1. Read the following passage.

The 400 000 hectares of bleak open moorland in the far north of Scotland constitute one of the finest 'blanket bogs' in the world. Although it supports relatively few species, this outstanding ecosystem is a wonderful reservoir of wildlife more usually associated with the Arctic tundra. In the fragile peat grow highly specialised plants that are adapted to
5 survive in the cold, wet, acidic conditions. Over 30 species of sphagnum moss live there, each occupying its own niche within the bog. Other characteristic plants are the sundews, which are insectivorous. They overcome the shortage of nutrients such as nitrates by digesting small insects that are trapped by long sticky hairs on the leaves. The bog is also an important breeding ground for several species of birds, which make use of the vast
10 numbers of insects and other invertebrates that proliferate in early summer. For instance, about 70% of Britain's population of greenshanks breed here, before migrating to the coasts further south for the winter.

However, this fragile ecosystem is threatened by extensive afforestation with conifers. Patches of forest already dot the landscape. Drainage work for each patch affects a much
15 wider area than is to be planted, by lowering the water table and thus altering the habitat for the mosses. Predators such as foxes live in the forest, and few birds nest within a kilometre of a forest patch. Patches of forest are, therefore, much more damaging than they might seem. The rate of growth of trees in this harsh habitat is slow, with many casualties due to fierce gales. Without the tax incentives made available by the
20 government, afforestation in this area might well not be economic.

(a) (i) Explain what is meant by *'niche'* (line 6).

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(1)

(ii) Explain how drainage work could cause the elimination of some species of moss.

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(1)

(b) Suggest why the ecosystem supports 'relatively few species' (line 2).

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(2)

(c) Suggest the advantage to the greenshank of migrating from its breeding grounds to the coast (lines 11-12).

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(1)

(d) Sundew plants are able to digest insects trapped on their leaves. Explain how this is of benefit to the sundews in this environment.

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(3)

(e)   Evaluate the case for growing trees in this habitat.

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(4)
(Total 12 marks)

2.   The numbers of species of woody plants in samples from 227 hedges of different ages were
counted. The results are shown in the graph. The size of the solid circles shows the number of
hedges in each category.

Number of species of woody plants in 30 m of hedge

Age of hedge / years

Key
•   1 - 4   hedges
●   5 - 14   hedges
●   15 - 30   hedges

(a)   (i)   Suggest the age range of the hedges which are likely to support the most complex food webs. Explain your answer.

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(3)

(ii)   Explain how the complex food webs maintained by these hedges may be of benefit to farmers.

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(2)

(b)   (i)   Calculate the **maximum** percentage of hedges which are 1000 years old or over in this sample. Show your working.

Answer .... %

(2)

(ii)   Many hedges have been removed from arable land in recent years. Explain **two**
        advantages to farmers of removing hedges.

1 ....

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2 ....

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(2)
(Total 9 marks)

3.   When sewage is discharged into a river, the river becomes polluted with small particles of
         organic material. The population density of animals and the biochemical oxygen demand (BOD)
         were recorded from a river immediately upstream from a sewage outlet and at different
         distances downstream. **Figures 1** and **2** show the results.

Asellus is an invertebrate animal that feeds on dead organic matter and is able to live in water
mildly polluted by organic waste.
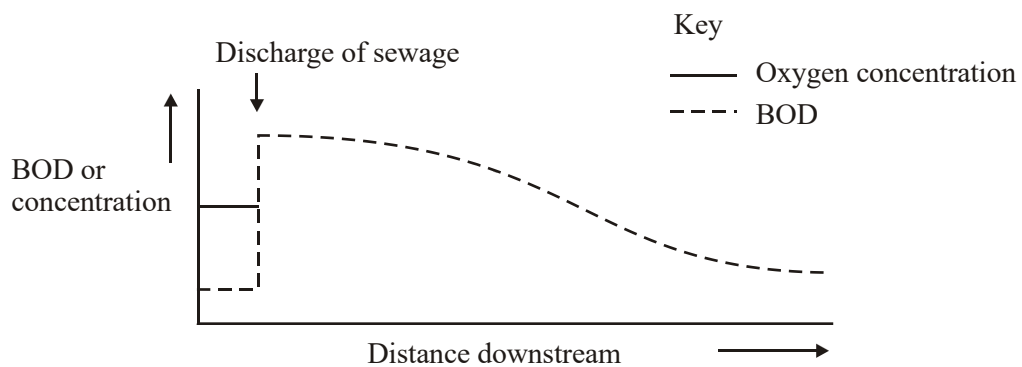
Figure 1
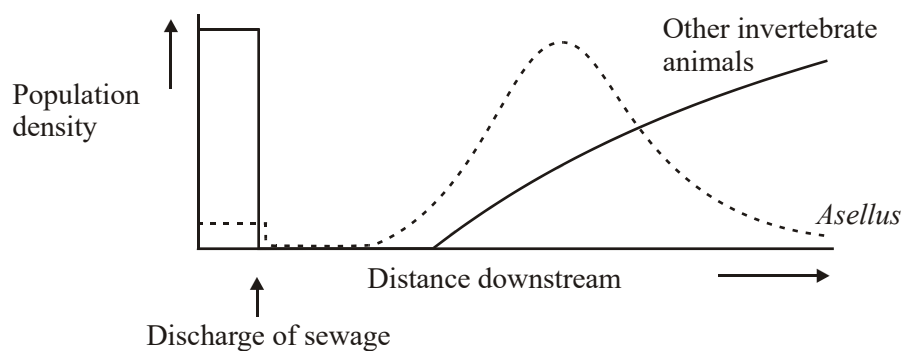
Figure 2

(a)   On **Figure 1** continue the line for oxygen concentration to show how this would be
       expected to change downstream from the point of discharge of sewage.

(1)

(b)   Explain the decrease in biochemical oxygen demand with distance downstream from the
       sewage outlet.

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(3)

(c)   Suggest an explanation for the changes in the population density of *Asellus* with distance
       downstream from the sewage outlet.

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(3)
(Total 7 marks)