

FOR OFFICIAL USE



National  
Qualifications  
2019

Mark

**X826/75/01**

**Environmental Science**

WEDNESDAY, 29 MAY

9:00 AM – 11:30 AM



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

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 11 and 12 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. You should 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.

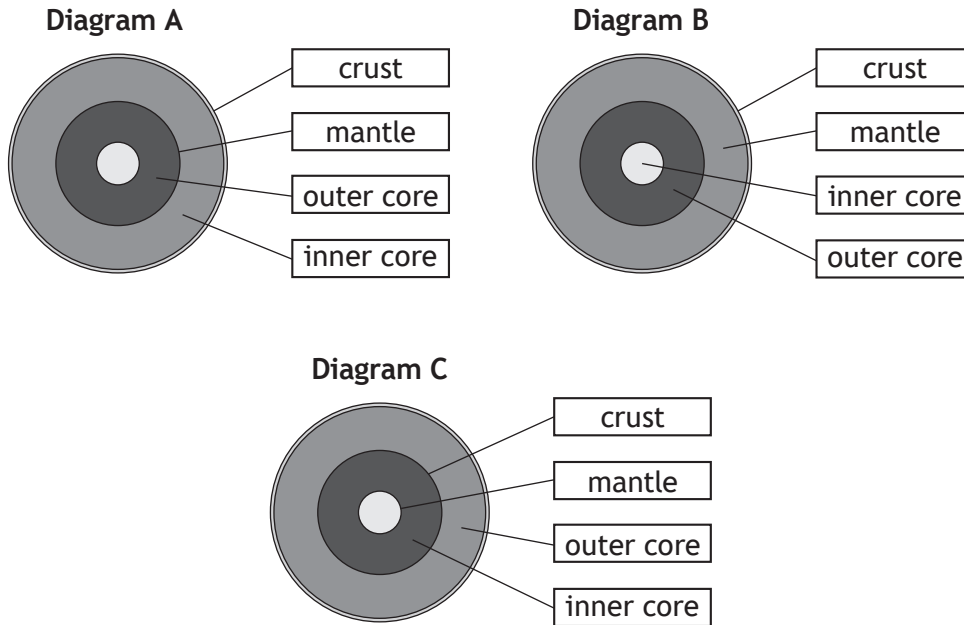


\* X 8 2 6 7 5 0 1 0 1 \*

SECTION 1 — 66 marks

Attempt ALL questions

1. The diagrams below show the layers of the Earth.



(a) State which diagram is labelled correctly.

1

Diagram \_\_\_\_\_

(b) Iron ore is located in the crust of the Earth.

1

Define the term *ore*.

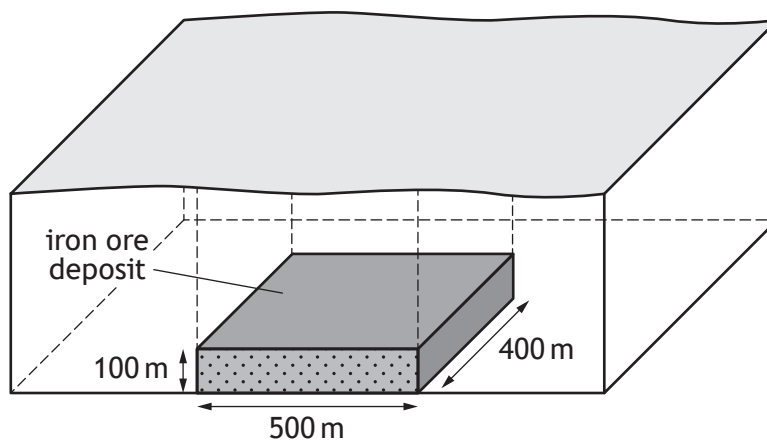
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1. (continued)

(c) The diagram below shows an iron ore deposit.



(i) Calculate the volume of the iron ore deposit.

1

*Space for calculation*

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

(ii) The ore has a density of 4 tonnes per m<sup>3</sup>.

Use the formula below to calculate the mass, in tonnes, of the ore.

1

$$(\text{mass} = \text{density} \times \text{volume})$$

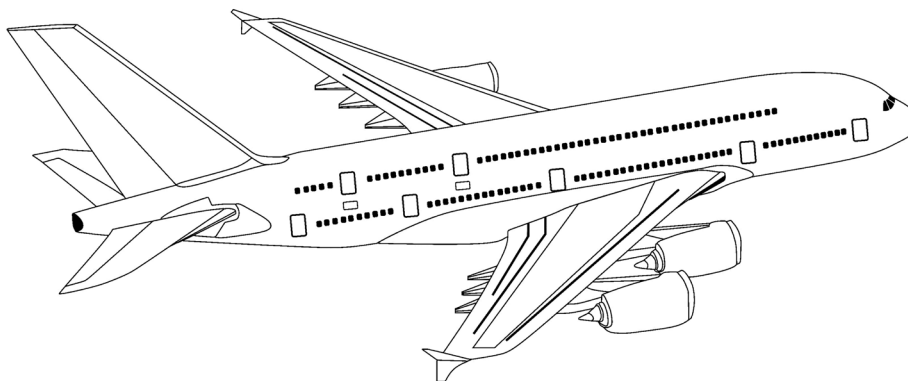
*Space for calculation*

\_\_\_\_\_ tonnes

[Turn over



2. The largest commercial aircraft ever built is a four-engine jet airliner. It usually operates on routes longer than 5000 km.



- (a) (i) Suggest one advantage of operating very large aircraft on longer routes. 1

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- (ii) An airline is considering using the aircraft on its route between London and Sydney in Australia. It uses 11 000 kg of aviation fuel for every hour it is in the air.

The flight will take 22.5 hours.

Calculate how much aviation fuel would be used during this flight. 1

*Space for calculation*

\_\_\_\_\_ kg

- (b) Commercial jet aircraft run on aviation fuel.

- (i) Name the raw material from which aviation fuel is produced. 1

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- (ii) Name the process by which aviation fuel is obtained from its raw material. 1

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## 2. (continued)

- (c) Air travel contributes to climate change.

Name one greenhouse gas, other than carbon dioxide, which contributes to climate change.

1

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- (d) Many airlines use carbon offsetting to reduce their greenhouse gas emissions.

- (i) Define *carbon offsetting*.

1

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- (ii) Suggest an example of how an airline might offset carbon emissions.

1

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[Turn over



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

2. (continued)

(e) The table gives information about features of modern passenger aircraft.

Aircraft type	Number of engines	Wide-bodied	Main construction material	Passenger capacity
PB-737	2	no	metal	210
PB-747	4	yes	metal	480
PA-350	2	yes	metal	360
PB-787	2	yes	carbon fibre	270
PA-380	4	yes	metal	850

Use the information from the table to complete the paired statement key below.

3

- 1 Aircraft has 2 engines Go to 2  
 Aircraft has 4 engines
- 2   
 PB-737  
Go to 3
- 3 Metal construction   
 Carbon fibre construction
- 4 Capacity for under 500 passengers   
 Capacity for over 500 passengers PA-380



3. (a) The global population is increasing every year.

(i) Suggest one reason why the global population is increasing.

1

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(ii) Increased global population has resulted in increased energy demand.

Name one source of non-renewable energy.

1

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(b) The table shows population growth in the United Kingdom since 1970 and projected figures to 2030.

Year	UK population (millions)
1970	56
1980	56
1990	57
2000	59
2010	62
2020	66
2030	71

Calculate the percentage increase in the UK population between 1970 and 2030.

1

*Space for calculation*

\_\_\_\_\_ %



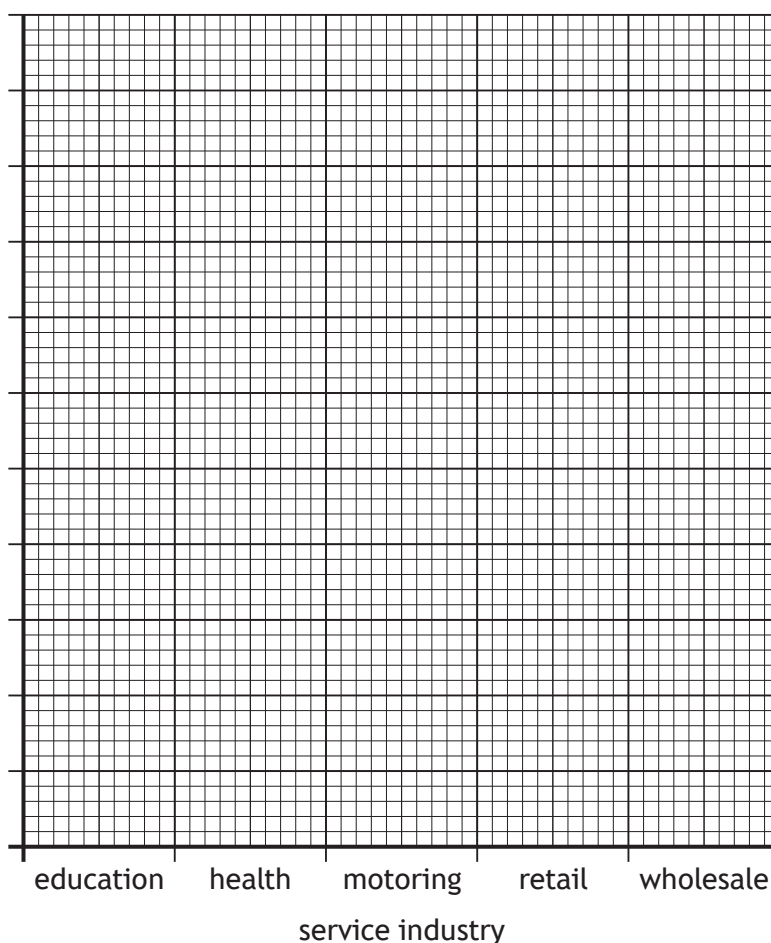
\* X 8 2 6 7 5 0 1 0 7 \*

4. The table shows the volume of waste produced during one year by service industries within Scotland.

Service industry	Volume of waste (thousand tonnes)
Education	85
Health	55
Motoring	23
Retail	105
Wholesale	54

- (a) Using the information from the table, complete the bar graph below by
- labelling the  $y$ -axis
  - adding a scale to the  $y$ -axis
  - showing the volume of waste for each service industry.

3



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





4. (continued)

- (b) Calculate, as a simple whole number ratio, the volume of waste produced from retail compared to that from education.

1

*Space for calculation*

retail \_\_\_\_\_ : \_\_\_\_\_ education

- (c) (i) Internet shopping is responsible for much of the waste produced in the retail industry.

1

Suggest a reason why.

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- (ii) Suggest a reason why a retail company would benefit from significantly reducing the waste it produces.

1

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- (iii) Explain how a named approach could be used by schools and colleges to manage waste more sustainably.

2

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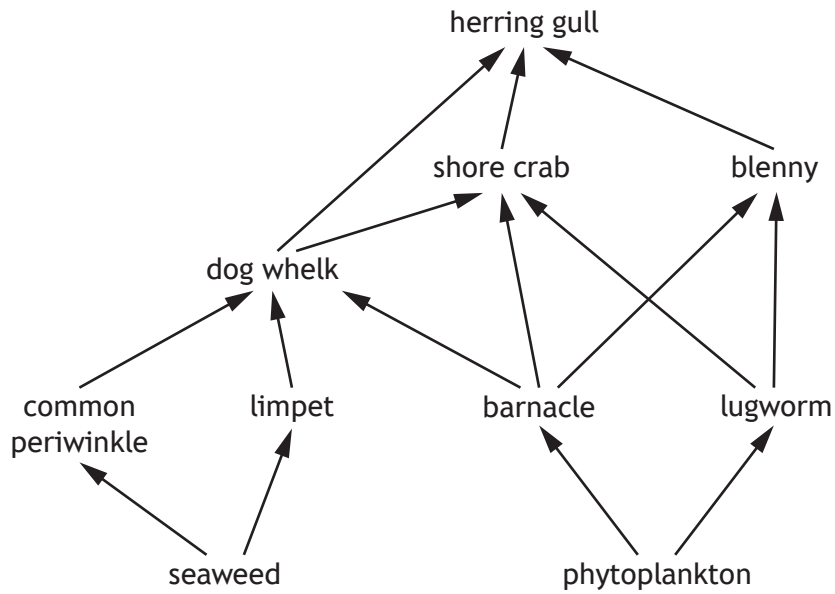
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[Turn over



5. The food web shown is from a rocky shoreline environment.



(a) (i) Name a tertiary consumer from the food web. 1

\_\_\_\_\_

(ii) State what is shown by the arrows in the food web. 1

\_\_\_\_\_

(iii) Overharvesting by humans for food has removed most of the shore crabs from the ecosystem.  
 Predict the impact this will have on the dog whelk population.  
 Explain your answer. 1

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

(iv) Other than the species named in the food web, name another economically important oceanic species. 1

\_\_\_\_\_

5. (continued)

(b) Seaweed makes its own food through photosynthesis.

(i) State the term used to describe an organism that can make its own food. 1

\_\_\_\_\_

(ii) The equation for photosynthesis is shown.



State one other input required for the reaction to occur. 1

\_\_\_\_\_

(iii) Describe a method that could be used to provide information about the distribution of seaweed down the rocky shore.

Your answer should include the equipment used and sampling technique. 3

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

(c) Describe the role of a detritivore in nutrient cycling. 2

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

[Turn over



6. Weathering processes break down rocks.

(a) Using the terms biological, chemical and physical, complete the table to show the type of weathering process.

Each term may be used more than once.

3

Weathering process	Weathering description
	Water freezes in cracks within rocks and expands when forming ice
	In hot deserts, surface rock flakes off due to frequent expansion and contraction of the rock
	Carbonic acid in rain reacts with limestone rock to produce calcium bicarbonate, which is highly soluble
	Tree roots grow into cracks and over time are capable of splitting rocks apart

(b) Ben Nevis is the highest mountain in the British Isles at 1345 metres above sea level. Weathering and erosion are reducing its height at an average rate of 0.1 mm per year.

Calculate how many years it would take to reduce Ben Nevis to sea level.

2

*Space for calculation*

\_\_\_\_\_ years

(c) Compare the processes of *erosion* and *weathering*.

2

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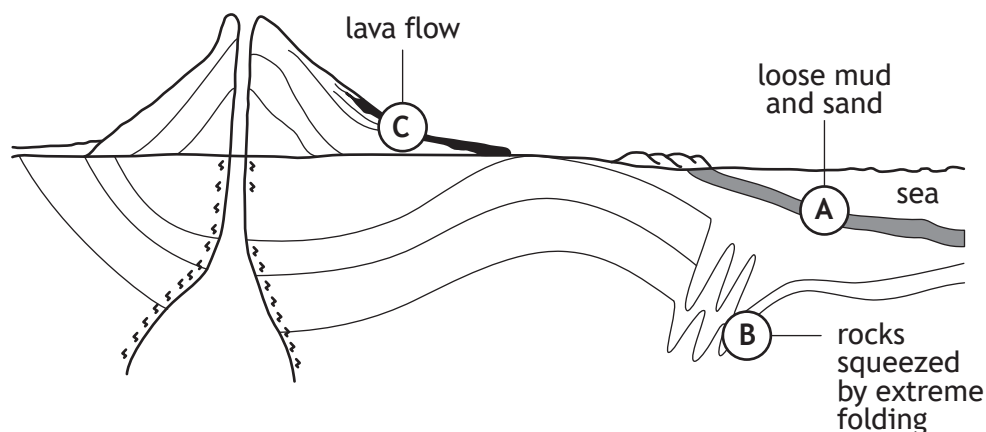
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7. The diagram shows where different rock types form.



(a) Complete the table by naming the rock type formed at each location. Choose from basalt, slate, granite, and shale. 2

Letter on diagram	Rock type
A	
B	
C	

(b) The sand at position A will eventually turn into sandstone. Explain why this rock will contain water. 2

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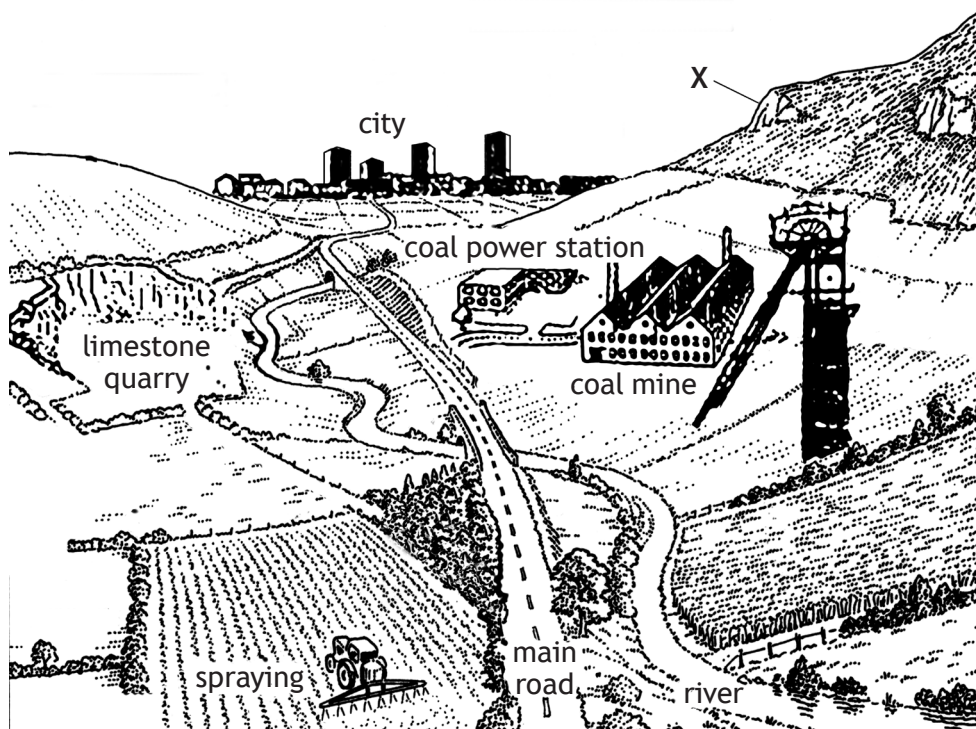
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[Turn over

8. The field sketch shows land use in a river valley.



(a) The land uses shown may have an impact on air quality.

For the following three land uses, explain the impact each may have on air quality.

3

Land use 1: spraying \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Land use 2: limestone quarry \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Land use 3: main road \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



\* X 8 2 6 7 5 0 1 1 4 \*

## 8. (continued)

- (b) At position X, environmental biologists are examining lichens growing on the cliff faces. Lichens are an example of an indicator species.

(i) Define the term *indicator species*.

1

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(ii) Position X is limestone rich.

Describe the formation of limestone.

2

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- (c) Referring to the diagram, suggest a human activity that may be a threat to biodiversity within the river.

Give a reason for your answer.

2

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[Turn over



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

8. (continued)

(d) The table shows the minimum concentration of dissolved oxygen needed for survival by some river fish species.

Fish species	Minimum concentration of dissolved oxygen needed for survival (mg l <sup>-1</sup> )
Trout	3.8
Minnow	3.2
Eel	2.0
Salmon	4.0
Pike	1.5

(i) Identify the fish species that is least tolerant of low dissolved oxygen concentration.

1

\_\_\_\_\_

(ii) Name all the fish species that would be found at a dissolved oxygen concentration of 3.5 mg l<sup>-1</sup>.

1

\_\_\_\_\_

\_\_\_\_\_

(iii) Name the organisation responsible for monitoring water quality in Scotland.

1

\_\_\_\_\_





## 8. (continued)

(e) When the quarry becomes unprofitable no further extraction of limestone will take place and an enormous hole will be left in the landscape.

(i) Suggest one potential use for the disused quarry.

1

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(ii) Suggest one way that this would benefit the local community.

1

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[Turn over



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

9. Intensive farming practices include growing high-yield crops over large areas.



(a) Describe two benefits of intensive farming.

2

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(b) Some farmers would like to introduce genetically modified (GM) crops. Explain why this may be harmful to the environment.

1

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## 9. (continued)

- (c) Organic farming is an alternative to intensive farming.

State one social, one economic and one environmental impact of organic farming.

3

A: social \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

B: economic \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

C: environmental \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[Turn over



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

**SECTION 2 — 20 marks**

**Attempt ALL questions**

Inverness is the most rapidly expanding city in Scotland. To accommodate the new growth in Inverness, more housing developments are planned.

One proposed housing development is near Culloden, which lies 7 km east of Inverness.

The Culloden battlefield site and Clava Chambered Cairns are internationally renowned historical sites that are visited by thousands of people from around the world each year.

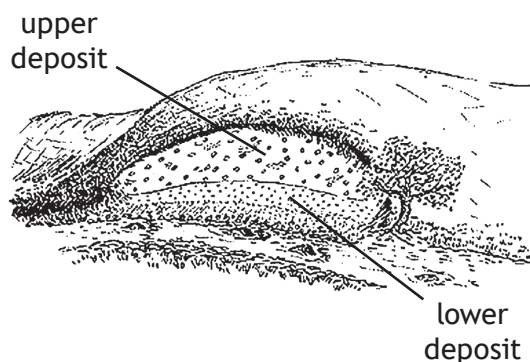
**Using the information shown in the supplementary source booklet, answer the following questions.**



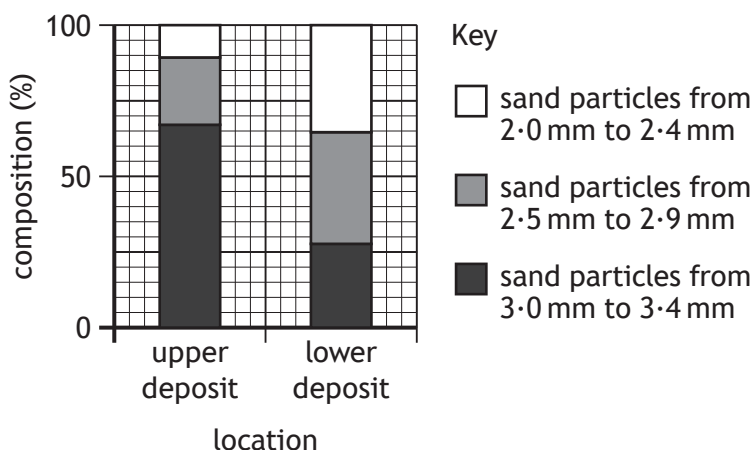
\* X 8 2 6 7 5 0 1 2 0 \*

10. (a) A geologist surveying the area has advised that site X has enough sand to provide material to build 1000 houses.

Field sketch of site X



Building product	Sand particle size required (mm)
Concrete blocks	2.5–3.4
Brick mortar	1.2–1.9



- (i) Using the sources above, explain why the upper deposit would be the best source of sand for manufacturing concrete building blocks. 2

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10. (a) (continued)

- (ii) Using sources **A**, **B** and **C**, evaluate why the concrete block manufacturer at **Z** wants to extract sand at site **X**.

2

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- (b) Two applications have been submitted to the local authority to build new housing.

- (i) Using sources **A**, **B** and **D** describe the habitats found in each of the proposed housing development sites.

(A) Site 1 \_\_\_\_\_

1

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(B) Site 2 \_\_\_\_\_

2

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- (ii) Explain why Site 2 is likely to have greater biodiversity than Site 1.

1

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## 10. (continued)

(c) Scottish wildcats are one of the world's rarest species.

(i) Describe the niche of the Scottish wildcat.

2

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(ii) A visitor at the caravan site believes they have spotted a Scottish wildcat in Culloden Forest. They have reported the sighting to local SNH staff.

Name the organisation represented by the letters *SNH*.

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(iii) Camera traps were used to confirm the visitor's sighting of the Scottish wildcat.

Suggest why camera traps rather than mammal traps were used.

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[Turn over

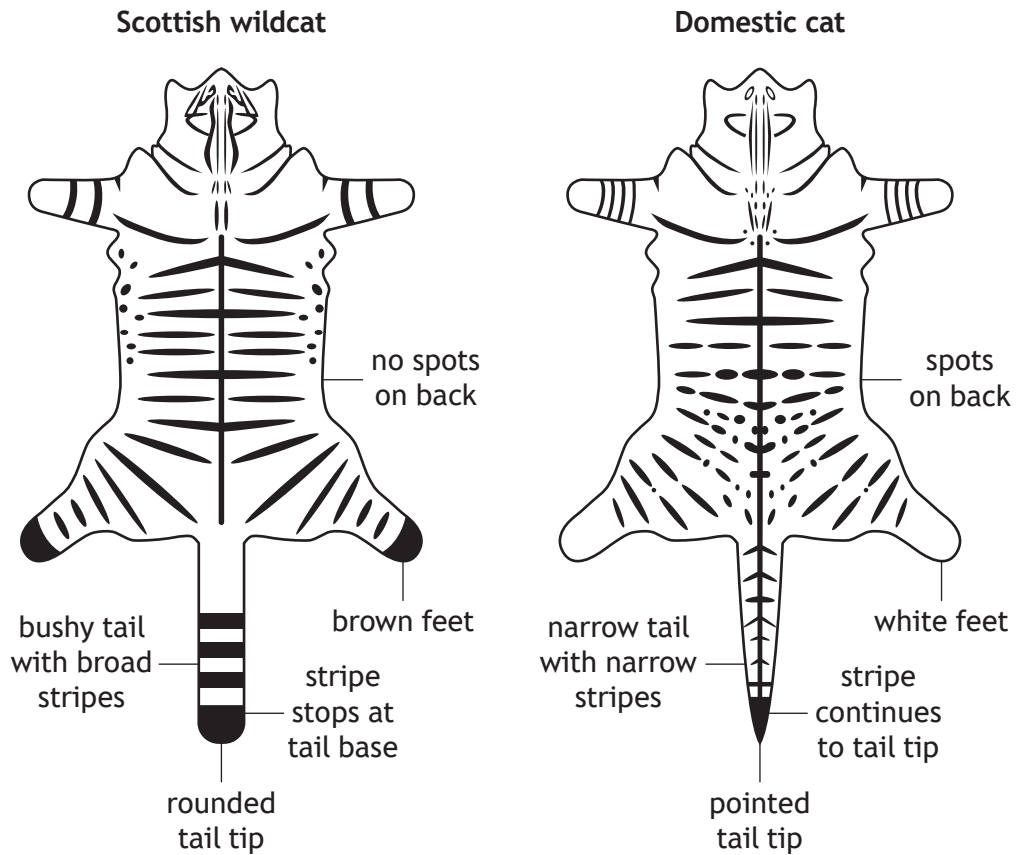


\* X 8 2 6 7 5 0 1 2 3 \*

10. (c) (continued)

(iv) Images of any cats caught on camera need to be identified as either Scottish wildcats or domestic cats.

The diagram below shows the distinguishing features for a Scottish wildcat and a similar domestic cat.



Source G shows the image of a cat caught on one of the camera traps.

Use the diagram above to identify whether the cat in Source G is a Scottish wildcat or a domestic cat.

Circle your answer.

Scottish wildcat

domestic cat

Justify your answer.

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1



10. (c) (continued)

(v) Explain why there may be some doubt in your identification. 1

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(vi) Scottish wildcats live alone for most of the year and defend an area for themselves, keeping out other Scottish wildcats. The size of an area defended by a Scottish wildcat is  $1.7 \text{ km}^2$ .  
 The total area of Culloden Forest is  $9 \text{ km}^2$ .  
 Calculate how many Scottish wildcats could be living in Culloden Forest. 1

*Space for calculation*

(vii) Scottish wildcat populations are threatened by several factors, including

- habitat loss through deforestation
- death by road accidents
- spread of disease from domestic cats.

Choose **one** of these factors and suggest a step that could be taken to reduce the threat to the Scottish wildcat population. 1

Factor \_\_\_\_\_

Step to reduce threat \_\_\_\_\_

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[Turn over



10. (continued)

- (d) A decision must be made whether to grant permission for one or both proposed housing developments to go ahead.

Using the evidence from the sources and your knowledge of Environmental Science, decide whether permission should be granted.

Justify your answer.

4

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SECTION 3 — 14 marks

Questions 11 and 12 each contain a choice

Write your answers to questions 11 and 12 on the following pages.  
You may use diagrams where appropriate.

- |  |                   |
|--|-------------------|
| <p>11. A The movement of water around, over and through the Earth is called the water cycle.<br/>Describe the various processes involved in the movement of water through the water cycle.</p> <p>OR</p> <p>B Describe the composition of the atmosphere and the importance of the 'natural' greenhouse effect.</p>  | <p>7</p> <p>7</p> |
| <p>12. A To meet the increasing energy demand in Scotland many methods of energy production are being used.<br/>Describe one sustainable method of energy production and its impacts on the environment and society.</p> <p>OR</p> <p>B Clean water is a valuable resource, which is increasingly in demand as the global population continues to rise.<br/>Describe how sustainable water supplies could be achieved in a developing country.</p> | <p>7</p> <p>7</p> |

[Turn over





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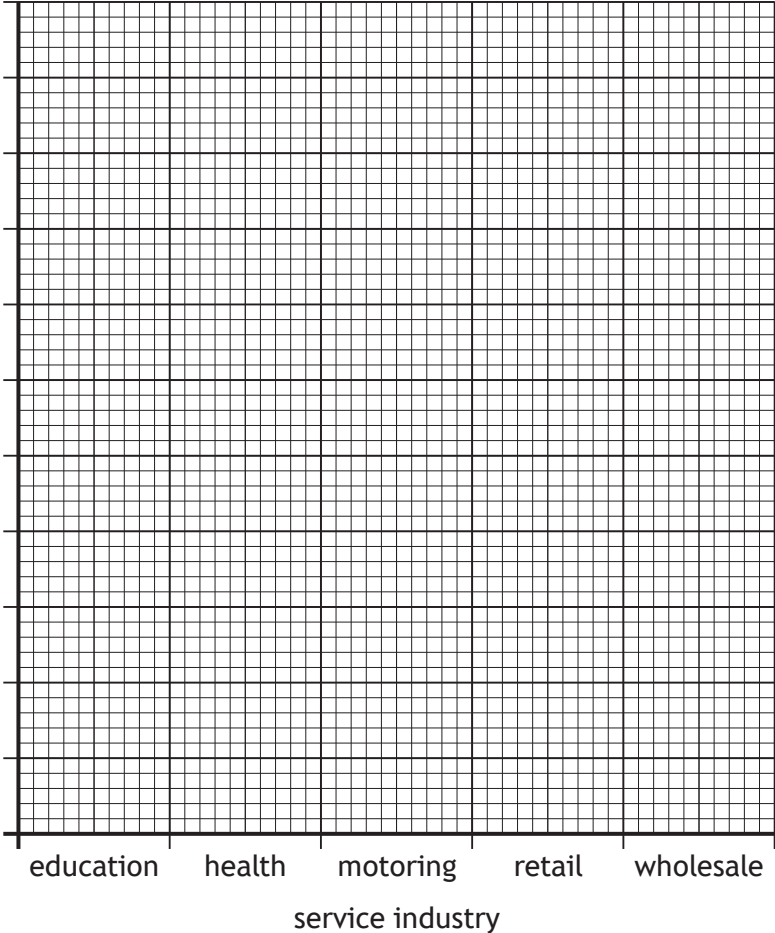
[END OF QUESTION PAPER]



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

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for question 4 (a)



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



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Question 2 [udaix/shutterstock.com](https://www.shutterstock.com/udaix)

Question 9 [Tyler Olson/shutterstock.com](https://www.shutterstock.com/TylerOlson)



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



National  
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2019

**X826/75/11**

## **Environmental Science Supplementary source booklet**

WEDNESDAY, 29 MAY

9:00 AM – 11:30 AM

This booklet contains sources for use with question 10 in Section 2.

### **Supplementary sources of information**

**Source A** is a map extract showing an area of Culloden

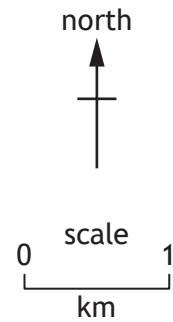
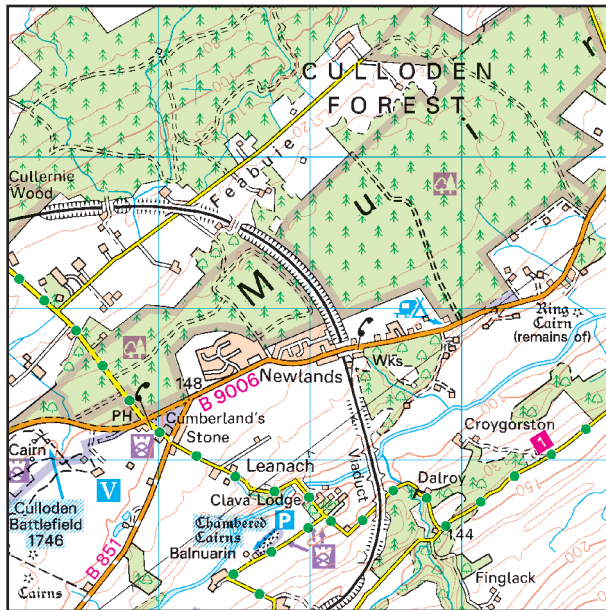
Sources B, C, D, E, F and G display information relating to the area shown in the Source A map extract

- **Source B** is a sketch map displaying proposed housing developments, factory and quarry area
- **Source C** is statements given by the owner of the factory
- **Source D** is extracts from a report by Scottish Natural Heritage
- **Source E** is some facts about Scottish wildcats
- **Source F** is a photograph taken from Newlands looking south-east
- **Source G** is a photograph of a cat taken using a camera trap in Culloden forest



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

Source A: Map extract of Culloden



Map key explaining symbols

	Coniferous wood		Perth to Inverness railway
	Mixed wood		Electricity transmitter line (pylon shown at standard spacing)
	Camp site / caravan site		Forestry Commission land
	Selected places of tourist interest		National Trust for Scotland (always open / limited access, observe local signs)

Source B: Sketch map of Culloden



Key

X	proposed quarry site		Perth to Inverness railway
Z	concrete block factory		B9006
1	proposed housing development (400 houses)		Culloden forest
2	proposed housing development (600 houses)		

**Source C: Statements by L McEwen owner of the concrete block factory at site Z**

1. If I have to obtain sand from more than 10 km away from my factory, I will not make a profit.
2. If 100 new houses were built in this area each year, I would be able to employ 10 more people in my factory.

**Source D: Extracts from a report by Scottish Natural Heritage about site X**

**Description of the site**

Clava Landforms Site of Special Scientific Interest (SSSI) is a nationally important site.

The SSSI is famous for the occurrence of clay bed deposits, the origin of which has attracted much controversy over the last 100 years.

The clay and sand sediments within the SSSI have provided a lot of evidence about the way in which geological layers were laid down on top of one another, as well as how Scotland's climate has changed through time.

The site is therefore of considerable importance.

**Management of the site**

The site is managed as rough grazing pasture for sheep and it is partly forested.

The main threats to the site include activities that would damage the physical integrity of the landforms. No such activities are currently occurring.

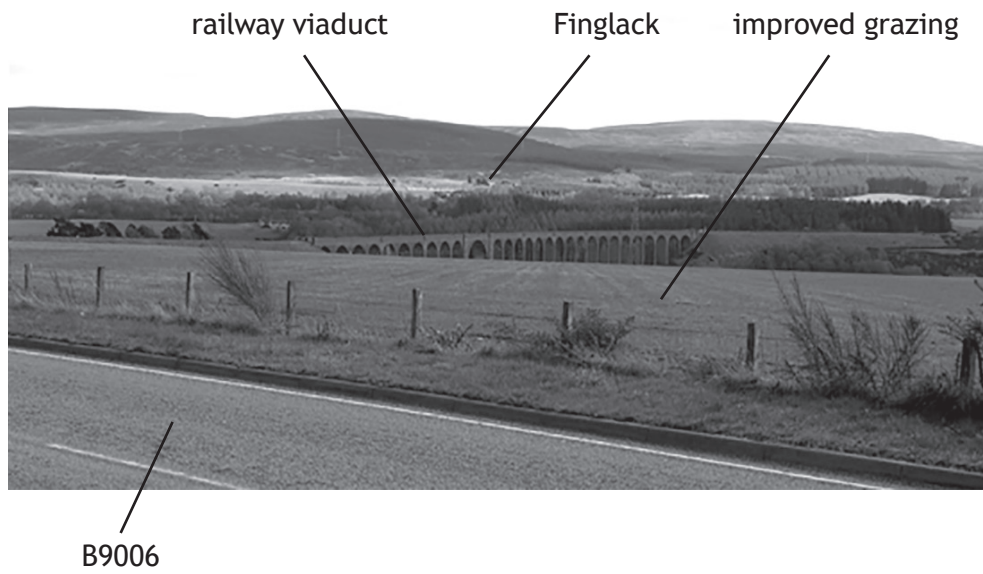
It is critical that the sediments are not disturbed or exploited to ensure that future research can be carried out on the site.

**Source E: Facts about the Scottish wildcat**

- Can be nearly a metre long
- Territory can be wide ranging
- Mostly solitary creatures
- Eats rabbits, voles, mice, and hares
- Don't like to be on open ground, preferring forest, avoiding urbanised and agricultural areas
- Den sites include under logs and tree roots
- May only live for 2–3 years due to spread of disease, persecution and road accidents
- No known predators

[Turn over

Source F: Photograph taken from Newlands looking south-east



Source G: Photograph of a cat caught by a camera trap in Culloden forest



[END OF SUPPLEMENTARY SOURCE BOOKLET]



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- Source A      Extract produced by Ordnance Survey Limited 2018.  
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- Source D      Extracts are adapted from the 'Site Management Statement' of *Dalroy and Clava Landforms, Site of Special Scientific Interest, Site ref: 491* by Scottish National Heritage.  
Contains public sector information licensed under the Open Government Licence v3.0.
- Source G      [davemhuntphotography/shutterstock.com](https://www.davemhuntphotography.com)