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National Qualifications
2021 ASSESSMENT RESOURCE

Mark

X826/75/01

Environmental Science
Section 2 Only

X8267501

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

SECTION 2 only

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

SQA ©

X8267501

DO NOT WRITE IN THIS MARGIN

Total marks — 20

Attempt ALL questions

Settlement X lies at the estuary of a major Scottish river, and sits on one of the largest shingle complexes in Britain. The shingle complex comprises rock debris continuously transported by the river from the Cairngorm Mountains since the last ice age, deposited as rounded stones in the river mouth. Sea level rise at the end of the last ice age flooded the estuary, leaving behind extensive deposits of shingle on the land surface as sea level fell again.

The shingle complex is constantly shaped by river and coastal processes. Shingle transported by river down to the estuary is moved westwards by coastal currents. Currently, the shingle complex extends 1 km inland and 8 km along the coast. The shingle banks closest to the shore have long provided protection to coastal communities, including Settlement X, against high tides and storms.

The shingle complex, the river, and the estuary are exceptional sites in their own right, and also as an integrated system. Two SSSI designations are in place, on account of the geomorphological nature of the shingle plus the range of specialised species it supports. Geomorphology refers to the formation and structure of a landform, such as the shingle banks.

Tourism brings valuable revenue to the area. Large numbers of wildlife enthusiasts visit the estuary each year, while the river supports salmon fishing, distilleries, canoeing and rafting companies, and local communities along its length. Golf courses sit on either side of the river, and hotels and B&Bs offer food and accommodation.

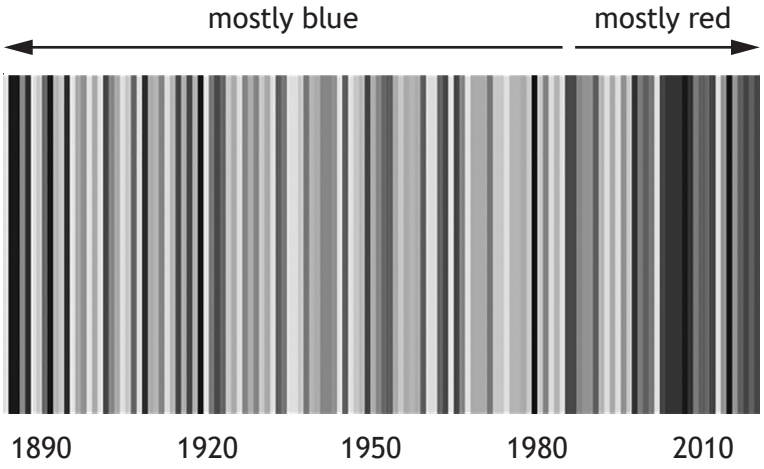
Sea level change and an increase in storm events over the last few decades have significantly eroded the shingle banks closest to the shore. In storm events, waves 'over-top' the banks, and have broken through them on occasion. Such events are now occurring almost annually and are also increasing in intensity. At the same time, the shingle banks are under threat from behind, due to increased precipitation affecting the river's flow rate and volume.

A team of coastal engineers has been commissioned to assess options for protection of the shingle complex and communities located behind them.

Using the information provided here and in the supplementary source booklet, as well as your knowledge of environmental science, attempt the following questions.

1. The UK Climate Change Risk Assessment (2017) lists risks linked to changes in temperature that are particularly likely to impact on Scotland (**Source D**).

The 'warming stripe' diagram is a visual representation of changes in temperature measured in Scotland between 1884 and 2019. Each stripe represents the average temperature in Scotland over a year. Blue lines represent cooler than average temperature and red lines represent warmer than average. The darker the line, the more the temperature differs from the average.



(a) Describe the overall trend shown in the diagram. **1**

(b) Freshwater drawn from the river is used by local communities and industries.

Suggest one way that climate change might affect water quality. **1**

[Turn over

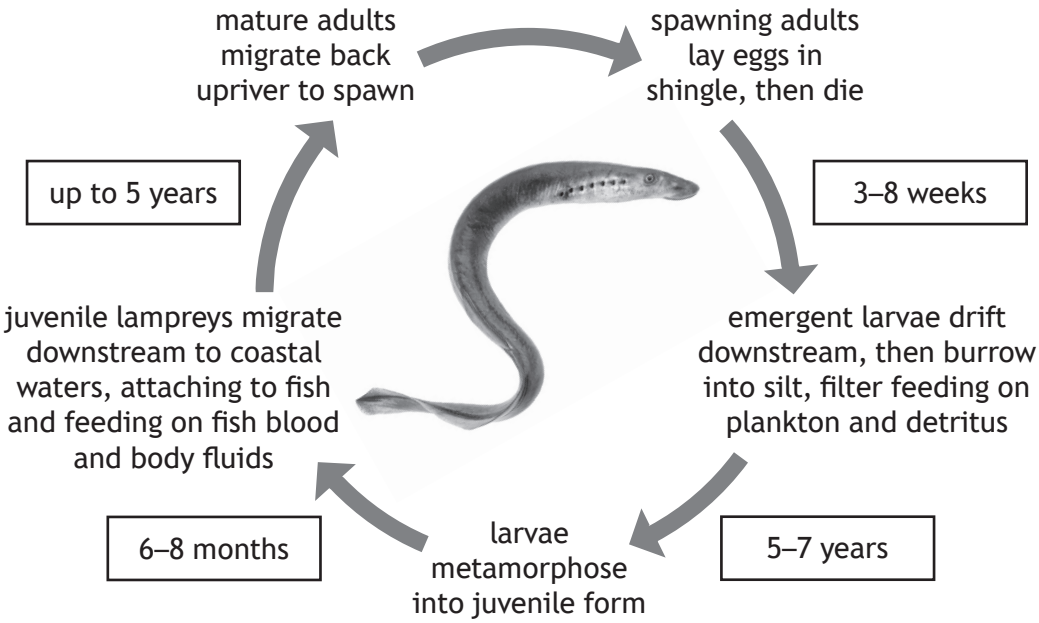
2. The sea lamprey is one of the species designated under the river's SSSI (**Source C**).

The sea lamprey is a jawless, eel-like vertebrate.

The juvenile and adult forms have a sucker-like mouth, lined with rows of sharp teeth.

Sea lampreys are able to survive in both freshwater and saltwater at different stages of their lifecycle.

The lifecycle stages are largely driven by water temperature.



Sea lamprey habitat requirements:

- minimal obstructions likely to prevent migration up or down a river
- good quality water
- clean sand and gravel areas for spawning
- silt for larvae to burrow into
- supply of organic matter for filter feeding by larvae
- plentiful supply of host fish for juveniles.

(a) Newly-hatched sea lampreys are filter-feeders that consume algae and dead organic matter found on river bottoms.

State the term used to describe an organism that feeds on dead organic matter. **1**

2. (continued)

(b) Explain why juvenile sea lampreys require a plentiful supply of fish in the area. **1**

(c) Explain one way that climate change could impact significantly on sea lamprey survival. **2**

[Turn over

3. A forestry plantation covering 818 hectares of the shingle complex was leased to the national organisation responsible for forestry management, in the late 1930s. Planting with trees helps stabilise large areas of the shingle.

(a) The table shows the proportion of land within the plantation covered by different tree species.

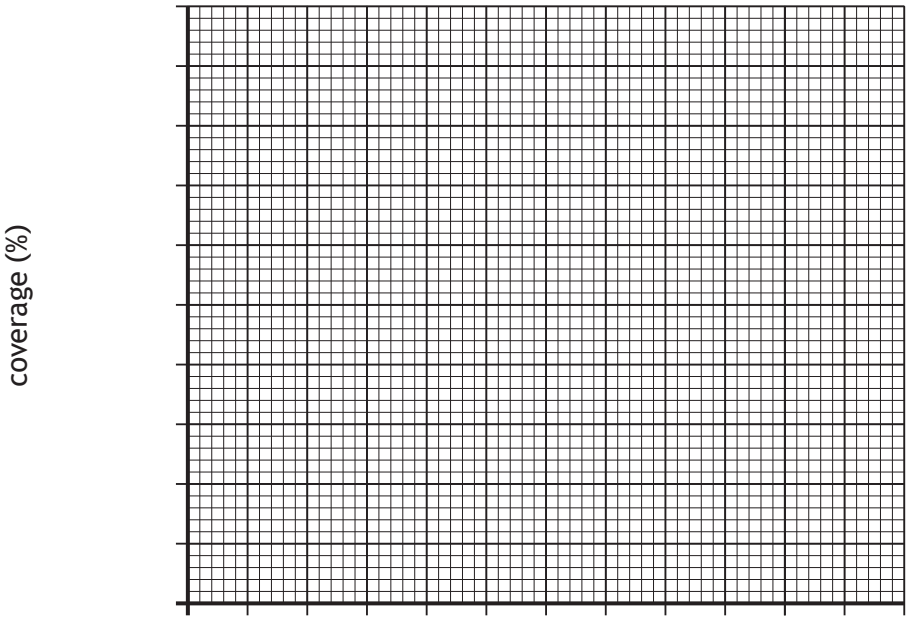
Tree species	Coverage	
	Hectares	%
Scots pine	401	49
Corsican pine		13
Mixed broadleaves	16	2
Lodgepole pine	25	3
Mixed conifer	245	30
Other	25	3

(i) Complete the table by calculating the area planted with Corsican pine, rounded to the nearest hectare. **1**

Space for working

3. (a) (continued)

(ii) Using information from the table, draw a bar graph to show the percentage of land covered by the different tree species present in the plantation. **2**



(Additional graph paper, if required, can be found on page 11.)

(iii) Part of the plantation lies within a SSSI. Forestry and Land Scotland (FLS) is required to prepare a conservation management plan for this area.

Name the national organisation that will advise FLS on best conservation practice within the SSSI. **1**

(iv) The conservation management plan includes a requirement for the periodic removal of gorse from the shingle. Gorse is an extremely hardy, evergreen, prickly, native shrub.

Suggest why there is a need to remove the gorse from the shingle complex. **1**

[Turn over

3. (continued)

(b) (i) The shingle consists of well-rounded, resistant rocks that have been transported up to 170 km by the river, from the Cairngorm Mountains.

Explain why the shingle is well-rounded on arrival at the estuary. **2**

(ii) Describe how the rounded nature of the rocks will impact on the porosity of the shingle. **1**

4. A review of coastal engineering options for the estuary was carried out in 1996.

The estimated costs of the coastal engineering options in 1996 are shown in Source E.

The graph in Source F shows that £100 in 1996 was equivalent to £196 in 2020, when adjusted for inflation.

Calculate the **increase** in the estimated cost of the **most expensive** option shown in Source E between 1996 and 2020. **2**

Space for working

[Turn over

5. A do-nothing scenario could have serious consequences for the area, but coastal engineering is hugely expensive. The local authority must decide whether to implement coastal engineering in this area.

Using the evidence from the sources and your knowledge of environmental science, decide whether coastal engineering should be implemented in this area.

Justify your answer. **4**

Yes, it should be implemented ☐

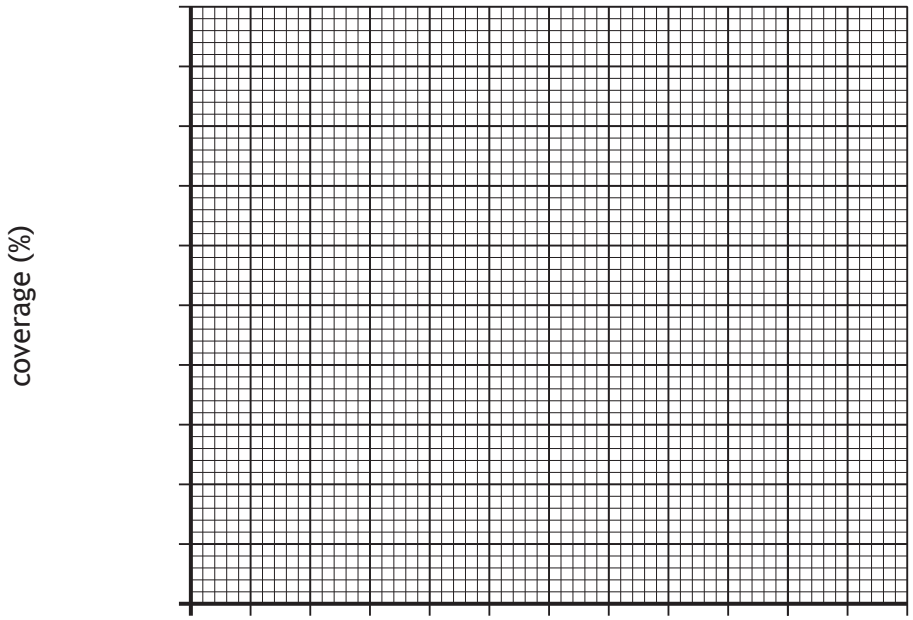
No, it should not be implemented ☐

Justification:

[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for question 3 (a) (ii)



MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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Question 1 Warming stripe diagram: © Copyright Ed Hawkins (University of Reading) and licensed for reuse under Creative Commons Attribution 4.0 International (CC BY 4.0)

Question 2 Lamprey: Good luck images/shutterstock.com