

FOR OFFICIAL USE



National  
Qualifications  
SPECIMEN ONLY

Mark

**S826/75/01**

**Environmental Science**

Date — Not applicable

Duration — 2 hours 30 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 — 100**

**SECTION 1 — 66 marks**

Attempt ALL questions.

**SECTION 2 — 20 marks**

Attempt ALL questions.

**SECTION 3 — 14 marks**

Questions 15 and 16 each contain a choice.

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.



SECTION 1 — 66 marks

Attempt ALL questions

1. Buzzards are birds of prey, commonly found throughout Scotland.



- (a) State the term used to describe the place where buzzards live.

1

\_\_\_\_\_

- (b) Buzzards are part of the woodland ecosystem, which has several components.

Complete the table below to identify the terms and their definitions.

2

<i>Term</i>	<i>Definition</i>
Community	All the organisms that live together in an ecosystem.
Species	
	The variety that exists within living things.

1. (continued)

MARKS

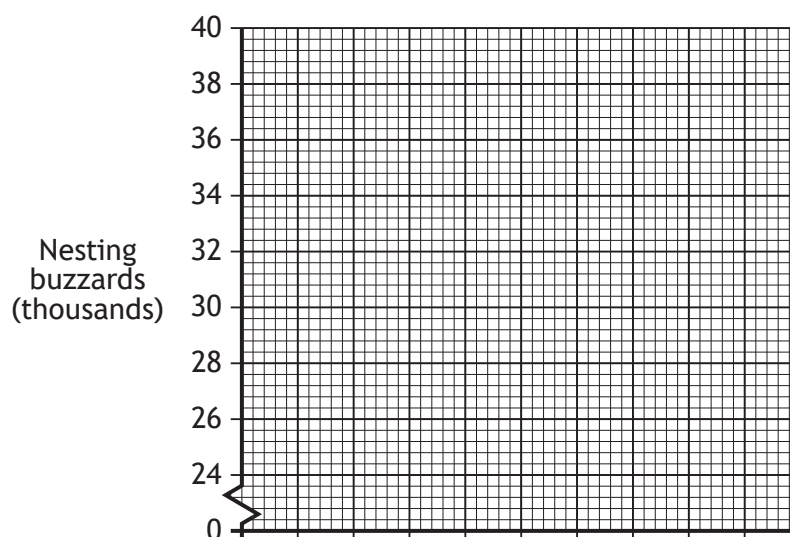
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- (c) The table below shows the changes in the number of nesting buzzards in northern Scotland between 2007 and 2015.

Year	Number of nesting buzzards (thousands)
2007	30.0
2009	30.5
2011	31.5
2013	32.5
2015	34.0

- (i) Using the information from the table, complete a bar graph below by:

- 1 adding the scale and label to the horizontal (x) axis; 1
- 2 showing the number of nesting buzzards between 2007 and 2015. 1



(Additional graph paper, if required, can be found on *page 31*.)

- (ii) Use the data to predict the nesting buzzard population in 2017. 1

\_\_\_\_\_ buzzards

- (iii) Suggest how the reliability of the data relating to the number of buzzards could be improved. 1

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2. The Borders Railway linking Edinburgh to Tweedbank in the Scottish Borders opened in 2015. It is the largest new railway to be built in the UK for over 100 years.

- (a) Some people believe that a rail link between Edinburgh and the Scottish Borders will help reduce the impact on climate change.

Indicate whether you agree, disagree, or neither agree nor disagree with this statement by ticking (✓) the appropriate box below.

Give a reason for your choice.

1

	Tick (✓)
Agree	
Disagree	
Neither agree nor disagree	

Reason \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- (b) The railway tracks are made of steel.

A number of statements about steel are listed below.

Tick (✓) the statements that are correct.

1

Steel is a

renewable resource

☐

non-renewable resource

☐

physical resource

☐

biological resource.

☐

- (c) State **two** uses of iron, other than for making steel railway tracks.

2

\_\_\_\_\_

\_\_\_\_\_



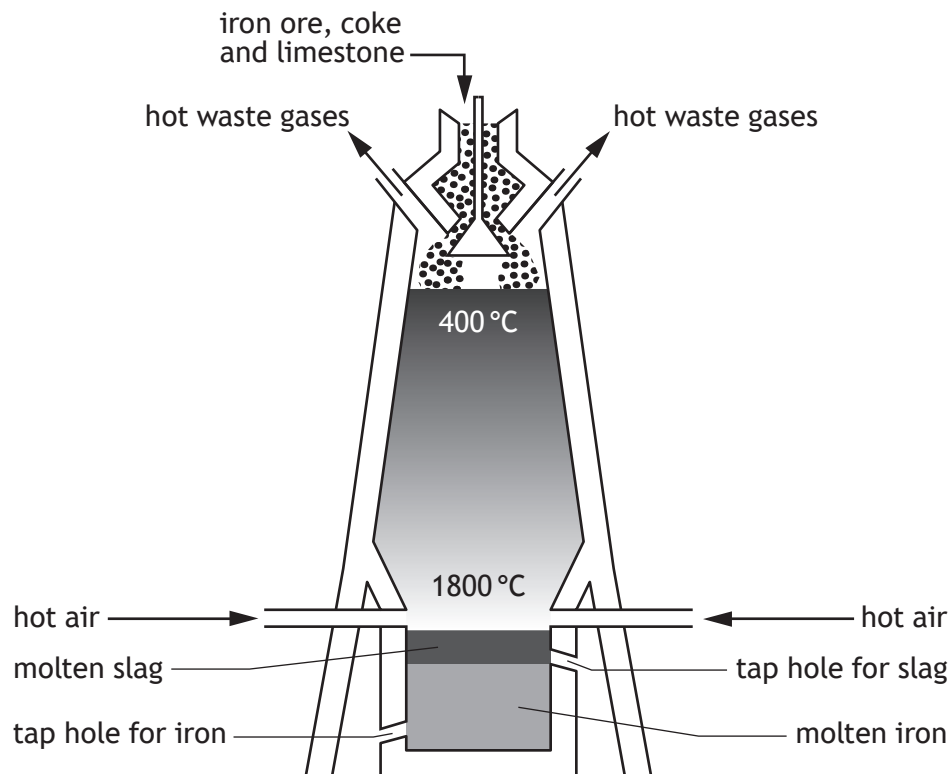
2. (continued)

MARKS

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- (d) A mixture of iron ore, coke and limestone is heated to produce molten iron. Steel is made from molten iron.

The diagram below shows the industrial equipment that is required to produce molten iron.

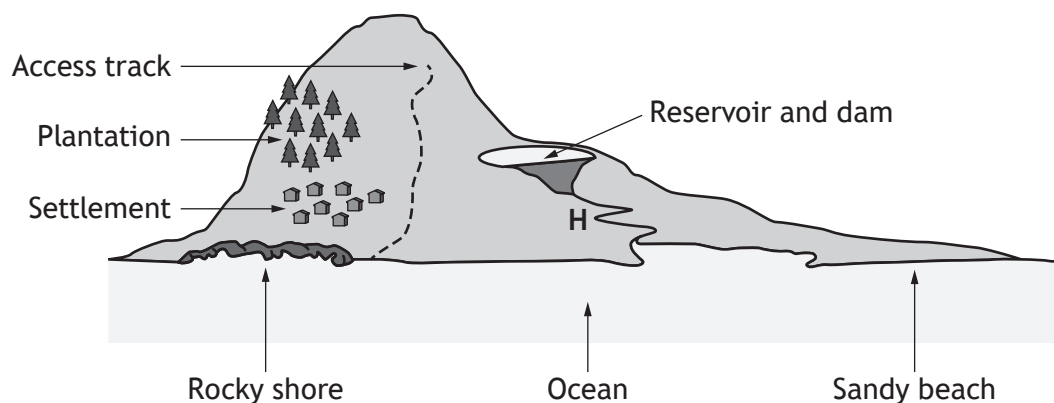


- (i) Name the piece of industrial equipment that is used to produce molten iron. 1
- \_\_\_\_\_
- (ii) Name one waste gas given off during the production of molten iron. 1
- \_\_\_\_\_
- (iii) Describe the purpose of adding limestone during the production of molten iron. 1
- \_\_\_\_\_
- \_\_\_\_\_

[Turn over



3. The diagram below shows an island where renewable sources of energy are used to generate electricity.



- (a) Site H shows the location of a hydroelectric power (HEP) scheme.  
Describe one advantage and one disadvantage of locating the HEP scheme here.

2

Advantage \_\_\_\_\_

\_\_\_\_\_

Disadvantage \_\_\_\_\_

\_\_\_\_\_

- (b) (i) Other than the HEP scheme, suggest one other way in which water could be used to generate electricity.

1

\_\_\_\_\_

- (ii) Explain how energy sources from water can be sustainable.

1

\_\_\_\_\_

\_\_\_\_\_



3. (continued)

MARKS

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- (c) The school on the island has installed a new biomass boiler to provide heat. The wood pellets that are used to power the boiler come from a sustainably managed source on the island.

- (i) The annual cost of heating the school was £20 000. The biomass boiler has reduced this cost by 80%.

Calculate the new annual cost of heating the school.

1

*Space for calculation*

£ \_\_\_\_\_

- (ii) The government has set a target to reduce greenhouse gas emissions. The biomass boiler replaced an oil-fired boiler.

Compare the greenhouse gas emissions from burning biomass with those from burning oil.

2

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- (d) In order to make the island's energy supply completely sustainable, there are proposals to build a wind turbine.

Place a 'W' on the island diagram to indicate the best location for a wind turbine.

1

[Turn over



\* S 8 2 6 7 5 0 1 0 7 \*

4. The global human population currently stands at over seven billion people and is growing at a rate of around 1% per year.

- (a) State **one** example of an environmental impact brought about by the increasing human population, **and** describe its effect on biodiversity.

2

Environmental impact

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Effect on biodiversity

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- (b) Genetically modified (GM) crops are grown in many countries.

Supporters of GM crops believe that the crops will help relieve the pressure on food supplies brought about by the increasing global human population.

A 2010 survey found that 70% of European citizens are against growing GM crops or importing GM foods into Europe.

- (i) Suggest **one** reason why so many Europeans may have this view.

1

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- (ii) Other than growing GM crops, state **two** farming strategies that would help to provide food supplies for the increasing global human population.

2

1 \_\_\_\_\_

2 \_\_\_\_\_





**MARKS**

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- (i) Year-round access to produce that is usually seasonal can have environmental consequences.

2

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- Outline the advantages and disadvantages of using organic farming methods.

4

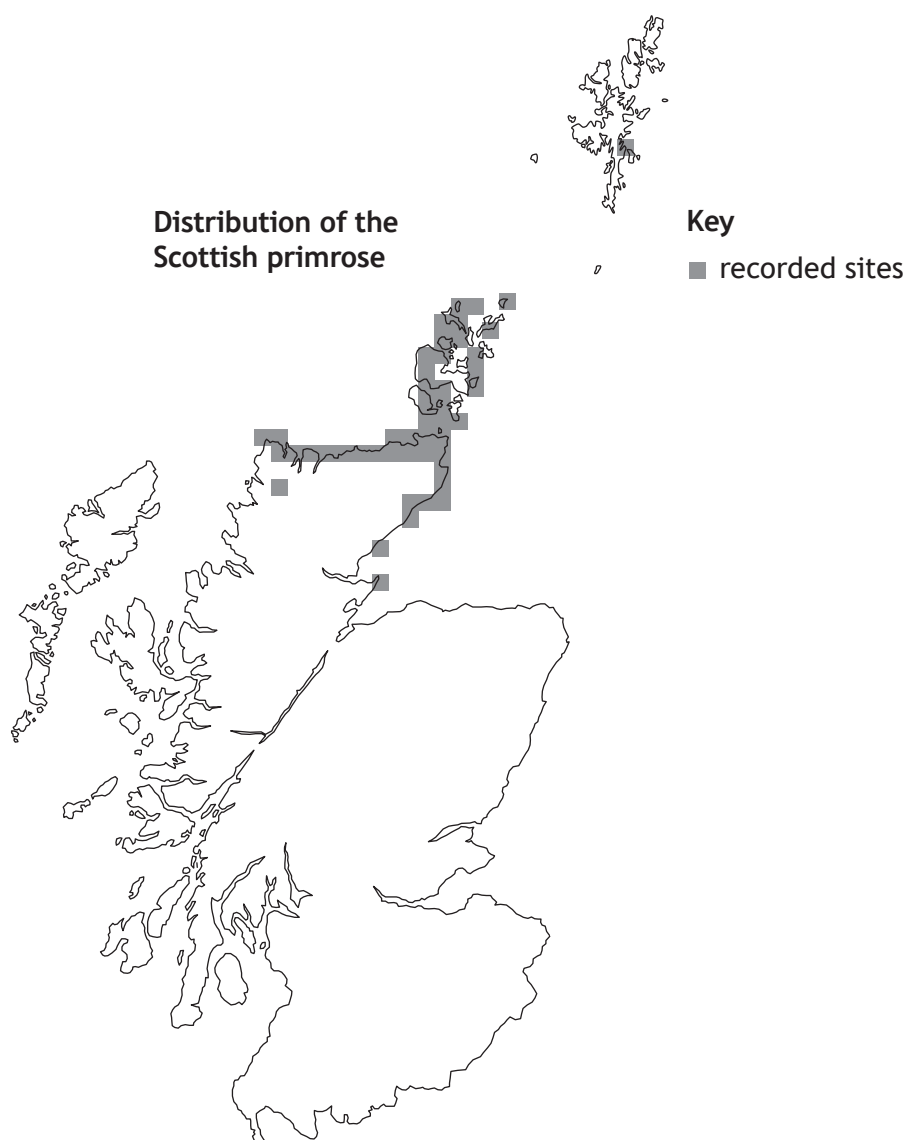
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\* S 8 2 6 7 5 0 1 0 9 \*

5. It is predicted that the average temperature across Scotland will rise by around 2 °C by the 2050s. This increase could have a significant impact on the distribution of many species of plants, including the Scottish primrose.

The Scottish primrose is a plant native to Scotland. It is adapted to a cool climate with short summers, and is mostly found on the coasts of Caithness and north-west Sutherland and in the Orkney Isles. The Scottish primrose produces more seedlings in warmer periods but these are easily out-competed by other species.

The current distribution of the Scottish primrose is shown on the map below.



- (a) Explain the impact an increase in temperature could have on the future distribution of the Scottish primrose.

2

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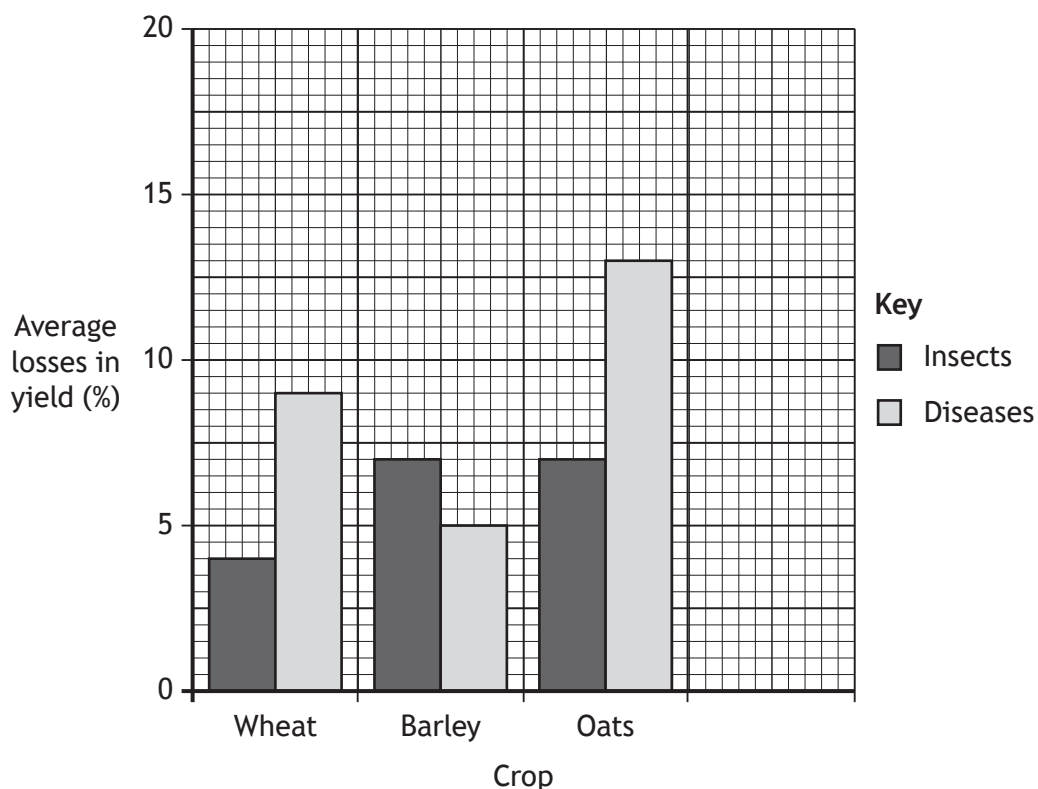
5. (continued)

MARKS

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- (b) The predicted temperature increase may also result in an increase in pest species and diseases which affect crops.

The graph below shows the average losses in percentage yield caused by insects and diseases in the production of three types of crop in Scotland.



- (i) State which crop has the lowest combined percentage loss from these two causes.

1

*Space for working*

Crop \_\_\_\_\_

- (ii) Explain why it would not be a valid conclusion to say that diseases caused more tonnes of oats to be lost than any of the other crops named.

1

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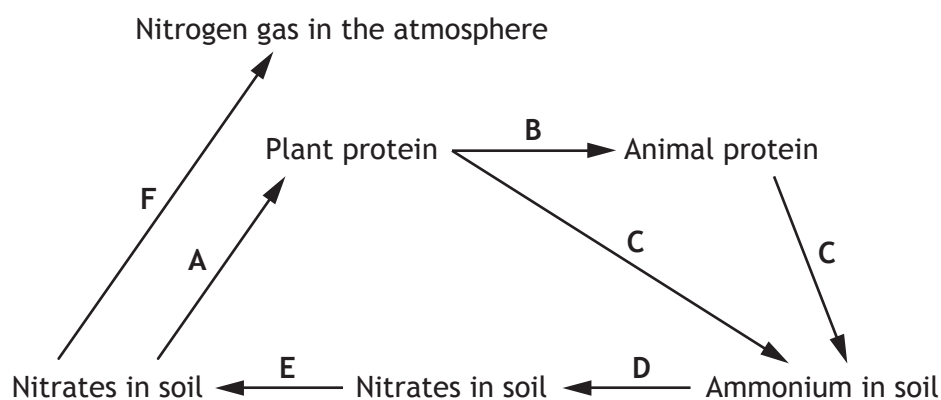


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[Turn over



6. The diagram below represents part of the nitrogen cycle.



Use the information from the diagram to answer the following questions.

- (a) (i) On the diagram above add one arrow to represent nitrogen fixation. 1
- (ii) State which letter in the diagram represents decay. 1
- Letter \_\_\_\_\_
- (iii) Explain the effect on plant growth if process F was increased. 2
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (b) State a nitrogen-containing substance that can be added to soil to increase crop yield. 1
- \_\_\_\_\_

7. Lichens are an indicator species that can be found growing on tree trunks in towns and rural areas. Many lichens are sensitive to pollutants in the air.

(a) Define the term *indicator species*.

1

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- (b) The following table shows the approximate maximum levels of air pollution tolerated by some species of lichen.

<i>Lichen species</i>	<i>Maximum level of air pollution tolerated (<math>\mu\text{g m}^{-3}</math>)</i>
<i>Graphis elegans</i>	50
<i>Hypogymnia physodes</i>	70
<i>Lepraria incana</i>	125
<i>Parmelia sulcata</i>	60
<i>Ramalina fraxinea</i>	35
<i>Usnea subfloridana</i>	40

- (i) Identify the lichen that is least tolerant to air pollution.

1

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- (ii) The level of air pollution in one area was found to be  $65 \mu\text{g m}^{-3}$ .  
Select **all** the species of lichen which would be found growing in the area.

1

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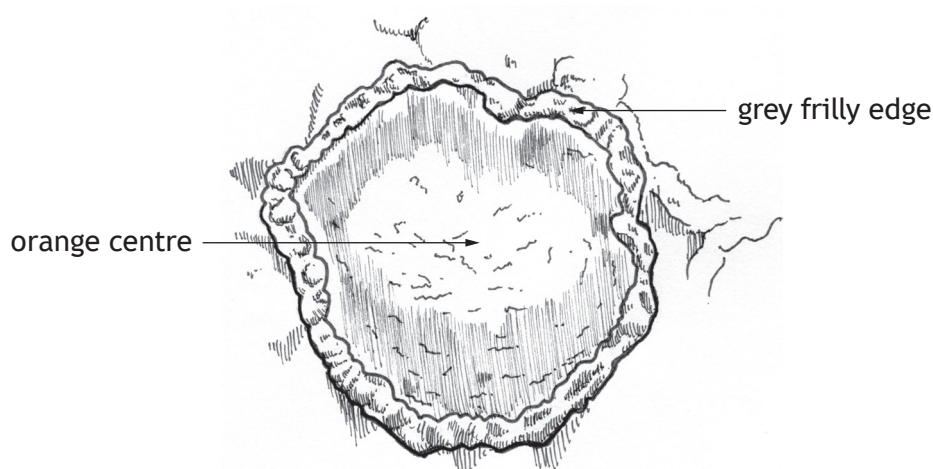
\* S 8 2 6 7 5 0 1 1 3 \*

7. (continued)

MARKS  
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- (c) A field sketch of a lichen, which is loosely attached to a tree trunk by root-like strands, is shown below.

Field sketch of lichen fruiting body



- (i) Using the paired statement key below, identify the lichen shown in the field sketch diagram.

1

1. Lichen cannot be removed from tree bark Lichen can be removed without damaging tree bark	Go to 2 Go to 5
2. Lichen made up of fine powder/tiny balls Lichen not just made up of fine powder	<i>Lepraria incana</i> Go to 3
3. Grey with lobed edges Green or grey without lobed edges	<i>Diploicia canescens</i> Go to 4
4. Yellow-green to green with disc shaped fruits Grey-green with dome shaped fruits	<i>Lecidella elaeochroma</i> <i>Buellia punctata</i>
5. Leafy lichens attached to bark by root-like strands Bushy or hair-like lichens	Go to 6 Go to 7
6. Edges of fruits orange Edges of fruits grey	<i>Degelia plumbea</i> <i>Pannaria rubiginosa</i>
7. Lichen orange Lichen green or grey	<i>Teloschistes flavicans</i> Go to 8
8. Lichen shaped like a string of sausages Lichen not shaped like a string of sausages	<i>Usnea articulata</i> <i>Usnea florida</i>

Lichen \_\_\_\_\_



7. (c) (continued)

MARKS

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- (ii) Give one **similarity** and one **difference** between *Usnea articulata* and *Teloschistes flavicans*.

2

Similarity \_\_\_\_\_

\_\_\_\_\_

Difference \_\_\_\_\_

\_\_\_\_\_

- (iii) Suggest why identification of lichens based on colour may not be very reliable.

1

\_\_\_\_\_

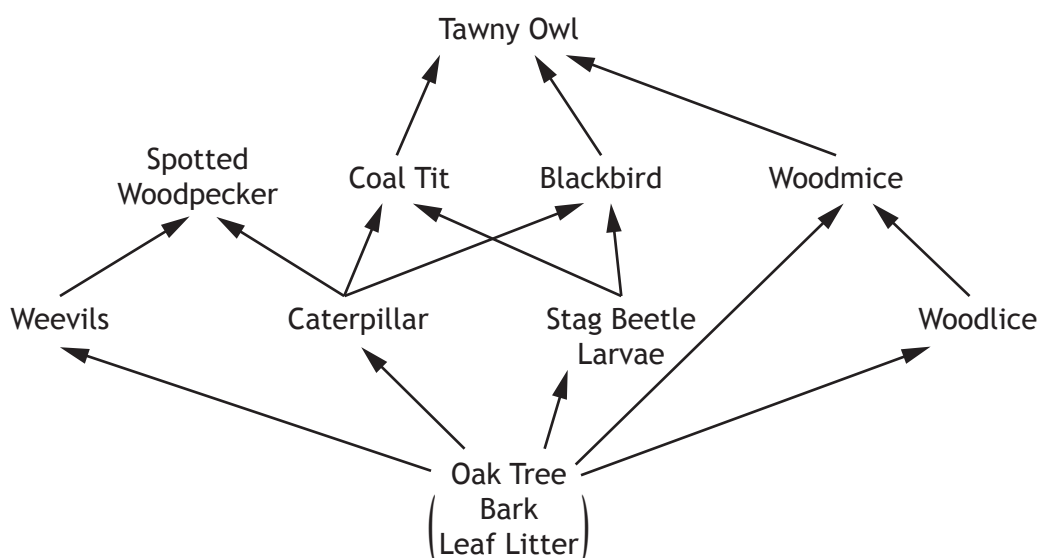
\_\_\_\_\_

[Turn over



\* S 8 2 6 7 5 0 1 1 5 \*

8. The diagram below shows part of a food web in an oak woodland community.



Using information from the diagram answer the following questions.

(a) Name an omnivore.

1

\_\_\_\_\_

(b) Coal tits and spotted woodpeckers share a common food source.

Suggest **two** ways in which competition between these two species is reduced.

2

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(c) State one way in which energy is lost from this food web.

1

\_\_\_\_\_



9. The company responsible for building a new road bridge re-uses or recycles waste materials where possible.

- (a) The table below shows the waste management strategy and the mass of waste produced at the construction site during one month.

<i>Waste management strategy</i>	<i>Mass of waste (tonnes)</i>
Re-used on site	5.00
Recycled off site	14.89
Sent to landfill	2.28

Calculate the percentage of waste that is re-used at the construction site. 2  
Show your working clearly.

*Space for calculation*

\_\_\_\_\_ %

- (b) As a result of the company's waste management strategy, it is estimated that 22 fewer journeys were made between the construction site and the landfill site.

- (i) Describe one benefit to the construction company and one benefit to the environment of reducing the number of journeys to the landfill site. 2

Benefit to the construction company

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Benefit to the environment

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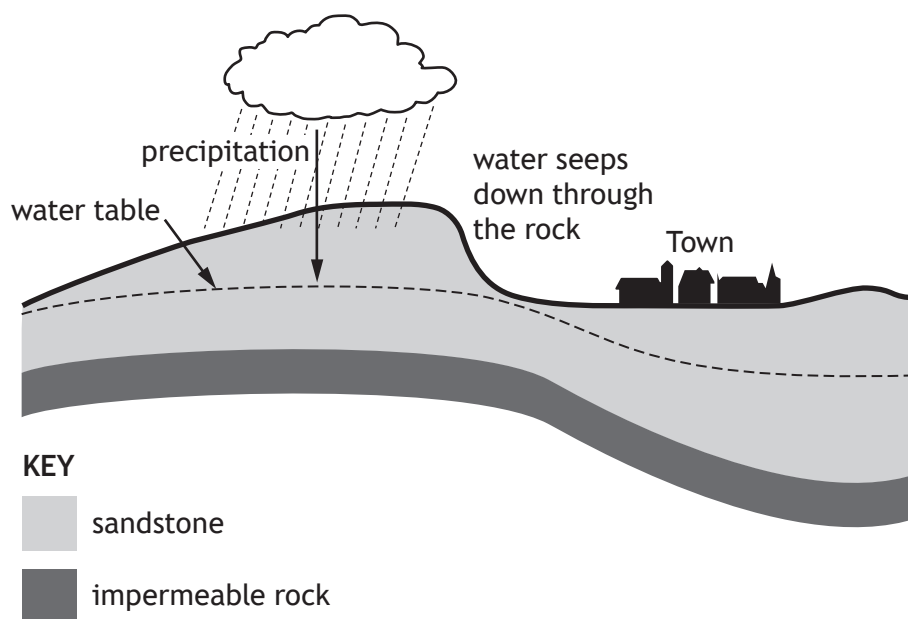
- (ii) Suggest a material from a construction site that could be recycled. 1

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\* S 8 2 6 7 5 0 1 1 7 \*

10. Consider the diagram below, which shows part of the water cycle.



(a) Precipitation infiltrates the ground and is stored as groundwater.

(i) Define the term *groundwater*.

1

\_\_\_\_\_

(ii) Explain how groundwater can be extracted for use as a water supply.

1

\_\_\_\_\_

\_\_\_\_\_

(b) The town is expected to double in size in the future.

Explain how this could affect the water table.

2

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



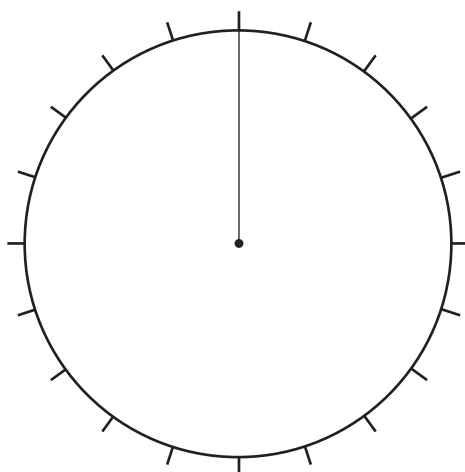
\* S 8 2 6 7 5 0 1 1 8 \*

(c) The table below shows domestic use of water in a developed country.

<i>Use</i>	<i>Percentage of water used (%)</i>
Flushing toilet	30
Bath and shower	20
Washing machine and dishwasher	15
Drinking	5
Other	30

- (i) Use the data in the table to complete the pie chart.  
Fully label each section clearly.

2



(An additional pie chart, if required, can be found on *page 32*.)

- (ii) Suggest one likely difference in the percentage of domestic water used in a developing country compared to that of a developed country.

1

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- (iii) Give one reason for your answer.

1

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\* S 8 2 6 7 5 0 1 1 9 \*

**SECTION 2 — 20 marks****Attempt ALL questions**

The Forest of Glen Tanar in Aberdeenshire is the third largest expanse of native pinewood in the UK. It was declared a National Nature Reserve (NNR) in 1979 and a Site of Special Scientific Interest (SSSI) in 1984.

A geologist working for a mining company has recently been surveying the area.

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



\* S 8 2 6 7 5 0 1 2 0 \*

11. During the survey, the geologist identified three sample points for further investigation. These are marked on **Source B**.

Two hundred rocks were collected from the river at each of these points. The types of rocks in each sample were identified and counted. The results are shown in the table below.

Sample point	Numbers of each rock type found		
	Granite	Sandstone	Limestone
1	200	0	0
2	170	30	0
3	80	80	40

- (a) (i) Express, as a simple ratio, the number of granite to sandstone to limestone rocks at sample point 3.

1

*Space for working*

\_\_\_\_\_ granite : \_\_\_\_\_ sandstone : \_\_\_\_\_ limestone

- (ii) Using **Source B**, give one reason why granite is the most common rock found at sample point 1.

1

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- (iii) Using **Source B**, explain the trend in the number of granite rocks between sample points 2 to 3.

2

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- (iv) Identify which rock classification is **least** common in the samples of rocks. Circle your answer.

1

sedimentary

igneous

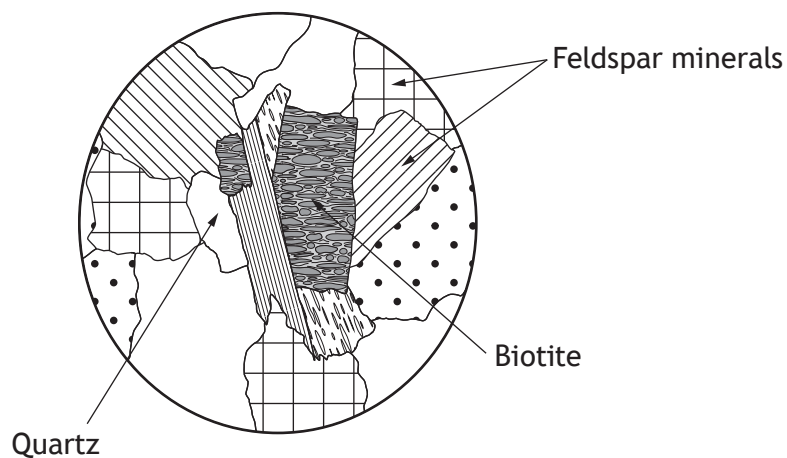
metamorphic

[Turn over



\* S 8 2 6 7 5 0 1 2 1 \*

- (b) The diagram below shows Glen Tanar granite magnified under a microscope. This shows some of the common mineral types it contains.



Define the term *mineral*.

1

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- (c) During the survey the geologist found deposits of gold where granite comes into contact with limestone.

Using **Source B**, state which sample point is most likely to contain some gold.

Give a reason for your answer.

2

Sample point \_\_\_\_\_

Reason \_\_\_\_\_

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\* S 8 2 6 7 5 0 1 2 2 \*

12. The mining company proposes to quarry granite within Glen Tanar forest. This is shown at location **Q** on **Source B**.

**Source C** shows the extent of the proposed quarry area.

Using the information provided in **Source C**, calculate the volume of granite (in million m<sup>3</sup>) that will eventually be removed if the mining company develops the quarry.

1

Use the formula:

$$\text{volume} = \frac{(a \times b \times c)}{2}$$

*Space for calculation*

\_\_\_\_\_ million m<sup>3</sup>

[Turn over



\* S 8 2 6 7 5 0 1 2 3 \*

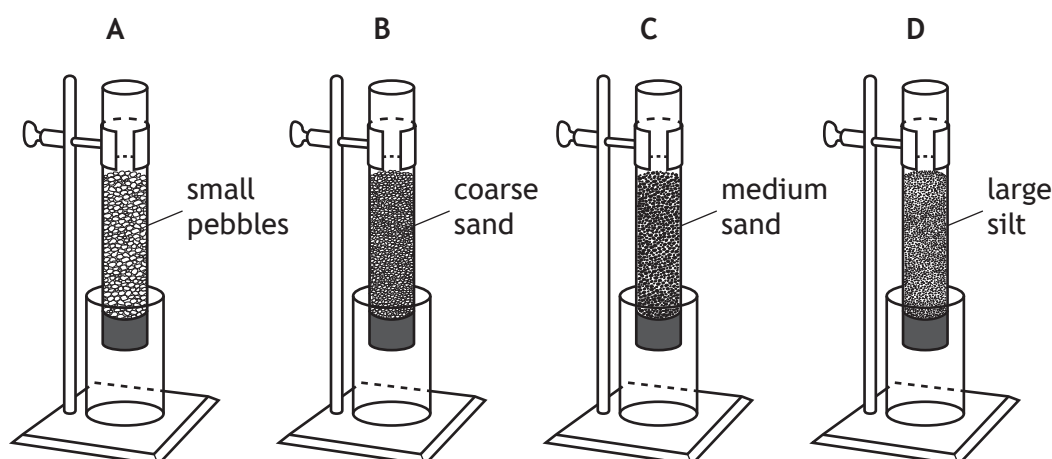
13. A number of environmental assessments must be carried out before permission to develop the quarry can be granted.

- (a) Rock samples from the proposed quarry site will be tested for permeability and porosity.

The geologist will set up an experiment to investigate the effect of the grain size of the rock samples on permeability.

The diagram below shows four columns. The grains in each column are of uniform size and will be dried thoroughly before the experiment is started.

The same volume of water will be poured into each column and the time taken for the water to drain through will be measured.



- (i) State which column the water will drain through most quickly. Suggest a reason for your choice. 1

Column \_\_\_\_\_

Reason \_\_\_\_\_

- (ii) Explain why it is good experimental practice to ensure the grains are dry at the start of the experiment. 1

\_\_\_\_\_  
\_\_\_\_\_

- (iii) Permeability is closely related to porosity. Explain why a rock may have a low permeability but a high porosity. 2

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





- (b) The proposed quarry site is very rich in invertebrates. Some were recorded as vulnerable, rare, or nationally scarce, and some were recorded as only being found in Scots pine forests.

Invertebrate populations within the forest will be assessed in mid-summer. Sampling methods used will include:

- a visual search for holes in decaying trunks and fallen branches
- a sieving of decayed wood debris
- the use of sweep nets on vegetation.

- (i) Name another sampling method that could be used to sample invertebrate populations.

1

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- (ii) State one limitation of the named sampling method.

1

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- (iii) Suggest why sampling took place in mid-summer.

1

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[Turn over



\* S 8 2 6 7 5 0 1 2 5 \*

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

4

[illegible]

\* S 8 2 6 7 5 0 1 2 6 \*

**SECTION 3 — 14 marks**

**Questions 15 and 16 each contain a choice**

Write your answers to questions 15 and 16 on the following pages.

You may use diagrams where appropriate.

- 15. A** Energy produced from wind farms contributes to Scotland's economy.

Describe the effects that wind farms have on:

- (a) landscape
- (b) wildlife.

**7**

**OR**

- B** Commercial fishing is a renewable Scottish industry. However, in recent years, fish stocks have reduced significantly and remaining stocks must be conserved.

Describe and explain the following approaches to conserve fish stocks.

- (a) Marine conservation areas and zoning.
- (b) Sustainable fishing methods.

**7**

- 16. A** Photosynthesis is an important process within the carbon cycle.

Describe the process of photosynthesis and explain its importance to primary consumers.

**7**

**OR**

- B** Freshwater loch ecosystems can be damaged by human activity.

Describe how this may occur and suggest conservation measures which could be taken to minimise this damage.

**7**

**[Turn over**



\* S 8 2 6 7 5 0 1 2 7 \*

MARKS

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SPACE FOR ANSWERS



\* S 8 2 6 7 5 0 1 2 8 \*

SPACE FOR ANSWERS

MARKS

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\* S 8 2 6 7 5 0 1 2 9 \*

MARKS

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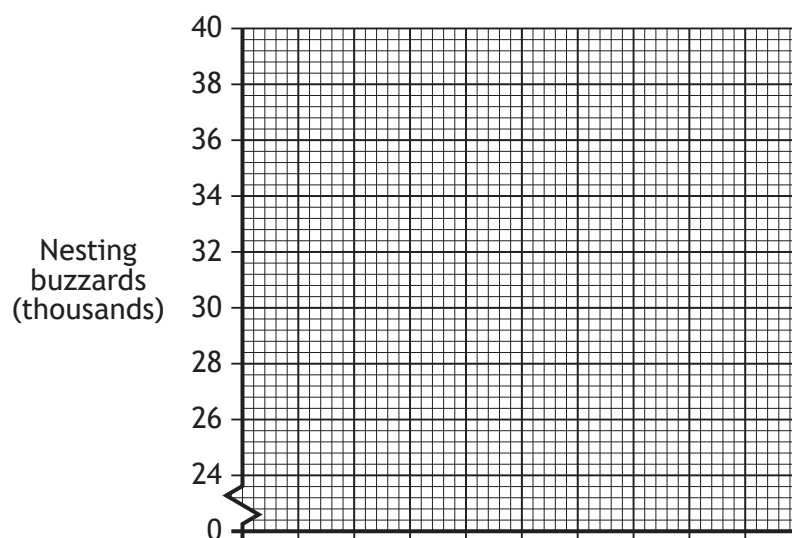
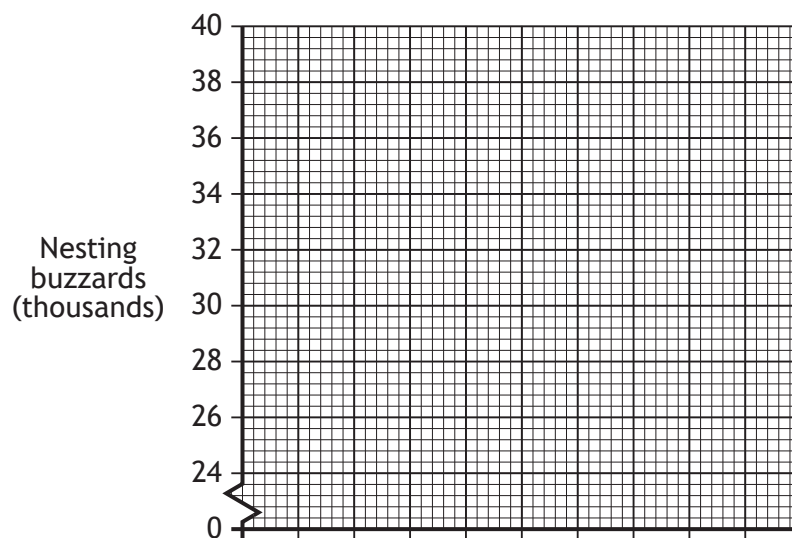
SPACE FOR ANSWERS

[END OF QUESTION PAPER]



ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

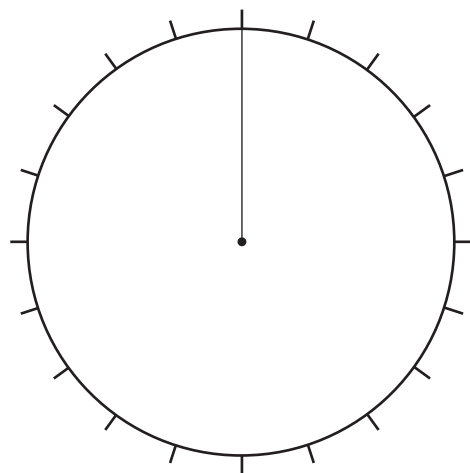
Additional graphs for Question 1 (c) (i)



\* S 8 2 6 7 5 0 1 3 1 \*

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional pie chart for Question 10 (c) (i)



\* S 8 2 6 7 5 0 1 3 2 \*



MARKS

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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



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MARKS

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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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Question 1      aaltair/shutterstock.com





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## **Environmental Science Supplementary Source Booklet**

Date — Not applicable

Duration — 2 hours 30 minutes

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This booklet contains sources for use with Questions 11 to 14 in Section 2.

### **Supplementary Sources of Information**

**Source A** is a map extract showing Glen Tanar in Aberdeenshire.

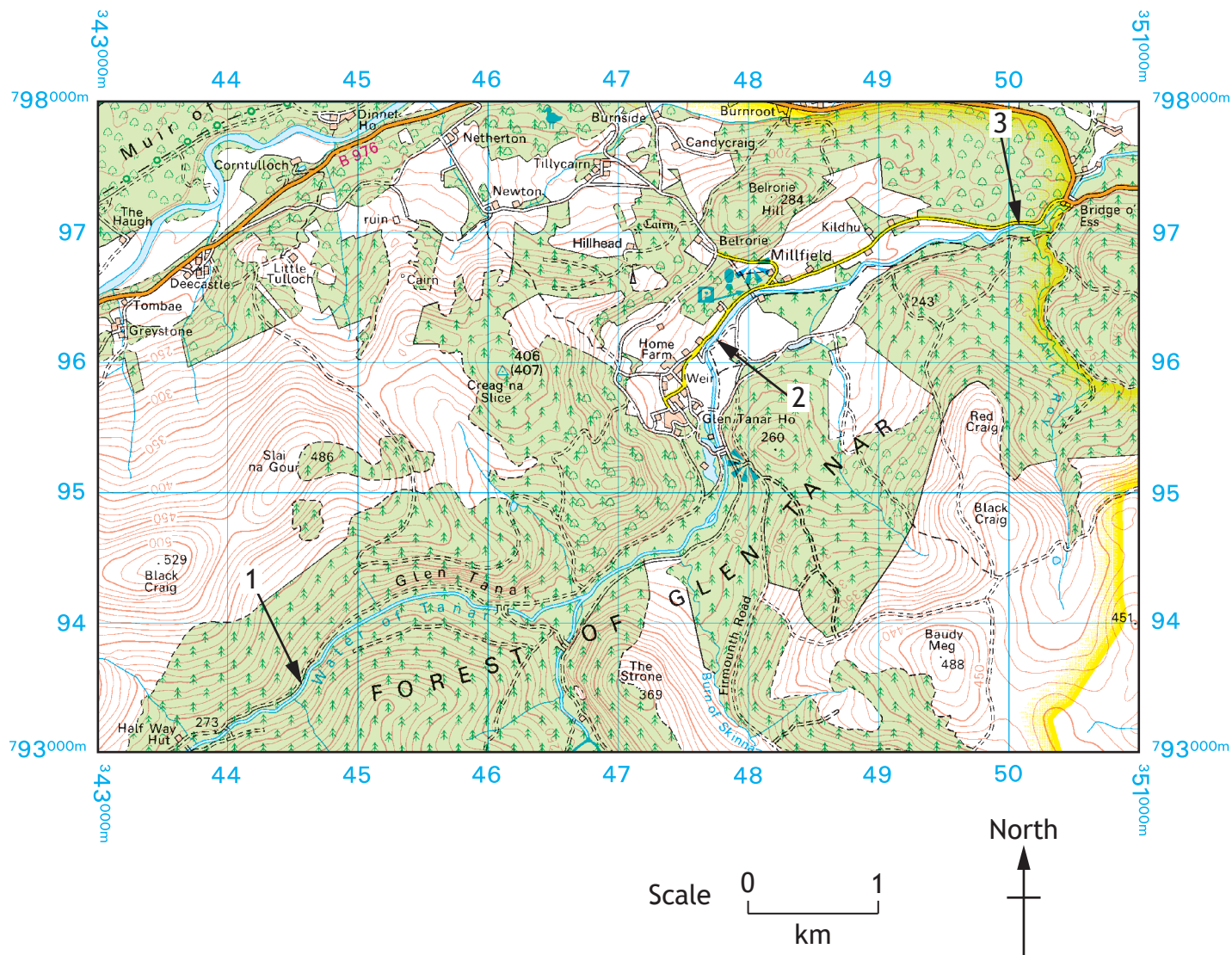
Sources B and C display information relating to the area shown in the Source 1 map extract:

- **Source B** is a sketch map displaying surface rocks and watercourses present in the area
- **Source C** is a profile diagram of a proposed quarry shown at location Q on the sketch map (Source B)







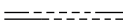




\* S 8 2 6 7 5 1 1 \*

## Source A: Map extract of Glen Tanar in Aberdeenshire



### Map key explaining symbols

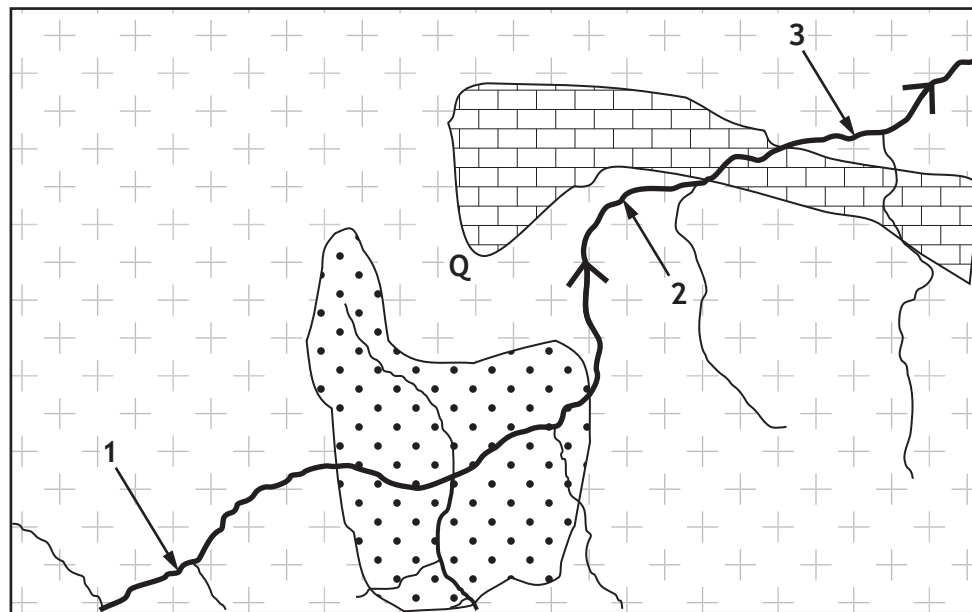
	Parking		Walks/Trails
	Viewpoint		Coniferous wood
	Visitor centre		Non-coniferous wood
	Path/Other road, drive or track		Mixed wood
			Boundary of the Cairngorm National Park (All the area to the west of this line lies within the National Park.)

1 2 3 River bed rock sampling points.

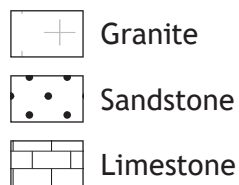
Extract produced by Ordnance Survey Limited 2017.  
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Source B: Sketch map displaying surface rocks and watercourses present in the area



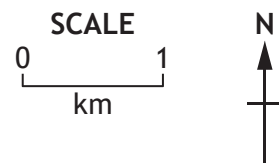
**KEY**



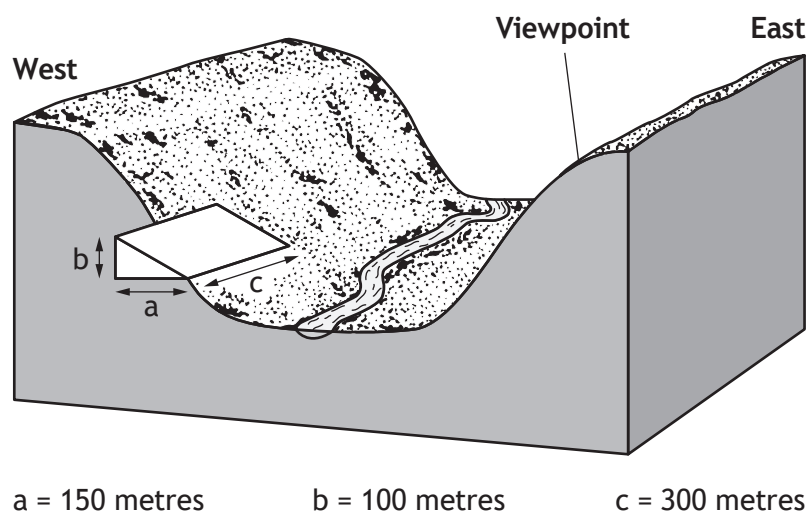
 Arrow showing the direction of river flow

Q: Proposed site for a quarry

1-3: River bed rock sampling points



Source C: Profile diagram of Glen Tanar and quarry site



[END OF SUPPLEMENTARY SOURCE BOOKLET]



National  
Qualifications  
SPECIMEN ONLY

**S826/75/01**

**Environmental Science**

## Marking Instructions

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

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## General marking principles for National 5 Environmental Science

*This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.*

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.
- (c) If a specific 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 must seek guidance from your team leader.
- (d) There are no half marks awarded.
- (e) Where a candidate makes an error at an early stage in a multi-stage calculation, credit should normally be given for correct follow-on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.
- (f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including unit) on its own.
- (g) Where a wrong answer (for which no credit has been given) is carried forward to another step, credit will be given provided the end result is used correctly.

## Marking instructions for each question

### Section 1

Question			Expected answer(s)	Max mark	Additional guidance
1.	(a)		Habitat.	1	
	(b)		A group of organisms that can interbreed to produce fertile offspring.  Biodiversity.	2	1 mark for each.
	(c)	(i)	Adding the scale and an appropriate label to the x-axis.  Correctly drawn bars, with clear bar tops.	1  1	1 mark for adding the scale and appropriate label.  1 mark for accurately drawing the bars.  Allow $\pm\frac{1}{2}$ box tolerance in drawing the bar tops.  A gap should be left between each bar to reflect missing years. Do not award the plotting mark if no gap.
		(ii)	35 500–36 000.	1	Must include thousand otherwise no mark.
		(iii)	Collect data each year (not just each alternative year).  Or any other valid response.	1	
2.	(a)		Agree – rail link means fewer cars on the road so less greenhouse gases.  Disagree – so much greenhouse gas produced during construction.  Neither agree nor disagree – answer as appropriate.	1	Reason must match the decision.
	(b)		Non-renewable resource and physical resource	1	
	(c)		Steel manufactured products/ reinforced concrete/cast iron/ wrought iron products.  Or any other valid response.	2	Any two.



Question			Expected answer(s)	Max mark	Additional guidance
2.	(d)	(i)	Blast furnace.	1	
		(ii)	Carbon dioxide/carbon monoxide/sulphur dioxide.	1	Any one.
		(iii)	Helps remove impurities from the iron (to form slag).	1	
3.	(a)		<b>Advantages:</b> <ul style="list-style-type: none"> <li>Water availability – reservoir/steep slope above power station/head of water.</li> <li>Power station is located on a more gentle slope, so easier to construct.</li> </ul> <b>Disadvantages:</b> <ul style="list-style-type: none"> <li>Not very close to settlement, where demand for power is greatest.</li> <li>No power lines to allow connection to the grid.</li> </ul> Or any other valid response.	2	1 mark for a correct advantage. 1 mark for a correct disadvantage.
	(b)	(i)	Tidal/wave power.	1	
		(ii)	<b>HEP:</b> Dam construction is environmentally damaging/uses cement (which releases carbon dioxide during manufacture) but only needs to be built once.  <b>Tidal:</b> Move away from barrages (which can damage estuarine ecosystems) to submerged turbines.  <b>Wave:</b> Equipment must be robust and firmly attached to land or the seabed but only needs to be installed once.  Or any other valid response.	1	Any one.
	(c)	(i)	£4000	1	$20\,000 \times 80/100 = 16\,000$  $20\,000 - 16\,000 = 4000$

Question			Expected answer(s)	Max mark	Additional guidance
3.	(c)	(ii)	<b>Biomass:</b> Carbon neutral/maintains balance of gases.  <b>Oil:</b> Releases locked-in carbon at a faster rate than can be harnessed/enhances the greenhouse effect.  Or any other valid response.	2	Must compare biomass and oil. Max of 1 mark if only biomass or only oil.
	(d)		‘W’ should be placed near the top of the access track because site is exposed, but still near the settlement to provide power, and above the tree line so not sheltered.	1	Justification not required but this is the most advantageous site.
4.	(a)		<b>Environmental impact:</b> destruction of habitats/ litter/contamination of land or water. Or any other valid response.  <b>Effect on biodiversity:</b> <ul style="list-style-type: none"> <li>• No change – ability of humans to create technical ‘fixes’.</li> <li>• Increase – a focus on conservation actually ensures that biodiversity is encouraged.</li> <li>• Decrease – humans take up more and more land and resources.</li> </ul> Or any other valid response.	2	1 mark for environmental impact. 1 mark for relevant effect on biodiversity.
	(b)	(i)	Informed citizens/health/ environmental concerns.  Or any other valid response.	1	
		(ii)	Improved irrigation/change of agricultural practice/ mechanisation/appropriate use of fertilisers or pesticides.  Or any other valid response.	2	Any two.

Question			Expected answer(s)	Max mark	Additional guidance
4.	(c)	(i)	<p>Imported produce may have an earlier or longer growing season/require no additional heat or light, but will involve emissions from transportation/food miles.</p> <p>Locally-produced food will have fewer associated food miles but may require more energy inputs to grow the produce.</p> <p>Or any other valid response.</p>	2	<p>Must compare imported with locally produced.</p> <p>Max of 1 mark if only imported or only locally produced.</p> <p>Response should relate to environmental, social or economic factors.</p>
		(ii)	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Use of natural pesticides/companion planting/biological control in place of synthetic pesticides.</li> <li>• Use of natural fertilisers/manure/green manure/bone meal.</li> <li>• Use of organic matter to enrich soil.</li> <li>• Crop and livestock rotation to allow soil to recover.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Lower productivity per hectare than intensive farming.</li> <li>• Labour intensive.</li> <li>• Often more expensive end product.</li> </ul> <p>Or any other valid response.</p>	4	<p>Max of 2 marks if only disadvantages or only advantages.</p>
5.	(a)		<p>May result in extinction due to increased competition.</p> <p>No change due to more seedlings <b>but</b> outcompeted by other species.</p> <p>May increase due to more seedlings <b>and</b> competitors adversely affected by changing environment.</p>	2	<p>Increase, decrease/extinction or no change, with relevant reasoning.</p>

Question			Expected answer(s)	Max mark	Additional guidance
5.	(b)	(i)	Barley.	1	
		(ii)	Don't know total yield/tonnes/ amount for other crops.  Or any other valid response.	1	
6.	(a)	(i)	Arrow going from nitrogen in the atmosphere to nitrates in soil.	1	
		(ii)	C	1	
		(iii)	(Increased N loss to atmosphere/denitrification) less nitrate in soil AND therefore less nitrate available for healthy plant growth.	2	1 mark for impact on soil. 1 mark for consequent effect on plant growth.
	(b)		Fertilisers/manure/guano/ named fertiliser.	1	
7.	(a)		The presence, absence or abundance of certain living organisms that show an environment is affected by a particular set of environmental conditions.  Or any other valid response.	1	
	(b)	(i)	<i>Ramalina fraxinea</i> .	1	Spelling of scientific names should not be penalised unless unintelligible.
		(ii)	<i>Lepraria incana</i> and <i>Hypogymnia physodes</i> .	1	Both required for the mark.
	(c)	(i)	<i>Pannaria rubiginosa</i> .	1	
		(ii)	<b>Similarity:</b> Both are bushy or hair-like lichens.  <b>Difference:</b> <i>Teloschistes flavicans</i> is orange, <i>Usnea articulate</i> is green or grey.	2	1 mark for similarity. 1 mark for difference – must include a comparison.

Question			Expected answer(s)	Max mark	Additional guidance
7.	(c)	(iii)	Time of day when surveyed (could make it difficult to discern colours)/age or maturity of lichen/seasonal variability/perception of colour /health of lichen  Or any other valid response.	1	Any one.
8.	(a)		Woodmice.	1	
	(b)		Alternative food sources/occupy different niches/feed at different times of day/feed at different levels of the canopy.  Or any other valid response.	2	Any two.
	(c)		Heat/movement/undigested waste	1	Any one.
9.	(a)		22.6 (%)	2	1 mark for $\frac{5.00}{(5.00 + 14.89 + 2.28)} \times 100$ 1 mark for correct answer – accept 22.553, 22.55, 22.6
	(b)	(i)	<b>Construction company:</b> Save cost due to reduction in fuel use/employee time.  <b>Environment:</b> Reduction in carbon dioxide in the atmosphere/less road traffic/less noise.  Or any other valid response.	2	1 mark for benefit to construction company. 1 mark for benefit to environment.
		(ii)	Metal/plastic/glass  Or any other valid response.	1	Any one.
10.	(a)	(i)	Water that occupies pore spaces in soil and bedrock/aquifer.	1	
		(ii)	Sink a bore hole and pump out water from ground/dig a well and lower a bucket.	1	

Question			Expected answer(s)	Max mark	Additional guidance
10.	(b)		More water will be extracted/water will be extracted at a greater rate than it is replenished SO water table will fall.  Or any other valid response.	2	Must be a developed response, otherwise 1 mark.
	(c)	(i)	Correctly calculated and presented angles.  Correctly labelled.	2	1 mark for correctly drawn sectors – allow $\pm 2^\circ$ tolerance.  1 mark for correct labels – should include use and %.
		(ii)	(In a developing country) % for other will be greater/% for washing machines and dish washer, bath and shower will be less/% for drinking likely to be greater (than in a developed country).	1	Any one.
		(iii)	(In a developing country) greater proportion used for irrigation in small gardens or vegetable plots.  Or any other valid response.	1	Should be relevant to (ii).

## Section 2

Question			Expected answer(s)	Max mark	Additional guidance
11.	(a)	(i)	2:2:1	1	80:80:40 = 8:8:4 = 2:2:1
		(ii)	Bedrock in area has been cut by the river/weathering from the slopes is only granite.  Or any other valid response.	1	Any one.
		(iii)	<b>Trend:</b> The number of granite rocks declines from sample point 2 through to sample point 3.  <b>Reason:</b> The river starts to flow through different rock types/outcrops of sandstone and limestone.	2	1 mark for description. 1 mark for reason.
		(iv)	Sedimentary.	1	Combined total of sedimentary rocks (sandstone and limestone) is less than the number of igneous (granite) rocks.
	(b)		An element or chemical compound formed as a result of rock cycle processes.	1	
	(c)		Sample point 3.  <b>Reason:</b> Weathered rocks from junction of granite and limestone, above point 3 will fall into river, releasing gold.	2	1 mark for correct sample point. 1 mark for appropriate reasoning.
12.			2.25 (million m <sup>3</sup> )	1	$(150 \times 100 \times 300) / 2 = 2.25$ million
13.	(a)	(i)	Column A – because pebbles have large interconnected pore spaces which will allow the water to flow through.	1	Both correct for 1 mark.
		(ii)	To improve reliability of results/if wet or damp the extra water could affect results.	1	Anything to do with potential impact of residual water.
		(iii)	High porosity because this rock has a high % of pore space between the grains and will hold liquid/gas.  Low permeability because the pores are not very well connected and liquid/gas cannot flow through easily.	2	1 mark for explaining permeability.  1 mark for explaining porosity.

Question			Expected answer(s)	Max mark	Additional guidance
13.	(b)	(i)	Pitfall trap/capture-mark-recapture.	1	Any one.
		(ii)	Can only capture species which fall into the trap/are present at the time/species caught may not be representative of the actual biodiversity in the area.  Or any other valid response.	1	Response must relate to the named sampling method.
		(iii)	Likely to find both larvae and adults present.	1	
14.			<b>Arguments supporting quarry:</b> <ul style="list-style-type: none"> <li>Quarry would create jobs in this rural area (1 mark), examples such as lorry drivers. (1 mark) A small number of jobs in a rural area can have a significant positive impact on the local economy. (1 mark) Young people belonging to this area will be encouraged to stay if a variety of jobs are available. (1 mark)</li> <li>Granite/rock is a natural resource and is required for construction/other named use. (1 mark) Importing this resource from abroad would be expensive and the transport of such a bulky item would require burning fossil fuels. (1 mark)</li> <li>Quarry area would be rehabilitated after use (1 mark), and species would move back in so damage would not be permanent. (1 mark) Quarry site could provide an opportunity for another use in the future, eg mountain bike skills course. (1 mark)</li> </ul>	4	<p>A maximum of 2 marks for an appropriate extended reason. (Therefore it would be possible to attain full marks if only two reasons were covered but in detail.) 1 mark for reasons that are more briefly explained. (Therefore four acceptable reasons would need to be given.)</p> <p>Candidates may gain full marks by putting forward legitimate arguments supporting the quarry <b>OR</b> arguments against the quarry <b>OR</b> giving a balanced set of arguments which outline both sides of the debate.</p>



Question			Expected answer(s)	Max mark	Additional guidance
14.			<p><b>Arguments against quarry:</b></p> <ul style="list-style-type: none"> <li>• Area is designated an NNR and SSSI (1 mark); noise and dust would disturb protected species (1 mark).</li> <li>• Trees would have to be felled prior to quarry operations starting (1 mark); loss of trees would destroy habitat (1 mark) and reduce local biodiversity (1 mark).</li> <li>• Quarry blasting would disturb wildlife (1 mark) and put off visitors (1 mark).</li> <li>• Quarry would produce dust from blasting and lorry movement in dry periods (1 mark) and put off visitors (1 mark), disturb people living in the area (1 mark), and impact on local businesses that rely on visitors attracted by the quiet and attractive landscape (1 mark).</li> <li>• Quarry would create a large visual intrusion (1 mark); viewpoint looks straight into the proposed quarry site (1 mark).</li> </ul> <p>Or any other valid response.</p>		

### Section 3

Question			Expected answer(s)	Max mark	Additional guidance
15.	A		<p><b>Landscape</b> (1 mark for each up to max of 4 marks):</p> <ul style="list-style-type: none"> <li>• Disturbance during construction.</li> <li>• Some think wind farms unsightly.</li> <li>• Needs large areas of land.</li> <li>• May cause soil erosion.</li> </ul> <p><b>Wildlife</b> (1 mark for each up to max of 4 marks):</p> <ul style="list-style-type: none"> <li>• Construction may drive animal life away.</li> <li>• Plants may be trampled/destroyed during construction.</li> <li>• Birds/bats may be injured by blades.</li> <li>• Noise/blade movement may disturb nesting birds/other animals.</li> <li>• Interference with migration routes.</li> <li>• May be beneficial to wildlife if shooting no longer possible in the area.</li> </ul> <p>Or any other valid response.</p>	7	<p>Maximum of 4 marks awarded for landscape.</p> <p>Maximum of 5 marks awarded for wildlife.</p>

Question			Expected answer(s)	Max mark	Additional guidance
15.	B		<p><b>Marine conservation areas and zoning</b> (1 mark for each up to max of 4 marks):</p> <ul style="list-style-type: none"> <li>• Specified areas of UK inshore waters may be closed to fishing activity all year or temporarily/seasonally.</li> <li>• Conservation designations aim to protect the seabed, overlaying water, and flora and fauna within the protected area.</li> <li>• Catching or killing of certain marine species in conservation areas, including accidental capture of non-target species/bycatch, is banned.</li> <li>• Conservation designations include Marine Protected Area (MPA)/Marine Nature Reserve (MNR)/Marine Conservation Zone (MCZ).</li> <li>• MPAs include no take zones (NTZs) where fishing is banned.</li> <li>• UK waters include zones (inshore (6 miles from coast)/territorial (12 miles)/exclusive economic zone (200 miles)), each with different fishing rights.</li> </ul> <p><b>Sustainable fishing methods</b> (1 mark for each up to max of 5 marks):</p> <ul style="list-style-type: none"> <li>• Aim to reduce pressure on heavily fished species.</li> <li>• Imposed days in port.</li> <li>• Fishing quotas.</li> <li>• GPS monitoring/policing of fishing fleet.</li> <li>• Larger fishing net mesh to allow young fish to escape.</li> <li>• Ongoing scientific research to predict what can be caught to maintain sustainable levels.</li> <li>• Replace demand for some fish species with farmed fish/alternative species.</li> </ul>	7	<p>Maximum of 4 marks awarded for marine conservation areas and zoning.</p> <p>Maximum of 5 marks awarded for sustainable fishing methods.</p>

Question			Expected answer(s)	Max mark	Additional guidance
16.	A		<p><b>Process</b> (1 mark for each up to max of 5 marks):</p> <ul style="list-style-type: none"> <li>• Photosynthesis is the conversion of light energy to chemical energy.</li> <li>• Is carried out by plants/producer/autotroph.</li> <li>• Chlorophyll (is a green pigment that) absorbs light energy.</li> <li>• Only takes place during daylight hours.</li> <li>• Photosynthesis word equation (or description) is water/H<sub>2</sub>O + carbon dioxide/CO<sub>2</sub> + light + chlorophyll → glucose/C<sub>6</sub> H<sub>12</sub> O<sub>6</sub> + oxygen/O<sub>2</sub>.</li> <li>• Glucose/sugar/starch/carbohydrate is a store of chemical energy.</li> </ul> <p><b>Importance to primary consumers</b> (1 mark for each up to max of 5 marks):</p> <ul style="list-style-type: none"> <li>• Primary consumers feed on plants/producer/autotroph.</li> <li>• Consumers gain energy from glucose/sugar/starch/carbohydrate.</li> <li>• Chemical energy stored in glucose/sugar/starch/carbohydrate is used to power respiration.</li> <li>• Respiration word equation (or description) is glucose/C<sub>6</sub> H<sub>12</sub> O<sub>6</sub> + oxygen/O<sub>2</sub> → water/H<sub>2</sub>O + carbon dioxide/CO<sub>2</sub> + energy.</li> <li>• Released energy from respiration is used to power cell metabolism and repair/movement/heat.</li> <li>• Only about 10% of energy produced by the plant/producer/autotroph is available to be passed on to the primary consumer.</li> <li>• Oxygen generated during photosynthesis is also available for use by primary consumers.</li> </ul> <p>Or any other valid response.</p>	7	<p>Maximum of 5 marks awarded for process.</p> <p>Maximum of 5 marks awarded for importance to primary consumers.</p>

Question			Expected answer(s)	Max mark	Additional guidance
16.	B		<p><b>Activity/impact</b> (1 mark for each named activity, up to max of 3 marks, and 1 mark for each associated impact, up to max of 3 marks):</p> <ul style="list-style-type: none"> <li>• Pollution from industries (eg chemical, paper or named industry) could impact on water quality/biodiversity.</li> <li>• Pollution from agriculture (eg fertilisers, slurry) could enter the loch and affect water quality/cause eutrophication.</li> <li>• Pollution from transport/boats (eg oil, fuel) could cause a slick and coat/be ingested by aquatic organisms.</li> <li>• Anglers removing (too many) fish could affect the aquatic food web.</li> <li>• Habitat disturbance (eg by draining, road building, transport, construction) could drive away species.</li> <li>• Noise from motorised recreational activity (eg water skiing, jet skiing) could drive away species.</li> </ul> <p><b>Conservation measures</b> (1 mark for each up to max of 3 marks):</p> <ul style="list-style-type: none"> <li>• Award legal protection (national designation or local bylaw).</li> <li>• Monitoring of water quality/pollution by SEPA.</li> <li>• Monitoring of species (eg by ranger service/SNH/SWT/conservation body).</li> <li>• Creation of conservation areas (eg SSSI, nature reserve).</li> <li>• Education.</li> <li>• Introduction of fishing permits.</li> <li>• Follow polluter pays principle.</li> </ul> <p>Or any other valid response.</p>	7	<p>Maximum of 3 marks awarded for named activities.</p> <p>Maximum of 3 marks awarded for impacts associated with named activities.</p> <p>Maximum of 3 marks awarded for conservation measure.</p>

[END OF SPECIMEN MARKING INSTRUCTIONS]