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# A-level ENVIRONMENTAL STUDIES

Unit 4 Biological Resources and Sustainability

Friday 17 June 2016

Morning

Time allowed: 2 hours

## Materials

You will need no other materials.  
You may use a calculator.

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- Two of these marks are for the Quality of Written Communication.
- You will be marked on your ability to:
  - use good English
  - organise information clearly
  - use specialist vocabulary where appropriate.
- Question 7 should be answered in continuous prose.  
Quality of Written Communication will be assessed in this answer.



J U N 1 6 E N V S 4 0 1

HB/211199/Jun16/E3

**ENVS4**

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ANSWER IN THE SPACES PROVIDED**



Answer **all** questions in the spaces provided.

**1** **Table 1** shows some terms and definitions connected with agriculture.

Complete **Table 1**.

**[5 marks]**

**Table 1**

Term	Definition
Vegetative propagation	Use of corms, bulbs, or runners to produce offspring that are genetically identical to the parent
Selective breeding	
	A technique used to produce genetically identical offspring from small pieces of parent plant tissue
Monoculture	
Crop rotation	Growing a different crop in a field on a cycle of three, four or five years
	Cultivation by turning over the soil
Heterotrophic nutrition	



2 A variety of salad, vegetable and fruit crops is grown in glasshouses in the UK.

2 (a) (i) Outline **three** ways in which growing crops in glasshouses may increase yields.

[3 marks]

1 \_\_\_\_\_

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2 \_\_\_\_\_

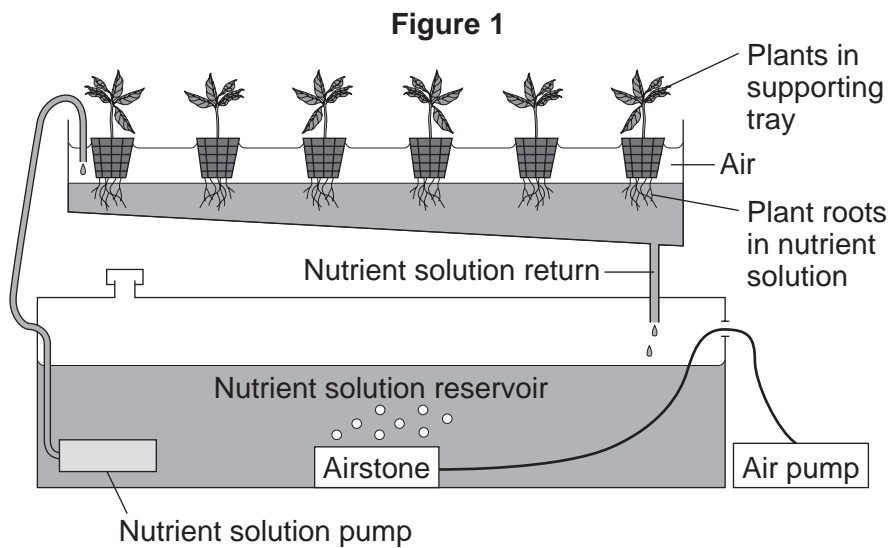
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3 \_\_\_\_\_

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2 (a) (ii) **Figure 1** shows the production of a crop, such as strawberries, in a glasshouse using the system of hydroponics.

In a hydroponic system, no soil is used because the plants are grown in a continually flowing, well-oxygenated nutrient solution.



Suggest **one advantage** and **one disadvantage** of using hydroponics to grow plants in a glasshouse.

[2 marks]

Advantage \_\_\_\_\_

\_\_\_\_\_

Disadvantage \_\_\_\_\_

\_\_\_\_\_



2 (b) **Figure 2** shows a type of Faba bean, *Vicia* sp., a field bean grown in the UK.

**Figure 2**



Field beans are leguminous plants grown as a monoculture. They are an important economic crop. Most of the bean crop is grown for livestock feed. They are grown as an alternative to other imported crops like soya. Some of the crop is exported to the Middle East and North Africa for human consumption.

Discuss how field bean cultivation may affect the sustainability of agriculture.

**[5 marks]**

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**3 (a)** Primary productivity in marine ecosystems is dependent on various factors.

**3 (a) (i)** Complete **Table 2** by inserting the correct marine ecosystem, from the box, next to its primary productivity value.

[1 mark]

open ocean	upwelling zone	continental shelf
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**Table 2**

Marine ecosystem	Primary productivity / $\text{g m}^{-2} \text{yr}^{-1}$
	400 – 1000
	200 – 400
	2 – 400

**3 (a) (ii)** Explain why primary productivity varies between these marine ecosystems.

[2 marks]

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3 (b) Figure 3 shows a map of the fisheries around Iceland and the UK.

Figure 3

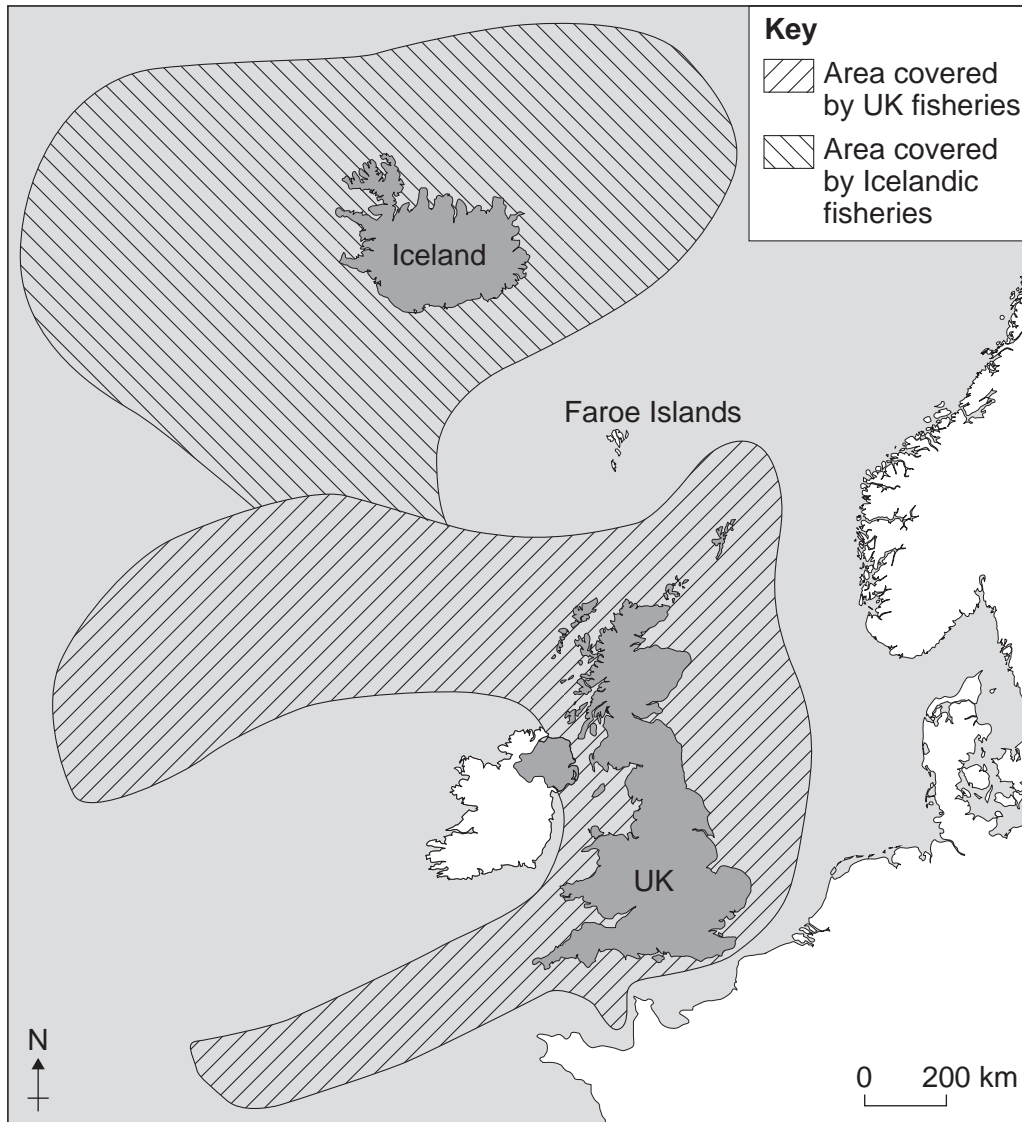
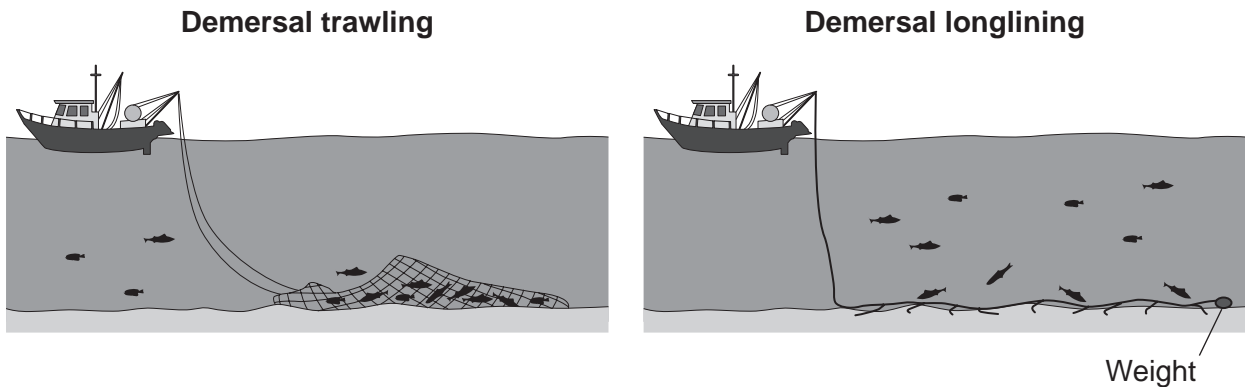


Figure 4 shows two methods of demersal fishing.

Figure 4

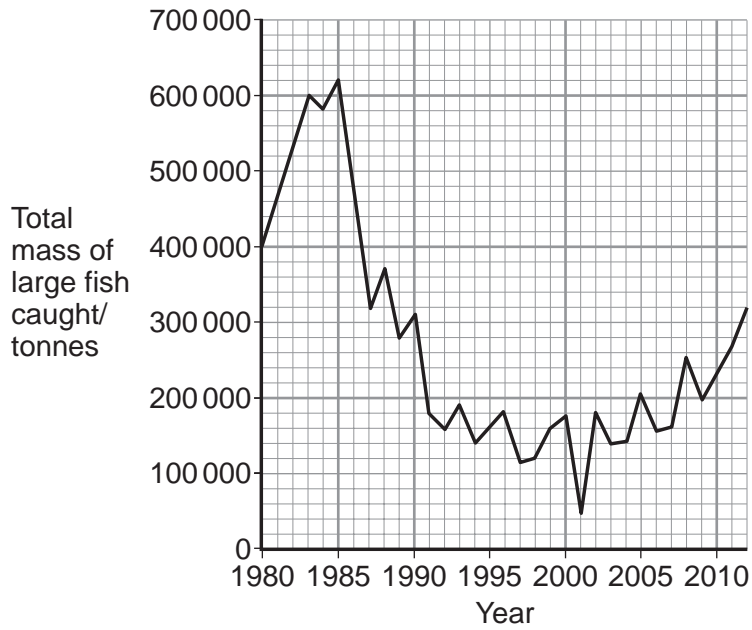


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**Figure 5** shows the total mass of **large** fish (greater than 40 cm in length) caught in the North Sea using the technique of demersal trawling, between 1980 and 2012.

**Figure 5**



- 3 (b) (i)** Calculate the percentage decrease in the total mass of large fish caught in 2002 compared with 1985.

[1 mark]

\_\_\_\_\_ %





**3 (b) (ii)** Suggest reasons for the change in catch of large fish as shown by the data in **Figure 5.**  
**[4 marks]**

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**3 (c)** Suggest how a change from demersal trawling to demersal longlining by Iceland's fisheries has allowed fishing to continue, without causing a reduction in the catch of large fish.  
**[2 marks]**

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4 Read the passage below.

### Expansion of oil-palm plantations in tropical Africa

The African oil palm, *Elaeis guineensis*, provides an essential ingredient found in cosmetics, soap, biodiesel and vegetable cooking oil. The global demand for these products is increasing. As a result, the African oil palm is now widely cultivated beyond its native range, notably in South-East Asia. The creation of vast oil-palm estates has caused large-scale deforestation and the local extinction of some species.

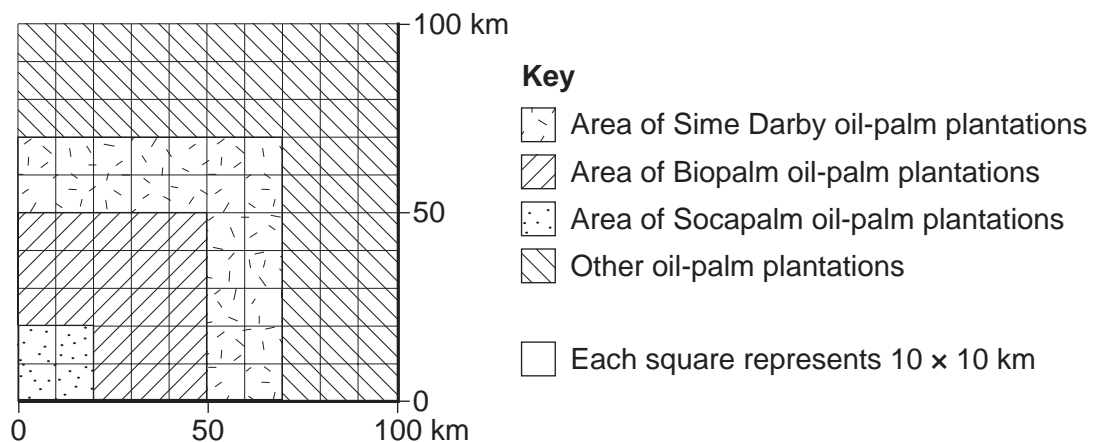
The rate of expansion of South-East Asian oil-palm plantations has decreased due to a diminishing supply of new agricultural land. This, combined with economic incentives, has seen foreign agribusinesses converting large tracts of land in west and central Africa to grow oil palm. It can be safely assumed that the high levels of deforestation, forest fragmentation and biodiversity loss that industrial oil-palm cultivation has caused in South-East Asia and other tropical countries will, in time, occur in Africa too.

The UN Food and Agriculture Organisation estimates that, globally, the land area given over to oil-palm cultivation more than quadrupled between 1961 and 2012, when it reached 182 109 km<sup>2</sup>. The majority of this was in the South-East Asian countries of Indonesia and Malaysia, whose oil-palm plantations cover 101 172 km<sup>2</sup> and 56 656 km<sup>2</sup> respectively. The annual global production of palm oil has reached 50 million tonnes and Indonesia and Malaysia together account for approximately 80 per cent of this. However, sub-Saharan Africa's contribution is significant. According to a report published in 2012 by the environmental group Greenpeace, 26 000 km<sup>2</sup> are under oil-palm plantations.

In the West African country of Cameroon, several foreign agribusinesses, such as Sime Darby, Biopalm, and Socapalm, have been granted permission to develop oil-palm plantations alongside forest reserves of high conservation value. These plantations threaten fragile ecosystems.

**Figure 6** represents the 10 000 km<sup>2</sup> designated as oil-palm plantations in Cameroon and the proportions of that land leased to foreign agribusinesses.

**Figure 6**



The increasing use of palm oil in food and cooking is now causing a noticeable shift in the causes of deforestation in tropical Africa. Large-scale forest clearing for oil palm is accompanied by a surge in bushmeat hunting, as the influx of plantation workers need to feed themselves and supplement their incomes. This may be a disaster for Africa's lowland primates and for conservation generally.

30

**Use information from the passage and your own knowledge to answer the questions that follow.**

- 4 (a)** Suggest some economic incentives that may have been used to attract foreign agribusinesses to grow oil palm in parts of Africa. (*Lines 7 – 10*)

[2 marks]

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- 4 (b) (i)** Calculate the annual yield of palm oil produced per km<sup>2</sup> in Indonesia and Malaysia together. (*Lines 14 – 22*)

[1 mark]

\_\_\_\_\_ t km<sup>-2</sup>

- 4 (b) (ii)** What percentage of the total land area designated for oil-palm plantations in Cameroon is allocated to the Biopalm plantations? (*Figure 6 and Lines 23 – 28*)

[1 mark]

\_\_\_\_\_ %

- 4 (c)** Explain why forest fragmentation may contribute to a loss in biodiversity in the remaining forest. (*Lines 10 – 13*)

[2 marks]

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**4 (d)** Suggest how oil-palm plantations may be managed in a more sustainable way.  
(Lines 29 – 33)

**[4 marks]**

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- 5 The Forestry Commission has planted large areas of non-native coniferous plantations in Scotland. The impact of increasing the area covered by these non-native conifers on the surrounding streams and wildlife has been investigated.

**Figure 7** shows a Dipper, *Cinclus cinclus*, a bird found in Scotland.

**Figure 7**



Dippers dip in and out of fast-flowing streams where they feed on stream invertebrates, including caddis fly larvae. The numbers of Dipper breeding pairs and factors that might affect their numbers were investigated in ten of Scotland's streams, streams **A – J**. Dippers are not directly affected by stream pH.

The following data were collected for each stream.

- pH of stream water
- percentage cover of coniferous trees in surrounding area
- number of Dipper breeding pairs per km
- territory length of each Dipper breeding pair
- number of caddis fly larvae



The pH of stream water and the percentage cover of coniferous trees in the surrounding areas are shown in **Table 3**.

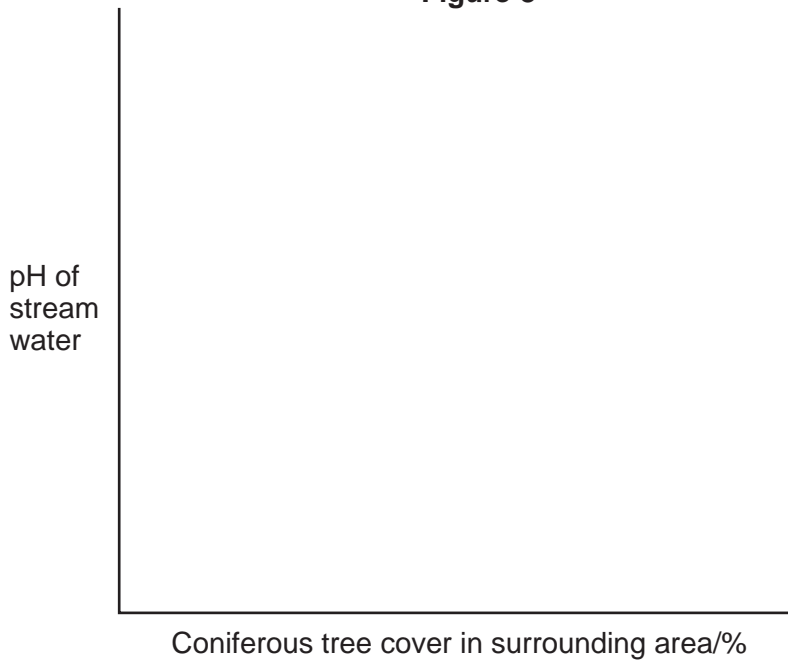
**Table 3**

Stream	pH of stream water	Coniferous tree cover in surrounding area / %
A	5.7	90
B	7.2	20
C	7.1	30
D	5.5	100
E	6.7	40
F	6.3	65
G	7.5	10
H	7.9	0
I	6.2	55
J	6.0	85

5 (a) (i) Draw a line on **Figure 8** to show the trend indicated by the data in **Table 3**.

[1 mark]

**Figure 8**



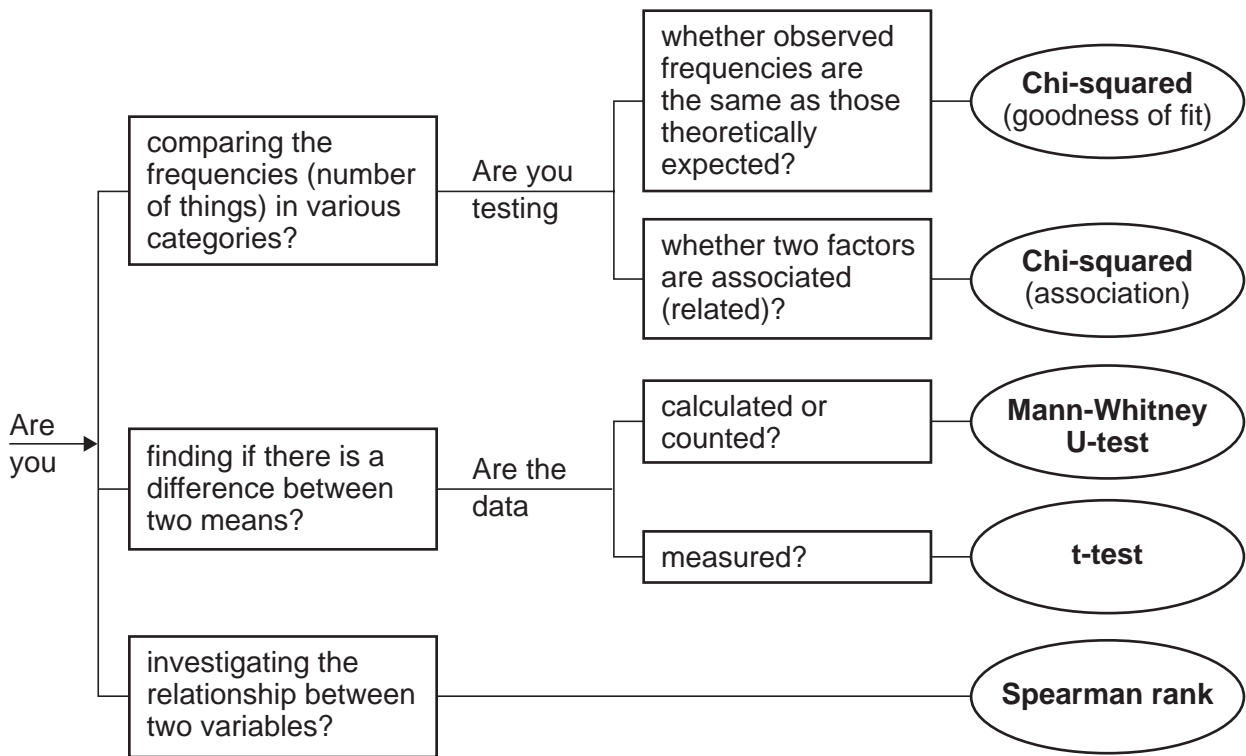
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5 (a) (ii) Use the flow diagram in **Figure 9** to select a suitable test to assess the statistical significance of the effect of coniferous plantations on stream pH.

**Figure 9**



Tick (✓) **one** box to show which statistical test you have chosen.

[1 mark]

- Chi-squared (goodness of fit)
- Chi-squared (association)
- Mann-Whitney U-test
- t-test
- Spearman rank





5 (a) (iii) Suggest a suitable hypothesis for this statistical test.

[1 mark]

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5 (a) (iv) It was concluded that the hypothesis could be accepted and the result was statistically significant at the  $p = 0.05$  level.

Explain what is meant by the term **statistically significant at the  $p = 0.05$  level**.

[1 mark]

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5 (b) Suggest reasons for a possible relationship between the surrounding coniferous plantations and stream pH.

[2 marks]

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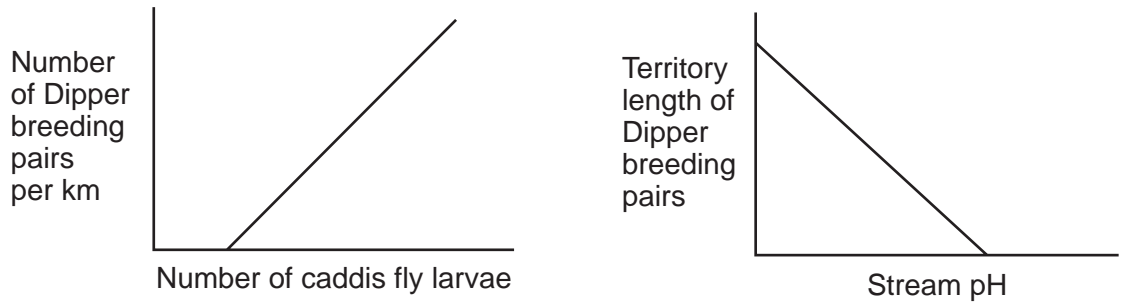
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5 (c) **Figure 10** shows some data from the Dipper surveys.

**Figure 10**



Suggest how the data in **Figure 10** may support the proposal that Dippers could be used as an indicator species of water quality.

**[4 marks]**

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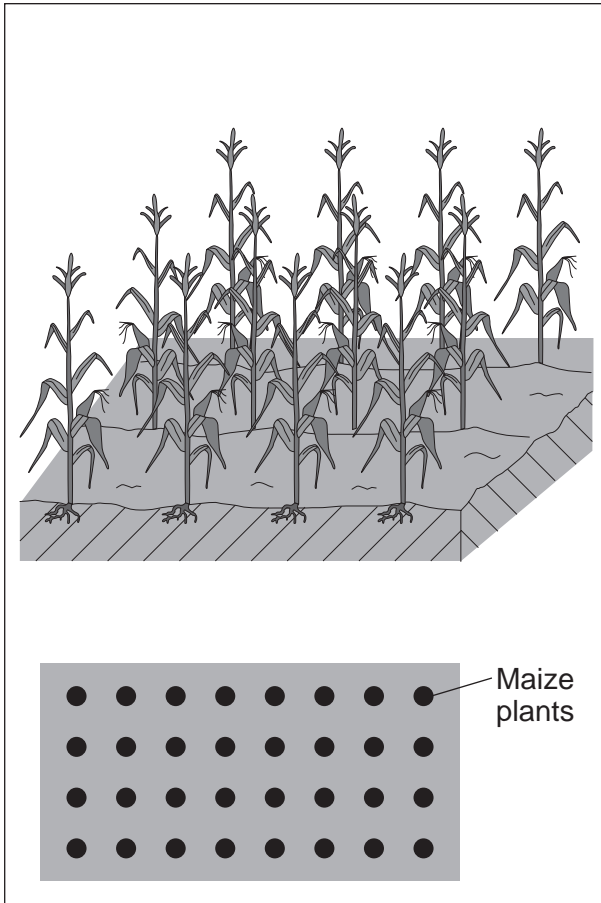
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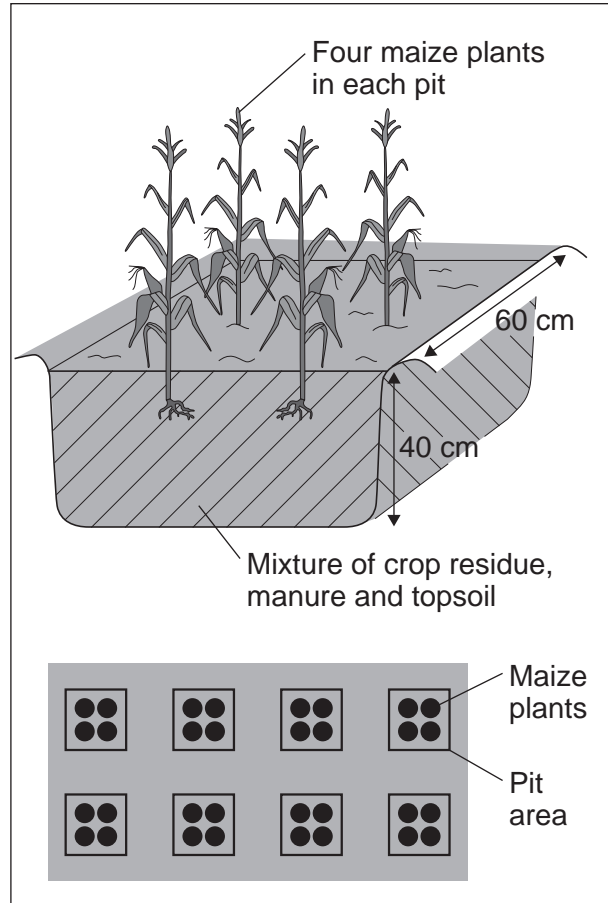


- 6 Maize is a staple food in many Less Economically Developed Countries (LEDCs). Traditionally, maize plants have been grown in rows (**Figure 11**). In East Africa, field experiments have been implemented to determine if the yield in maize can be improved by planting maize in groups in prepared pits (**Figure 12**).

**Figure 11**  
Maize grown in rows



**Figure 12**  
Maize grown in prepared pits



Maize yields and soil characteristics were recorded.

The results are shown in **Table 4**.

**Table 4**

Parameter / mean values	Maize grown in rows	Maize grown in prepared pits
Maize yield / t ha <sup>-1</sup>	1.3	8.5
Soil organic matter / %	2.18	9.10
Soil total N / %	0.10	0.45
Soil total P / ppm	13.8	23.1
Soil pH	5.3	6.6
Soil water content / %	35.0	75.5



**6 (a)** Using information from **Figure 11**, **Figure 12** and **Table 4**, and your own knowledge, explain how growing maize in prepared pits has increased the yield.

**[6 marks]**

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**6 (b)** Suggest disadvantages of growing maize in prepared pits.

**[3 marks]**

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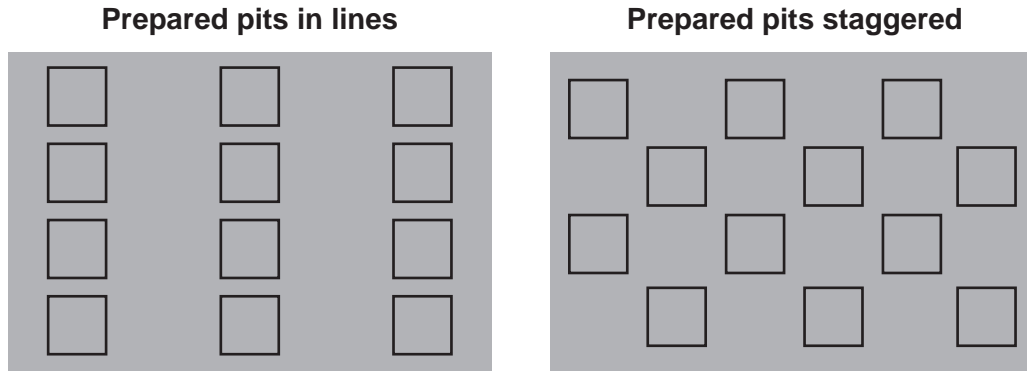


- 6 (c)** Two plots of the same area in a field were compared. Both plots had maize grown in prepared pits.

In one plot, the prepared pits were arranged in lines; in the other plot, the prepared pits were staggered (**Figure 13**).

Growing maize in prepared pits where they are staggered in a field, instead of arranged in lines, reduces soil erosion.

**Figure 13**



Using information from **Figure 13** and your own knowledge, describe **one** method that may be used to compare the effect of these two agricultural practices on soil erosion.

**[6 marks]**

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7 Write an essay on **one** of the following topics.

**Credit will be given for your understanding of the relationship between different areas of the subject, also for the organisation and presentation of the essay and for grammar, punctuation and spelling.**

**You should answer this question in continuous prose.**

**Either**

7 (a) Discuss the environmental impacts of livestock production. **[20 marks]**

**or**

7 (b) Discuss how aquaculture may be managed to maximise yields without causing serious environmental impacts. **[20 marks]**

**or**

7 (c) Discuss how the unsustainable consumption of resources, population pressure and environmental degradation are intricately linked. **[20 marks]**

Which question have you chosen?

Tick (✓) **one** box.

7 (a)

7 (b)

7 (c)

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