



FOR OFFICIAL USE

--	--	--	--	--	--

National
Qualifications
SPECIMEN ONLY

Mark

--

S826/76/01

Environmental Science Paper 1

Date — Not applicable

Duration — 45 minutes



Fill in these boxes and read what is printed below.

Full name of centre

--

Town

--

Forename(s)

--

Surname

--

Number of seat

--

Date of birth

Day

--	--

Month

--	--

Year

--	--

Scottish candidate number

--	--	--	--	--	--	--	--	--

Total marks — 20

Attempt ALL questions.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. Score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



Total marks — 20
Attempt ALL questions

The Forest of Glen Tanar in Aberdeenshire is the third largest expanse of native Scots pine woodland in the UK. It was declared a National Nature Reserve (NNR) in 1979 and a Site of Special Scientific Interest (SSSI) in 1984. The majority of the forest lies within the Cairngorms National Park.

A motorsports organisation is seeking permission to hold a car rallying stage within the Forest of Glen Tanar. They want to use the Glen Tanar area for one week in June, and will make use of existing forest tracks. The proposed route will pass mostly through areas of semi-managed Scots pine woodland and moorland.

The rally attracts international attention and is expected to bring an additional 4000 visitors into the area during the stage. It is estimated that the rally could contribute approximately £250 000 to the local economy.

An assessment of potential impacts of the rally stage on the area must be undertaken.

Using the information shown in the Supplementary Source booklet, answer the following questions.



* S 8 2 6 7 6 0 1 0 2 *

1. (a) **Source B** shows the key aims of the Cairngorms National Park which are referred to when considering proposals and developments within the national park.

Suggest why the Cairngorms National Park may have difficulty fulfilling all these aims.

2

- (b) **Source C** shows the percentage of employment by industry sector within the Cairngorms National Park, the Highlands and Islands, and Scotland.

- (i) Identify the sector with greatest percentage employment within the Cairngorms National Park.

1

- (ii) Suggest one advantage and one disadvantage of having so many people employed in this one industry sector.

2

Advantage:

Disadvantage:

- (iii) According to the 2011 National Census, the population living within the Cairngorms National Park was 24 822.

Calculate how many people were employed in agriculture, forestry and fishing within the Cairngorms National Park.

1

Space for working

[Turn over



* S 8 2 6 7 6 0 1 0 3 *

1. (continued)

- (c) Other than forestry, the land around Glen Tanar is currently used for hill sheep farming, hunting, fishing, walking, mountain biking, horse riding, wildlife photography and estate safaris.

Suggest two reasons why the land users might object to the proposed rally stage in the Forest of Glen Tanar.

2



* S 8 2 6 7 6 0 1 0 4 *

2. (a) Ecologists surveying the proposed rally area used an index of diversity to compare common woodland bird species present in three areas that may be affected by the rally. These surveyed areas are marked on the map as Site 1, Site 2 and Site 3.

The index is calculated using the following formula:

$$I = \frac{\text{sum of absolute (positive) differences from mean}}{\text{number of species}}$$

The lower the index, the greater the species diversity at the site.

The ecologists collected the following data.

Bird species	Number of birds recorded at each site		
	Site 1	Site 2	Site 3
Blackbird (<i>Turdus merula</i>)	20	10	2
Chaffinch (<i>Fringilla coelebs</i>)	25	8	7
Rook (<i>Corvus frugilegus</i>)	14	17	6
Siskin (<i>Carduelis spinus</i>)	15	10	24
Song thrush (<i>Turdus philomelos</i>)	6	15	11

They used the following table to calculate the index for each site.

Bird species	Site 1		Site 2		Site 3	
	Number of individuals	Difference from mean	Number of individuals	Difference from mean	Number of individuals	Difference from mean
Blackbird	20	4	10	2	2	
Chaffinch	25	9	8	4	7	
Rook	14	2	17	5	6	
Siskin	15	1	10	2	24	
Song thrush	6	10	15	3	11	

Mean	16	–	12	–		–
------	----	---	----	---	--	---

Sum of differences from mean	–	4 + 9 + 2 + 1 + 10 = 26	–	16	–	
------------------------------	---	-------------------------	---	----	---	--

Index	26 ÷ 5 = 5.2		3.2			
-------	--------------	--	-----	--	--	--

[Turn over



2. (a) (continued)

(i) Calculate the index for Site 3.

2

(ii) State which of the three sites has the greater species diversity.

1



* S 8 2 6 7 6 0 1 0 6 *

2. (continued)

- (b) Glen Tanar SSSI is known to be very rich in invertebrates. Some are only found in Scots pine woodland. The table below shows some species of beetles named in the SSSI citation, and their preferred habitat.

Beetle species	Habitat
<i>Chrysanthia nigricornis</i>	Well-rotted fallen pine branches.
<i>Dictyoptera aurora</i>	Larvae develop in rotting pine trunks.
<i>Dendrophagus crenatus</i>	Below bark on recently fallen pine branches.
<i>Rhagium inquisitor</i>	Below bark on recently fallen pine branches.
<i>Rhagium bifasciatum</i>	Well-rotted pine branches.
<i>Quedius anthopus</i>	Rotten pine stumps.
<i>Pytho depressus</i>	Recently fallen pine trunks.
<i>Pityogenes quadridens</i>	Rotting pine bark.

Select which of the following sampling methods would be most appropriate for assessing the populations of the named beetles.

2

Justify your answer.

- transect and quadrat
- capture-mark-recapture
- paired statement key

[Turn over



* S 8 2 6 7 6 0 1 0 7 *

2. (continued)

- (c) The top speed of a rally car is around 140 mph, although the average speed can be significantly lower.

Suggest an environmental impact of high speed rallying within the forest.

1

- (d) The motorsports organisation would deploy a 'self-repair team' to manage the impact of the rally cars on the forest tracks. Following the event, this team would ensure that the tracks are returned to their previous state.

Suggest a reason why this would not fully address the environmental impacts of the rally.

1



3. A decision must be made about whether to grant permission to run the car rally through the Forest of Glen Tanar.

Using evidence from the information provided, and your knowledge of environmental science, decide whether or not permission should be granted.

Justify your answer.

5

[END OF SPECIMEN QUESTION PAPER]



* S 8 2 6 7 6 0 1 0 9 *

MARKS

DO NOT
WRITE IN
THIS
MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



* S 8 2 6 7 6 0 1 1 0 *

MARKS

DO NOT
WRITE IN
THIS
MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



* S 8 2 6 7 6 0 1 1 1 *



National
Qualifications
SPECIMEN ONLY

S826/76/11

**Environmental Science
Paper 1 — Supplementary Source Booklet**

Date — Not applicable

Duration — 45 minutes

Supplementary Sources of Information

Source A is a map extract showing the Forest of Glen Tanar in Aberdeenshire.

Source B is a table showing the aims of the Cairngorms National Park.

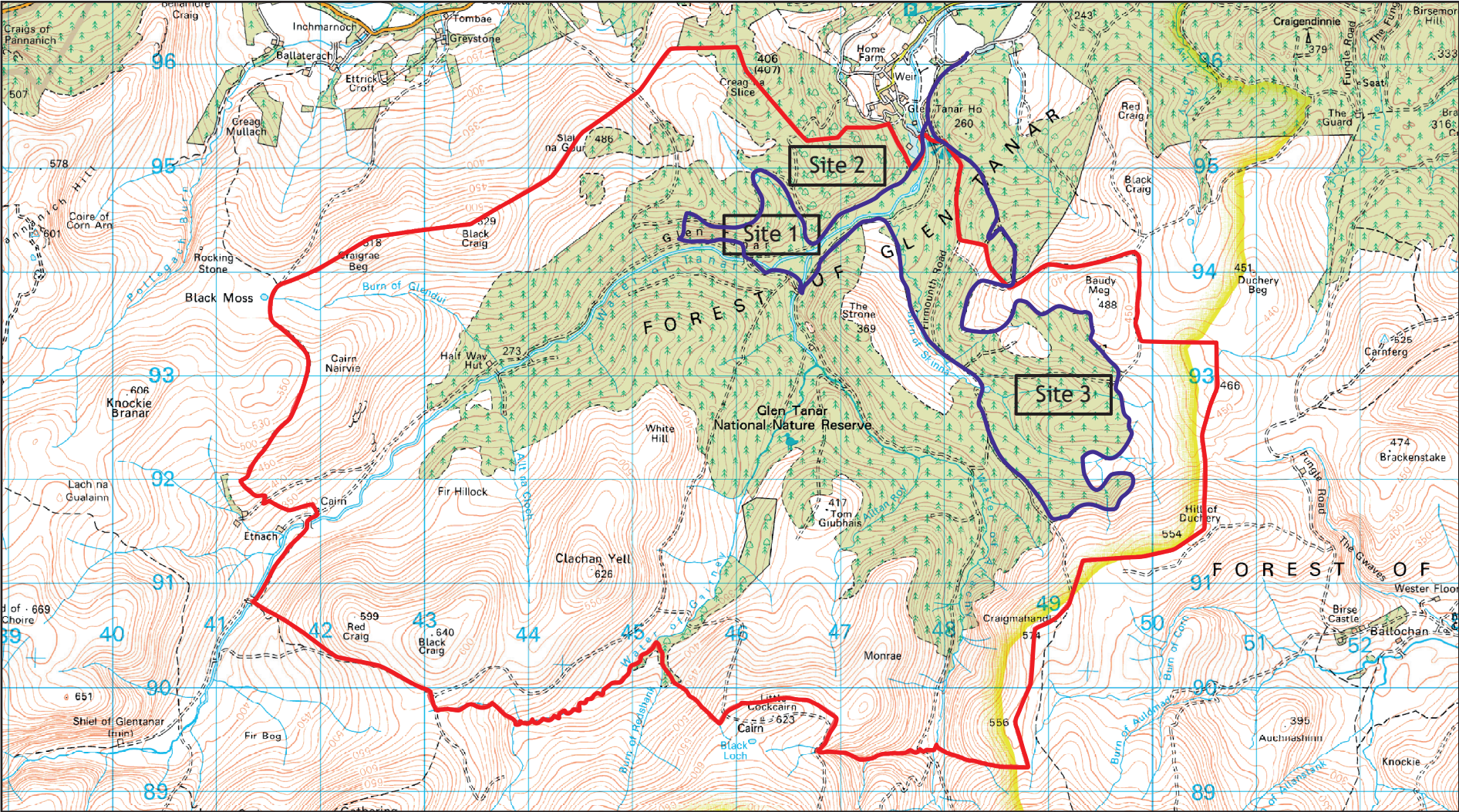
Source C is a graph showing percentage employment by industry sector within the Cairngorms National Park, the Highlands and Islands, and Scotland.

Source D is a table of information about the proposed rally stage in the Forest of Glen Tanar.











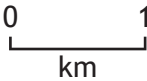
* S 8 2 6 7 6 1 1 *

Source A: Map extract showing the Forest of Glen Tanar in Aberdeenshire



Key

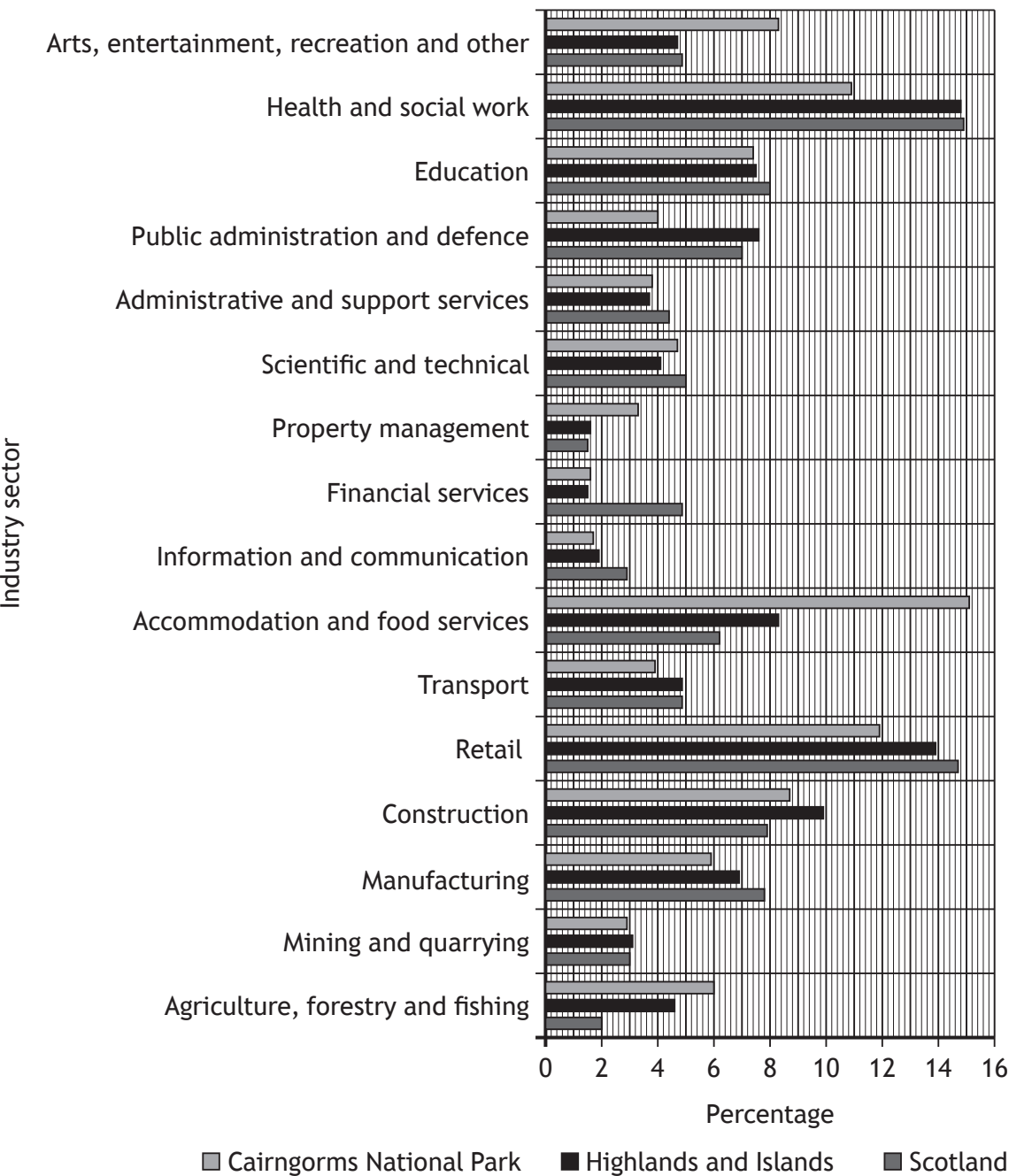
- | | |
|--|---|
|  Coniferous woodland |  Path / other road, drive or track |
|  SSSI boundary |  River |
|  National Park boundary |  Proposed rally route |
|  Forest track |  Survey sites |



Source B: Aims of the Cairngorms National Park

1.	To conserve and enhance the natural and cultural heritage of the area.
2.	To promote sustainable use of the natural resources of the area.
3.	To promote understanding and enjoyment (including enjoyment in the form of recreation) of the special qualities of the area by the public.
4.	To promote sustainable, economic, and social development of the area’s communities.

Source C: Percentage employment by industry sector within the Cairngorms National Park, the Highlands and Islands, and Scotland



Source D: information about the proposed rally stage in the Forest of Glen Tanar

- Access to the Forest of Glen Tanar is required for one week in June, with the rally stage taking place over one weekend.
- The rally is expected to attract international attention.
- The rally is predicted to bring in an additional 4000 visitors to the Glen Tanar area and Cairngorms National Park.
- It has been estimated that the rally could contribute around £250 000 to the local economy.
- The rally stage will make use of existing forest tracks, with the route passing through areas of semi-managed Scots pine woodland and moorland.
- Road signs will direct visitors to official car parks and spectator access points along the rally stage route. These access points will be located on minor country roads.
- Toilet facilities will be located at official spectator access points.
- Spectators will be encouraged to take their litter home, with a limited number of litter bins provided beside official toilet facilities.

[END OF SUPPLEMENTARY SOURCE BOOKLET]

Acknowledgement of Copyright

- Source A Map extract of *Glen Tanar* is taken from http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=724. Produced by: Geographic Information Group, SNH, 2011. Reproduced by kind permission of Scottish Natural Heritage Sitelink. © Crown Copyright and database rights (2017) – OS OpenData.
- Source B Aims of the Cairngorms National Park are taken from <http://cairngorms.co.uk/authority>. Reproduced by kind permission of the Cairngorms National Park Authority.
- Source C Chart is adapted from Page 6 of Cairngorms National Park Profile, 2014. Reproduced by kind permission Highlands and Islands Enterprise.



National
Qualifications
SPECIMEN ONLY

S826/76/01

**Environmental Science
Paper 1**

Marking Instructions

These marking instructions have been provided to show how SQA would mark this specimen question paper.

The information in this publication may be reproduced to support SQA qualifications only on a non-commercial basis. If it is reproduced, SQA should be clearly acknowledged as the source. If it is to be used for any other purpose, written permission must be obtained from permissions@sqa.org.uk.

Where the publication includes materials from sources other than SQA (ie secondary copyright), this material should only be reproduced for the purposes of examination or assessment. If it needs to be reproduced for any other purpose it is the user's responsibility to obtain the necessary copyright clearance.

General marking principles for Higher Environmental Science

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you should seek guidance from your team leader.
- (c) Where a candidate makes an error at an early stage in a multi-stage calculation, award marks for correct follow-on working in subsequent stages. Do not award marks if the error significantly reduces the complexity of the remaining stages. Apply the same principle in questions which require several stages of non-mathematical reasoning.
- (d) Award full marks for a correct final answer (including units if required) on its own, unless a numerical question specifically requires evidence of working to be shown.
- (e) Candidates may access larger mark allocations fully, whether they respond in continuous prose, linked statements or a series of discrete developed points.
- (f) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (g) In the detailed marking instructions, words separated by / are alternatives.
- (h) Do not award marks if a candidate gives two answers, where one is correct and the other is incorrect.
- (i) Where the candidate is instructed to choose one question to answer but instead answers both questions, mark both responses and award the better mark.
- (j) Award marks for a valid response, even if the response is not presented in the format expected. For example, award the mark if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested.
- (k) Candidates may use abbreviations (for example BOD, GPP) or chemical formulae (for example CO₂, H₂O) as acceptable alternatives to naming, unless otherwise required by the question.
- (l) Award marks, up to the maximum mark allocation for the question, for content that is outwith the course specification but used appropriately at the correct level for Higher.
- (m) If candidates are required to give a numerical answer, and units are not given in the stem of the question or in the answer space, they must supply the units to gain the mark. Do not penalise candidates repeatedly if units are required on more than one occasion.
- (n) If incorrect **spelling** is used:
 - and the term is recognisable, then award the mark;
 - and the term can easily be confused with another scientific term, then do not award the mark, for example bioaccumulation and biomagnification, or qualitative and quantitative;
 - and the term is a mixture of other terms, then do not award the mark.

(o) When presenting data:

- for marking purposes no distinction is made between bar charts (used to show discontinuous features, have descriptions on the x-axis and have separate columns) and histograms (used to show continuous features, have ranges of numbers on the x-axis and have contiguous columns)
- other than in the case of bar charts/histograms, if the question asks for a particular type of graph or chart and the wrong type is given, then do not give the mark(s) for this. Where provided, award marks for correctly labelling the axes, plotting the points, joining the points either with straight lines or curves (best fit rarely used) etc
- do not award the relevant mark if the graph uses less than 50% of the axes; if the x and y data are transposed; if 0 is plotted when no data for this is given (ie candidates should only plot the data given)

(p) Award marks only for a valid response to the question asked. For example, in response to questions that ask candidates to:

- **identify, name, give, or state**, they need only name or present in brief form
- **define**, they should give a statement of the definition
- **calculate**, they must determine a number from given facts, figures or information
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things
- **describe**, they must provide a statement or structure of characteristics and/or features
- **evaluate**, they must make a judgement based on criteria
- **explain**, they must relate cause and effect and/or make relationships between things clear
- **outline**, they must provide a brief sketch of content— more than naming but not a detailed description
- **predict**, they must suggest what may happen based on available information
- **suggest**, they must apply their knowledge and understanding of environmental science to a new situation. A number of responses are acceptable: award marks for any suggestions that are supported by knowledge and understanding of environmental science

Marking instructions for each question

Question			Expected answer(s)	Max mark	Additional guidance
1.	(a)		It is difficult to conserve the natural and cultural heritage (1 mark) while also encouraging people to use it (1 mark) OR Development will result in damage/degradation of habitats or wildlife (1 mark) so not meet the conservation aim (1 mark) Or any other valid response.	2	Response should refer to the impact of one aim on another aim.
	(b)	(i)	Accommodation and food services.	1	
		(ii)	Advantages – brings money into the area / jobs are flexible and would suit a wide range of circumstances Disadvantages – many jobs will be low paid / may be seasonal / may require people to have multiple jobs / limited progression opportunities / reliant on tourism Or any other valid response.	2	1 mark for advantage. 1 mark for disadvantage.
		(iii)	1489	1	$24\,822 \times 6\% = 1489.32$ Must be rounded to a whole person. Accept 1489 or 1490.
	(c)		Access would be restricted / noise pollution could disturb wildlife / landscape could be damaged by vehicles or trampling / risk of injury Or any other valid response.	2	Any two valid points.

Question			Expected answer(s)	Max mark	Additional guidance
2.	(a)	(i)	6	2	<p>1 mark for correctly calculating the mean for site 3.</p> <p>1 mark for correctly calculating the index for site 3.</p> <p>Mean = $(2+7+6+24+11) \div 5 = 10$</p> <p>Index = $(8+3+4+14+1) \div 5 = 6$</p> <p>Allow for follow through where the calculated mean is incorrect but the index is correctly calculated using the incorrect mean.</p>
		(ii)	Site 2	1	Of the three sites, Site 2 has the lowest index (3.2), which indicates the greatest diversity.
	(b)		<p>Capture-mark-recapture is a method for calculating population estimations</p> <p>OR</p> <p>Because:</p> <p>Transect and quadrat are used to assess what is present within the quadrat on one occasion only.</p> <p>Paired statement key is used to identify species, not to sample them.</p> <p>Or any other valid response.</p>	2	<p>1 mark for capture-mark-recapture.</p> <p>1 mark for appropriate reasoning.</p>
	(c)		<p>Noise pollution / air pollution / wildlife disturbed or killed / habitat destruction / soil erosion / dust pollution / vegetation flattened by cars</p> <p>Or any other valid response.</p>	1	Any one valid point.
	(d)		Only manages the physical damage to the track, not pollution or damage to vegetation or habitats.	1	

Question			Expected answer(s)	Max mark	Additional guidance
3.			<p>Yes:</p> <ul style="list-style-type: none"> • Potential to gain £250 000 for the local economy / boost to local businesses, which meets aim 4 of the Cairngorms National Park • People coming to the rally may stay longer in the area and spend more on other activities, which will support employment in accommodation and food services / arts, entertainment and recreation. • Is an exciting prospect for locals to have an internationally significant event on their doorstep, and they could get involved, which meets aim 3. • Is only for one week of the year, so environmental impact would be limited and habitats would recover. • Rally will make use of existing tracks so there would not be any new habitat destruction. • Activities which could impact on wildlife already take place in the area, so one more won't make much difference. <p>No:</p> <ul style="list-style-type: none"> • People interested in wildlife may be put off visiting due to the noise and disruption, resulting in loss of money to the area. • It is an SSSI and the rally could damage the habitat of endangered beetle species. • Traffic congestion on narrow country roads, resulting in increased journey times for locals. • Animal/bird disturbance, could affect breeding or development of young. • Rallying would result in significant noise and air pollution. • Clean water sources are likely to be affected by erosion of the tracks, increasing sedimentation. <p>Or any other valid response.</p>	5	<p>1 mark for each valid justification.</p> <p>Candidates may gain full marks by putting forward legitimate arguments supporting the rally OR arguments against the rally OR giving a balanced set of arguments which outline both sides of the debate.</p>

[END OF SPECIMEN MARKING INSTRUCTIONS]