5 marks)

5

5 (a) A student used pitfall traps to carry out a mark-release-recapture investigation on the woodlice population (small invertabrates) of the dunes.

Number of woodlice originally marked **(n^1)**	Number of woodlice in second sample **(n^2)**	Number of marked woodlice recaptured in second sample **(n_m)**
50	83	13

Use the student's results to estimate the population of woodlice on the dunes using the formula:

$$\text{Population} = \frac{n^1 \times n^2}{n_m}$$

Show your working.

Answer .....

(1 mark)

3 (b) Outline **two** limitations of the mark-release-recapture technique.

1 .....

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.....

.....

2 .....

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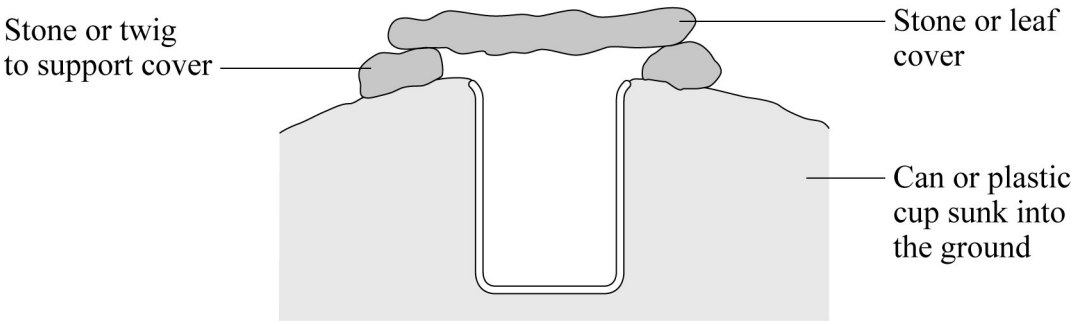
.....

.....

(4 marks)

5

6 Pitfall traps were used to compare the populations of sand dune invertebrates in sample areas of $100m^2$ in two different areas of the dunes. The diagram shows a typical pitfall trap.



6 (a) Suggest how sampling using pitfall traps would have been carried out to produce reliable data.

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(3 marks)

6 (b) The numbers of invertebrates found in the pitfall traps in the fixed dune are shown in the table.

Invertebrate groups	**Fixed dune**
cockchafers	2
ground beetles	5
spiders	3
springtails	7
millipedes	4
snails	5

Use the data in the table to calculate the index of diversity (**D**) for the fixed dune from the formula.

Show your working.

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

Where **N** = total number of organisms of all species
n = total number of organisms of a particular species
Σ = the sum of

Answer .....

(2 marks)

5

7 A student decided to carry out an investigation to assess the effect of trampling on the populations of plant species growing on chalk grassland. The student selected one heavily trampled area and one not so trampled and used random quadrat sampling to measure the percentage cover of each species.

7 (a) State **one** advantage of random sampling.

.....

.....

(1 mark)

7 (b) Explain why quadrat sampling was the appropriate technique to use for this study.

.....

.....

(1 mark)

7 (c) Describe how random quadrat sampling would have been used to record the percentage cover of the vegetation.

.....

.....

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.....

(3 marks)

7 (d) State **one** disadvantage of measuring percentage cover when assessing plant populations.

.....

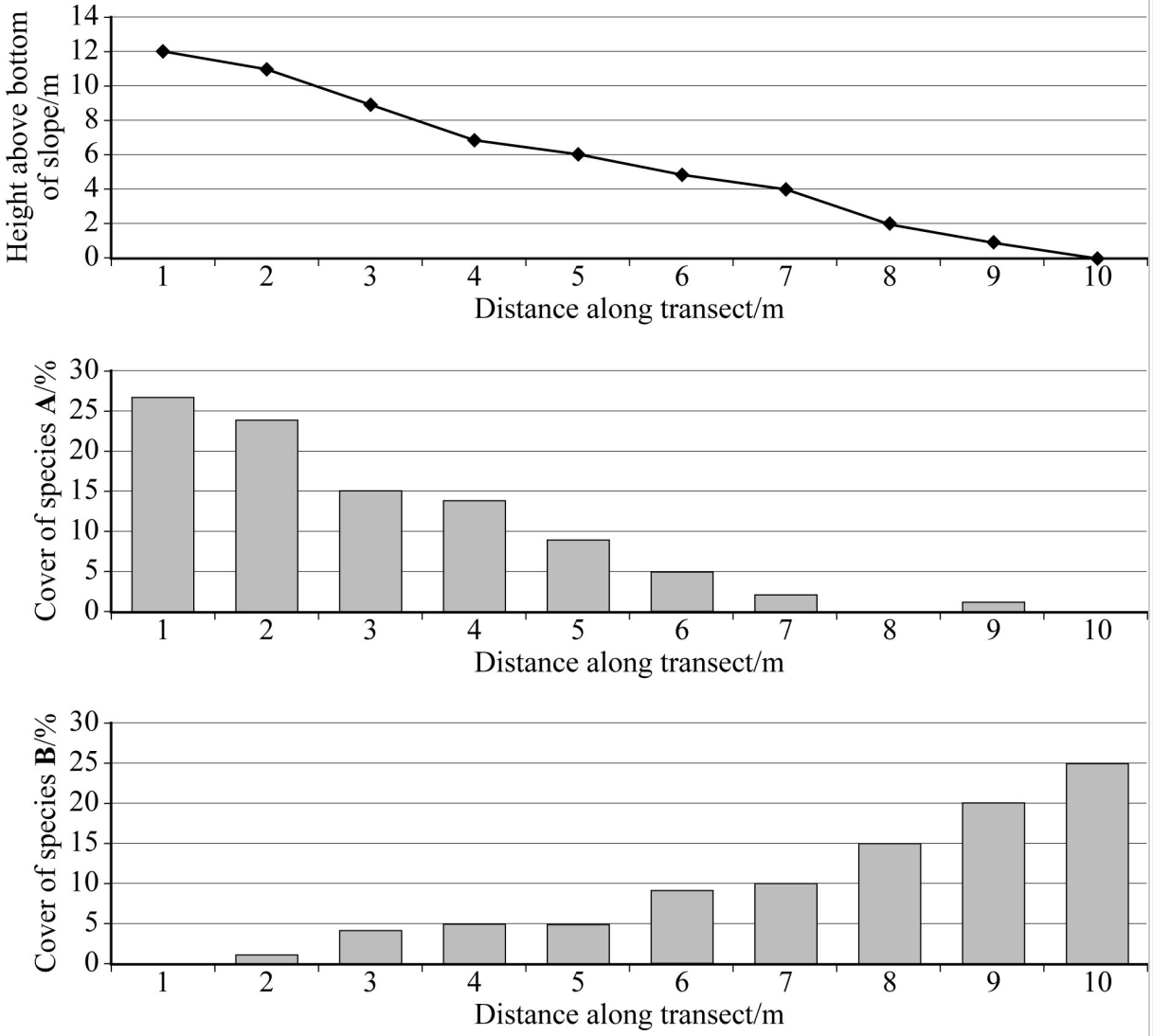
.....

(1 mark)

6

8 A student used a belt transect to investigate the distribution of two plant species down a slope. In each quadrat, the student recorded the percentage cover of each species and used these results to calculate the species frequency.

The diagram shows the results of the investigation.



8 (a) Calculate:

8 (a) (i) the species frequency of Species **A**

Show your working.

Answer .....

(2 marks)

8 (a) (ii) the mean percentage cover of Species **B**.

Show your working.

Answer .....

(2 marks)

8 (b) Suggest **one** advantage and **one** disadvantage of recording the percentage cover of the vegetation compared with counting the number of plants in each quadrat.

Advantage .....

.....

Disadvantage .....

.....

(2 marks)

6

9 (a) The table shows the results of a freshwater invertebrate survey in the River Edw and the River Irfon.

Invertebrates	**Numbers of individuals**	
	River A	**River B**
caddis fly	4	8
water hog louse	12	12
freshwater shrimp	2	6
mayfly larvae	1	4
index of diversity	**2.34**	

Use the data in the table to calculate the index of diversity (**D**) for River **B** from the formula:

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

Where **N** = total number of organisms of all species
n = total number of organisms of a particular species
Σ = sum of

Show your working.

Answer .....

(2 marks)

9 (b) Describe how a student would carry out a field survey on a river to find out how freshwater invertebrate populations are affected by differences in pH.

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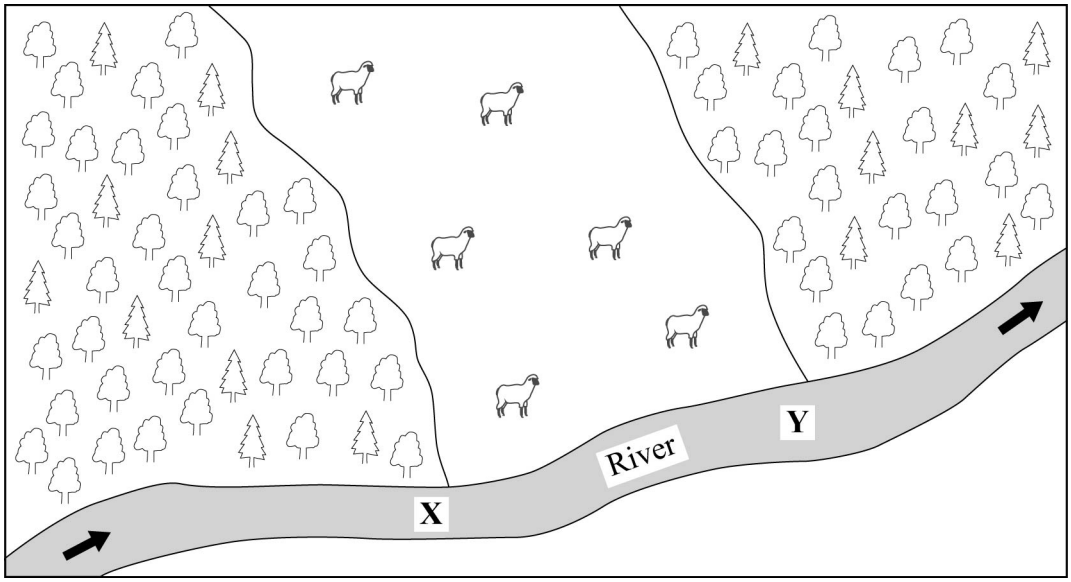
(5 marks)

7

10 The diagram shows an area of climax community woodland next to a river. Part of the woodland has been cleared recently and is now used for grazing sheep.



A survey of freshwater invertebrates was carried out, at sites **X** and **Y**, one afternoon in May.

Invertebrates	**Numbers of individuals**	
	Site X	**Site Y**
mayfly larvae	5	1
freshwater shrimps	12	6
water lice	10	5
stonefly larvae	1	0
species diversity	**3.08**	

10 (a) (i) Use the data in the table to calculate the index of diversity (**D**) at site **Y**.
Show your working.
The formula required is:

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

Where **D** = index of diversity
N = total number of organisms of all species
n = total number of organisms of a particular species
Σ = sum of

Answer .....
(2 marks)

10 (a) (ii) Suggest **two** ways in which this survey could be improved to make it scientifically valid.

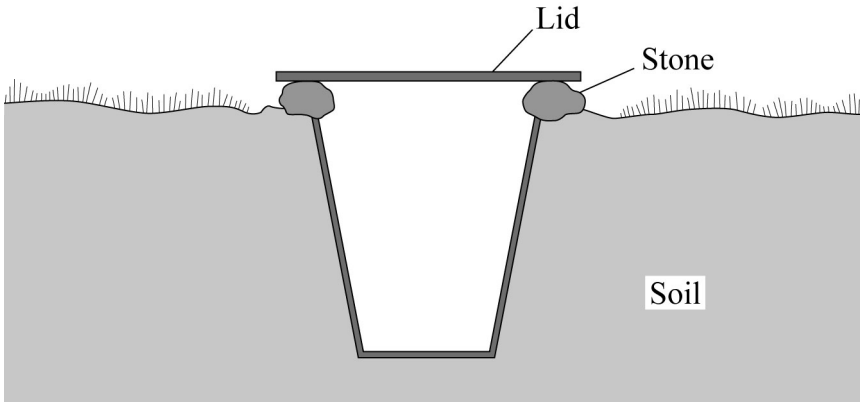
1 .....

.....

2 .....

.....
(2 marks)

10 (b) Before the woodland was cleared, pitfall traps were used to study the population of a species of beetle.



10 (b) (i) Describe how pitfall traps could be used to assess the impact of woodland clearance on the beetle population.

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(5 marks)

10 (b) (ii) Outline two weaknesses in this method of estimating populations.

1 .....

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2 .....

.....

(2 marks)

11

11 (a) A large supermarket chain wishes to develop an area to build a new superstore. Some local residents are trying to prevent the development.
A representative from an environmental pressure group thinks that the site can be protected because it is the habitat of an endangered species of beetle. The pressure group decides to use the mark-release-recapture method to estimate the beetle population.

11 (a) (i) Describe how this method could be used to estimate population size.

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(5 marks)

11 (a) (ii) Give **two** limitations of this technique.

1 .....

.....

2 .....

.....

(2 marks)

11 (b) The table shows data gathered on plant species (excluding grasses) in the area under threat and another local site. Common names for plant species are used.

Species	Endangered area	Other local site
rosebay willow herb	10	6
dandelion	9	10
plantain	7	1
daisy	21	5
spotted orchid	6	0
red campion	8	0
diversity index	**7.23**	

11 (b) (i) State **one** method that may have been used to gather the data.

.....

(1 mark)

11 (b) (ii) Suggest **one** reason why grasses were excluded from the survey.

.....

.....

(1 mark)

11 (b) (iii) Use the data in the table and the equation below to calculate the index of diversity for the other local site. Show your working.

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

Where **D** = index of diversity
N = total number of all organisms of all species
n = total number of organisms of a particular species
Σ = sum of

Answer .....

(2 marks)

11

12 In order to study the effect of hedgerow management, the population of woodlice living in a hedgerow was estimated using the following method.

- Four pitfall traps were set up at 2 metre intervals and left for 24 hours
- The woodlice that had fallen into the traps were marked with quick-drying paint and released back into their habitat
- The next day the traps were checked again and the number of marked and unmarked woodlice were counted.

The results are shown in the table.

	Trap number			
	1	**2**	**3**	**4**
Number of woodlice marked and released	2	28	0	10
Number of marked woodlice in second catch	0	4	0	2
Number of unmarked woodlice in second catch	5	17	3	11

12 (a) Use the formula to estimate the woodlouse population in the area.

Show your working.

$$\text{Population estimate} = \frac{\mathbf{n_1 \times n_2}}{\mathbf{n_m}}$$

Where $\mathbf{n_1}$ = number caught on the first occasion
$\mathbf{n_2}$ = number caught on the second occasion
$\mathbf{n_m}$ = number of marked individuals in the second catch

Answer.....

(2 marks)

12 (b) Suggest three reasons why it is not possible to make a reliable estimate of the woodlouse population size from these data.

1 .....

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2 .....

.....

3 .....

.....

(3 marks)

5

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Mark scheme – Topic 12: Practical Skills

Instructions: ; = 1 mark = alternative response A = accept R = reject

Question 1

Use of electronic probe/pH meter/universal indicator**;**
[**R** litmus paper]
Details of use (eg controls/repeats/means/calibration/comparison with colour standards etc)**;** 2

Total marks = 2

Question 2

2 (a) Greater stability of ecosystem/idea of balance/less prone to disruption**;**
reasoned explanation eg more interacting species/more complex food web**;** 2
[**R** reference to gene pool]

2 (b) Difficulty with identification**;**
difficulty in distinguishing individual plants**;** 2

Total marks = 4

Question 3

Belt transect**;**
from low tide to high tide/HWM to LWM/right angle to shore**;**
suitable number of sample points/quadrats at suitable distances**;**
identify species**;**
record frequency/percentage of cover/abundance scale**;**
repeat transect at different points**;** MAX 5

Total marks = 5

Question 4

	Letter	
Sampling bottom dwelling fresh water invertebrates in a stream	**A**	**;**
Sampling night flying moths	**H**	**;**
Comparing populations of daisies in two lawns with different weed control treatments	**F**	**;**
Collecting invertebrates in a soil or leaf litter sample	**B**	**;**
Investigating the zonation of seaweeds down a rocky shore	**E**	**;**

Total marks = 5

Question 5

5 (a) $50 \times 83/13 = 319$**;** 1
[**A** 319.23]

5 (b) negative effect of marking**;**
makes organisms susceptible to predation/wears off**;**

natural population change**;**
because of migration/births/deaths/predation**;**

behavioural changes by organism**;**
as result of environmental conditions (changes activity)/
or trap happy/trap shy**;**

critical time interval**;**
allows random mixing with remaining population**;** MAX 4

Total marks = 5

Question 6

6 (a) Large number of traps used in each area (minimum 10)**;**
random/systematic arrangement traps**;**
justification of positioning of traps**;**
suitable length of time before emptying (eg 24 hours)/same length of time for all traps**;**
reason for trap design eg raised mound or stone to prevent rain/large animals entering**;**
justified use of bait/use of alcohol (or equivalent) to kill catch**;**
repeat experiments for reliability/repeat at different time of day (eg at night)/different seasons**;** MAX 3

6 (b) $\frac{650}{102}$**;**

6.4 (6.37)**;** 2

Total marks = 5

Question 7

7 (a) Eliminates bias/allows statistical tests; 1

7 (b) Used when comparing two different areas/no gradient present/ no gradual change in vegetation expected; 1

7 (c) Mark out sample area of suitable size eg $10m^2$ in each location**;**
grid with co-ordinates to locate position of quadrats**;**
[**R** quadrats 'thrown']
appropriate quadrat size (eg 0.5m side length/$0.25m^2$)/ gridded quadrat used**;**
appropriate number of quadrats in each area (minimum 10)**;**
estimate area of ground/count number of squares covered by each species**;** MAX 3

7 (d) Subjective judgement/estimation/approximation**;**
[**R** 'inaccurate' unless qualified]
difficult when plants are layered/stratified/covered by others/ flattened**;** MAX 1

Total marks = 6

Question 8

8 (a) (i) 8/10**;**
= 80%**;** 2
[**A** 80 for 1 mark]

8 (a) (ii) $\frac{0+1+4+5+5+9+10+15+20+25}{10} = \frac{94}{10}$;
= 9.4 (%)**;** 2
[**A** $\pm$ 0.1%]

8 (b) **Advantage:**
overcomes problems where individual plants not easy to recognise (grasses/moss)/quicker to carry out/more useful environmental index/ index of plant activity**;** 1

Disadvantage:
Subjective/estimate only/less suitable for statistical analysis/less accurate/
difficult if vegetation is layered**;** 1

Total marks = 6

Question 9

9	(a)	Correct use of **Σn(n – 1)**/230/(56+132+30+12)**;** correct answer: 3.78**;**	2
9	(b)	Selection of suitable sites with reason**;** adequate number of sites chosen**;** take kick-sweep collections of freshwater invertebrates**;** correct sampling technique**;** count/identify**;** calculate diversity index**;** repeat tests at each site**;** same day/time**;** pH testing technique**;** water sampling technique**;**	MAX 5

Total marks = 7

Question 10

10	(a)	(i)	Correct use of **Σn(n – 1)**/50/0 + 30 + 20)**;** correct answer: 2.64**;**	1 1
10	(a)	(ii)	More sample points/separate points**;** sampling on different days/times/seasons/sampling over a long period**;**	1 1
10	(b)	(i)	1 Random sampling grid/coordinates**;** 2 large number of traps in wood and field**;** 3 sample caught-counted; 4 sample marked and released**;** 4 suitable time allowed before second sampling**;** 5 second sample count total and total recaptured**;** 6 use Lincoln index/use of equation**;** 7 repeat many times to increase validity of results**;** 8 3% minimum sample**;**	MAX 5
10	(b)	(ii)	1 May be emigration or immigration**;** 2 carnivores in trap may eat catch**;** 3 marked organisms are more predated/less predated**;** 4 some organisms are trap-happy/trap-shy**;** 5 marked organisms may not mix into population**;**	MAX 2

Total marks = 11

Question 11

11	(a)	(i)	Random sampling grid**;** suitable traps described or drawn/pitfall traps**;** numbers of traps**;** (min 20) sample caught-counted-marked released**;** suitable time allowed before second sampling**;** (min 24 hrs) second sample count total and total recaptured**;** use Lincoln index**;** explanation of equation**;** 3% min sample**;** repeat many times to increase validity of results**;**	MAX 5
11	(a)	(ii)	Assumes no emigration or immigration/population stable/ births and deaths**;** carnivores in trap may eat others**;** marked organisms are not predated**;** trap happy/trap shy**;** assumes random mixing**;**	MAX 2
11	(b)	(i)	(Random) quadrat survey**;** belt transect;	MAX 1
11	(b)	(ii)	Difficult to identify**;**	1
11	(b)	(ii)	Correct use of **Σn(n – 1)**/140/(30 + 90 + 0 + 20)**;** Correct answer: 3.3**;**	2

Total marks = 11

Question 12

12 (a) Correct answer: 280**;;** 2

Correct use of data but wrong answer = (1 mark)

$$P = \frac{(40 \times 42)}{6} \textbf{ OR } \frac{1680}{6}$$

[**R** $\frac{40 \times 36}{6}$/240]

12 (b) Sample too small/too few traps/not enough repeats**;**
Too short a time to mix**;**
Clumped distribution of animals**;**
Factors affecting probability of capture/recapture**;**
Birth/death of some woodlice**;**
Immigration/emigration**;**
Marking method affected woodlouse behaviour/
more obvious predators**;**
Mark removed by moulting**;** MAX 3

Total marks = 5