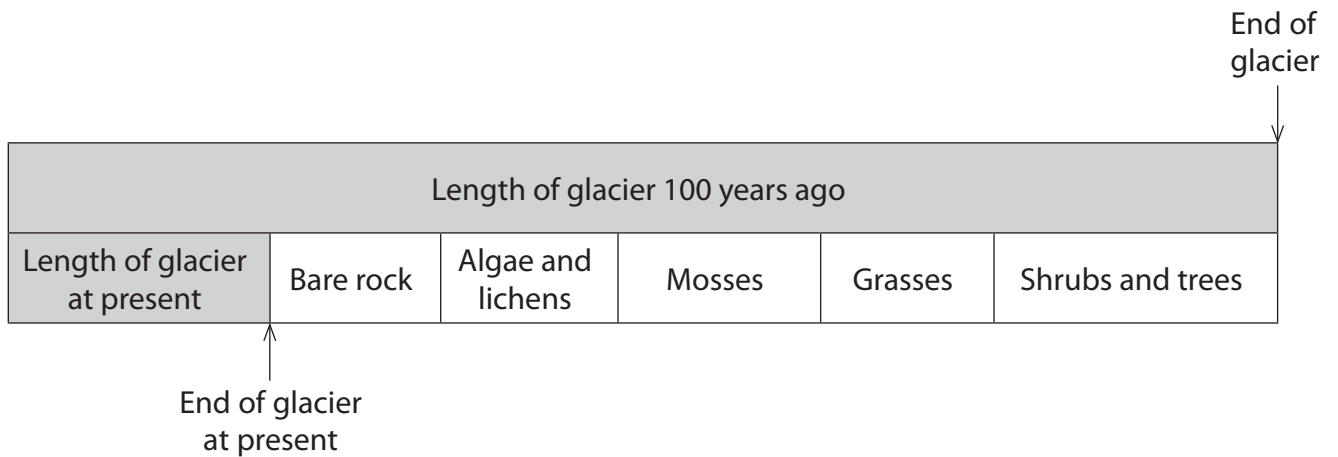


- 1 Glaciers are long, large masses of ice that formed thousands of years ago. As a result of warmer climates, more ice is melting. This is reducing the length of the glaciers. As a result, bare rock that was once covered by the glacier becomes exposed.

The diagram below shows the length of a glacier 100 years ago and the glacier at present. It also shows what is now found in a transect taken from where the front edge of the glacier is at present.



- (a) Using the information in the diagram, describe and explain the changes in the distribution of organisms with distance from the front edge of this glacier.

(3)

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- (b) *Epilobium latifolium* is a plant that occupies a niche in an area once covered by this glacier. It is a short flowering plant that grows in clumps.

The photograph below shows three clumps of *Epilobium latifolium*.



} Clump of *Epilobium latifolium*

Magnification $\times 0.2$

- (i) Explain what is meant by the term **niche**, using the plant *Epilobium latifolium* as an example.

(3)

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(ii) Describe how to carry out a study of the distribution of *Epilobium latifolium* from the front edge of this glacier.

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(iii) Suggest **one** abiotic factor that might affect the abundance of *Epilobium latifolium* and describe how this factor could be measured.

(3)

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(Total for Question 1 = 13 marks)

- 2 Surtsey is a newly-formed volcanic island. The volcanic eruption finished in 1967. The island is protected so that it can be used to study succession on volcanic islands.

The photograph below shows the plants on part of the island about 10 years after the island was formed.



(a) State what is meant by the term **succession**.

(1)

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(b) Suggest how this part of the island may have appeared five years before and five years after this photograph was taken. Give reasons for your answer.

(4)

Five years before

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Five years after

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(c) (i) Describe how to carry out a study to compare the distribution of *Honckenya pebloides* on two different parts of the island.

(4)

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(ii) Water availability affects the distribution of *Honckenya pebloides*.

Describe how water availability could be investigated in these two parts of the island.

(2)

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(d) In 1985, the lesser black-backed gull colonised this island.

A large increase in the number of species of plants was recorded after these birds colonised the island.

Suggest an explanation for this increase in the number of species of plants.

(2)

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(Total for Question 2 = 13 marks)

3 During the construction of a motorway in the 1970s, an area of Hampshire heathland, previously used for grazing, was abandoned. With the loss of the grazing animals, succession towards a climax community took place on this heathland.

By the 1990s, a scrubland community had developed. A characteristic of this scrubland is the presence of young trees, such as the Birch (*Betula pendula*).

(a) Explain what is meant by each of the following terms.

(i) Succession

(2)

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(ii) Climax community

(2)

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(b) In the 1990s, a management strategy was put in place to conserve the rare and endangered heathland plants.

(i) Suggest why it is important to conserve rare and endangered plants.

(2)

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(ii) Using the information given on page 18, suggest **one** management strategy that could have been used to conserve the heathland.

(1)

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(c) A survey of the occurrence of one rare and endangered plant species, Petty Whin (*Genista anglica*) was carried out.

In this study, a line of 8 people at 2 m intervals walked across the study area. They recorded the position, height and width of each specimen of Petty Whin. The direction of the line was changed several times to ensure that the whole area was covered.

(i) Place a cross (☒) in the box next to the term that describes the method used to collect data in this survey.

(1)

- A permanent
- B random
- C systematic
- D trial-and-error

- (ii) A statistical analysis of the data obtained gave a correlation value of 0.565 between height and width of Petty Whin. This correlation was not statistically significant.

Suggest reasons why the correlation was not statistically significant.

(2)

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(Total for Question 3 = 10 marks)

4 Clear areas with no trees can be found within many forests. These areas usually have communities of animals and plants which are different from those found in the wooded parts of the forest. These clear areas are maintained by the grazing of animals such as rabbits and deer.

(a) Describe what might happen to the clear areas in forests, over a long period of time, if the numbers of rabbits and deer decreased.

(3)

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(b) The butterfly *Boloria selene* (Small Pearl-bordered Fritillary) can be found in many of the clear areas of British forests.



Small Pearl-bordered Fritillary Magnification $\times 1.5$

This butterfly lays its eggs on low-growing plants such as *Viola riviniana* (Dog Violet), on which the caterpillars feed when they hatch.

The adult butterflies feed on nectar from plants such as *Ajuga reptans* (Bugle) and other low-growing species.

Since the plants on which the butterfly depends are able to grow only in forest clearings, small reproductively-isolated populations of *B. selene* can be identified in many forests.

(i) The distribution of plants in a forest is affected by many abiotic factors.

Name **one** of these factors and suggest how this factor could affect the distribution of the low-growing plants within the clear areas of a forest.

(3)

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(ii) Explain what is meant by the term **reproductively-isolated populations** of *B. selene*.

(3)

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(iii) Suggest why it is unlikely that any individuals within a population of *B. selene* would survive if the numbers of rabbits and deer decreased.

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(Total for Question 4 = 12 marks)