Cambridge Assessment International Education

Cambridge International AS Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4392160291

ENVIRONMENTAL MANAGEMENT **8291/21**

Paper 2 Management in Context **October/November 2023**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

[Turn over

1 (a) The World Bank classifies countries into income groups.

Fig. 1.1 shows the number of low-income economy countries (LICs), middle-income economy countries (MICs) and high-income economy countries (HICs) between 1987–2015.

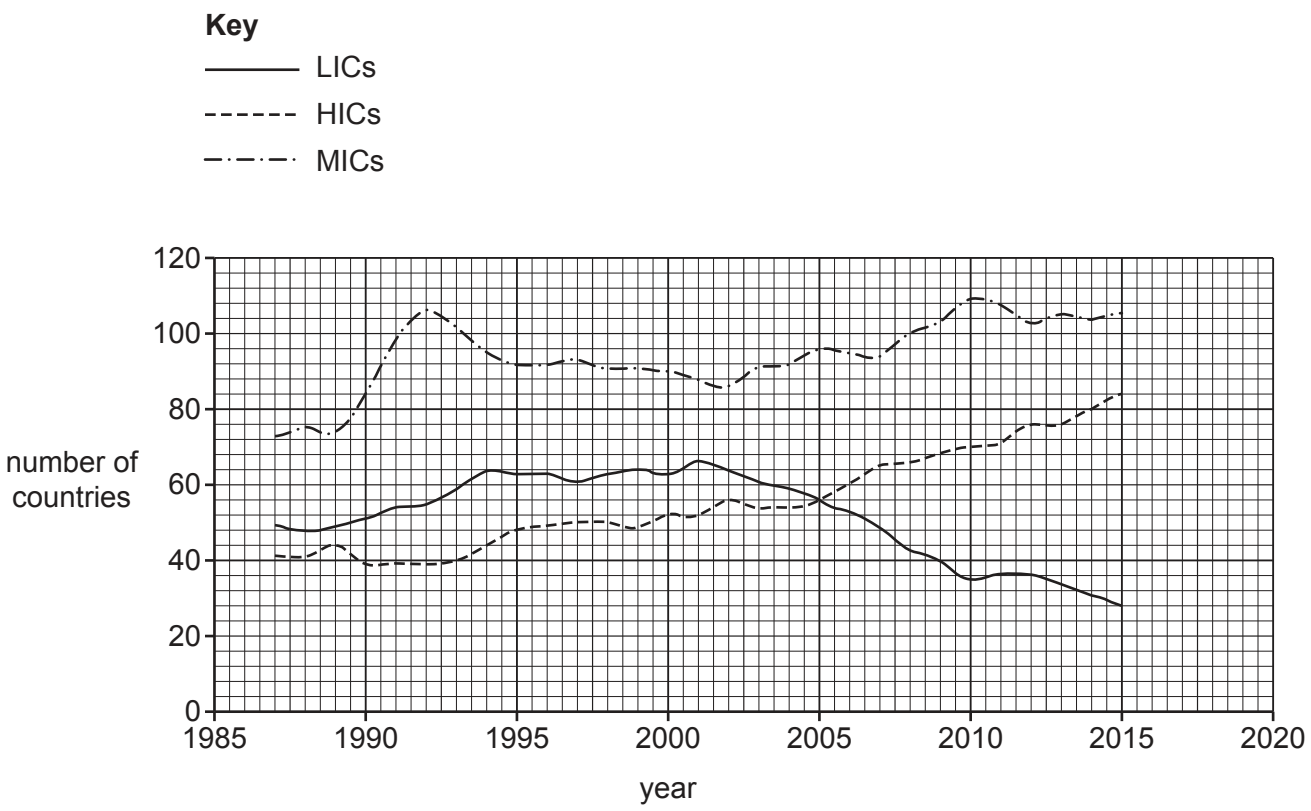

Fig. 1.1

Compare the trends shown by the data in Fig. 1.1 for LICs and HICs.

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..... [3]

(b) The United Nations classifies countries using the Human Development Index, HDI.

The HDI measures life expectancy, level of education and the income of a country.

A country is given an HDI score between 0 and 1. The closer a country gets to HDI 1, the more developed the country has become.

Table 1.1 shows information for three countries in 2020.

Table 1.1

country	China	Chad	Japan
World Bank classification	MIC	LIC	HIC
HDI score	0.761	0.328	0.919
income of country ÷ population / US$	10 410	700	45 180
mean number of births per woman	1.69	6.40	1.42
percentage literacy rate	96.8	22.3	99
expected years of schooling	14.0	7.3	15.2
life expectancy	77	54	81

(i) Use the data in Table 1.1 to suggest why Chad has an HDI score of 0.328.

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..... [2]

(ii) Use the data in Table 1.1 to suggest why some people think the HDI score is better than the World Bank classification.

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..... [1]

(c) From 1979 to 2015, China had a one-child policy per family. This policy aimed to limit the increasing population of the country. It is estimated that 400 million births were prevented by this policy.

Suggest the impacts of the one-child policy on China's use of natural resources.

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..... [2]

(d) Table 1.2 shows the percentage of the population in different age groups in China.

Table 1.2

age group	0 to 14	15 to 64	65+
percentage of population	17.8	80.0	12.6

Use the data in Table 1.2 to calculate the dependency ratio using the equation shown.

$$\text{dependency ratio} = \frac{[\text{young population (0 to 14)} + \text{old population (65+)}] \times 100}{\text{population aged 15 to 64}}$$

dependency ratio = ... [1]

(e) During the one-child policy, the mean number of births per woman in China decreased from 2.75 in 1979 to 1.62 in 2016. The working age population also decreased.

The United Nations estimates that 37% of China's population will be over 60 years of age by 2050.

Suggest the impact the one-child policy will have on China's economy by 2050.

Give reasons for your answer.

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..... [4]

[Total: 13]

2 **(a)** A student investigates the concentration of nitrate ions in a lake.

The student makes the following hypothesis:

'The concentration of nitrate ions in lake water increases on hotter days.'

The student collects a sample of lake water on each of five days and records the air temperature on each day. The student measures the concentration of nitrate ions in each water sample.

(i) State the independent variable in this investigation.

..... [1]

(ii) State **one** variable the student should control in this investigation.

..... [1]

(iii) Explain the benefit of repeating an investigation.

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..... [2]

(b) Table 2.1 shows the student's results.

Table 2.1

water sample	concentration of nitrate ions in mg/dm^3	air temperature / °C
1	2.7	21
2	3.1	19
3	4.2	23
4	3.3	32
5	2.5	35

(i) Calculate the mean concentration of nitrate ions shown in Table 2.1.

Give your answer to **one** decimal place.

mean = ... mg/dm^3 [2]

(ii) Calculate the air temperature range shown in Table 2.1.

range = ...°C [1]

(iii) The student's hypothesis for this investigation was:

'The concentration of nitrate ions in lake water increases on hotter days.'

Interpret the data in Table 2.1 to conclude whether the student's hypothesis is correct. Support your conclusion with evidence from Table 2.1.

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..... [1]

(iv) Describe a systematic sampling strategy the student could use to collect the five water samples.

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..... [1]

(v) One standard for drinking water in the United States is a maximum concentration of nitrate ions of 10 mg / dm^3.

The lake water has concentrations of nitrate ions lower than 10 mg / dm^3.

Suggest why it is **not** possible to conclude that the lake water is suitable to provide drinking water from only the results in Table 2.1.

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..... [1]

(c) Water in drinking wells is at risk of contamination from nitrate ions.

The map in Fig. 2.1 shows the location of drinking-water wells in the state of Minnesota in the United States and the concentration of nitrate ions in these wells.

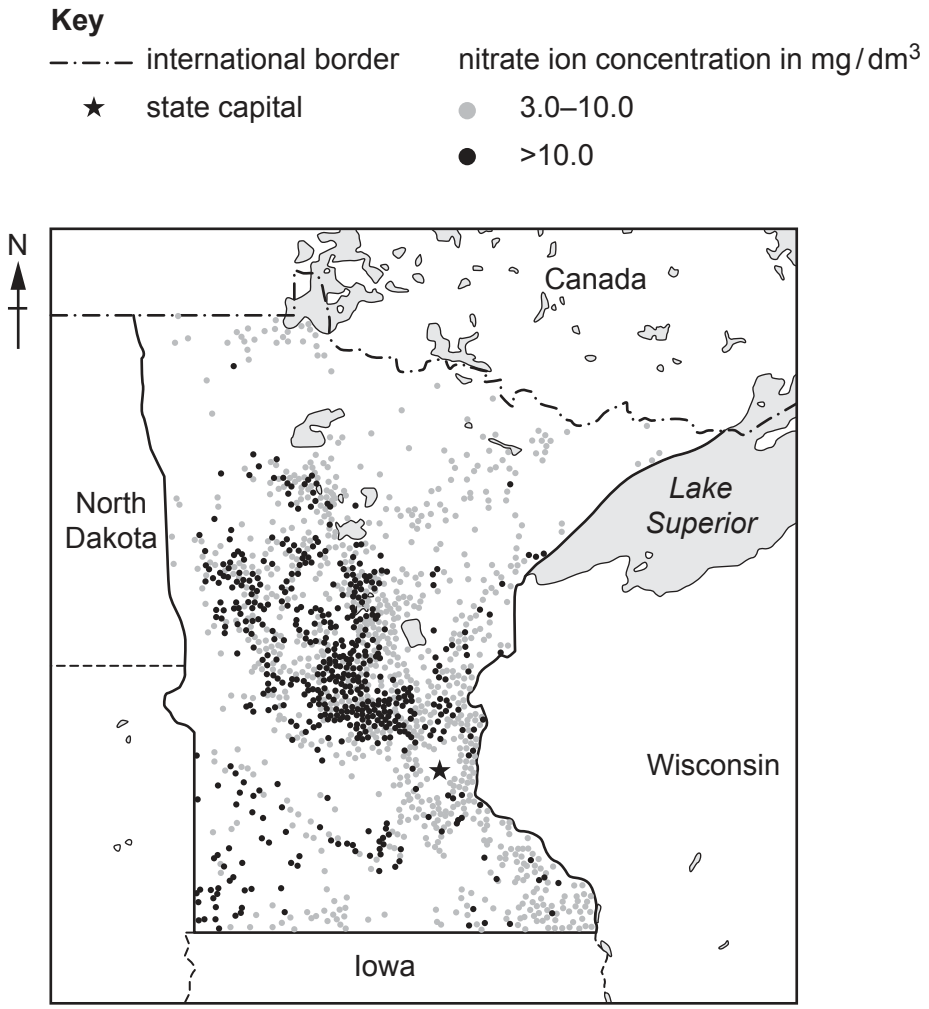

Fig. 2.1

(i) Describe the distribution of nitrate ion concentration in drinking-water wells shown in Fig. 2.1.

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..... [3]

(ii) State the process by which nitrate ions enter groundwater from soil.

..... [1]

(d) Artesian wells can supply drinking water.

State **two** other supply methods for drinking water.

1 .....

2 .....
[2]

(e) Polluted drinking water leads to water insecurity. Water insecurity leads to increased poverty.

(i) Suggest reasons why water insecurity leads to poverty.

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..... [2]

(ii) Explain how water insecurity can lead to lower levels of food production.

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..... [2]

[Total: 20]

3 **(a)** Fig. 3.1 shows incoming and outgoing solar radiation.

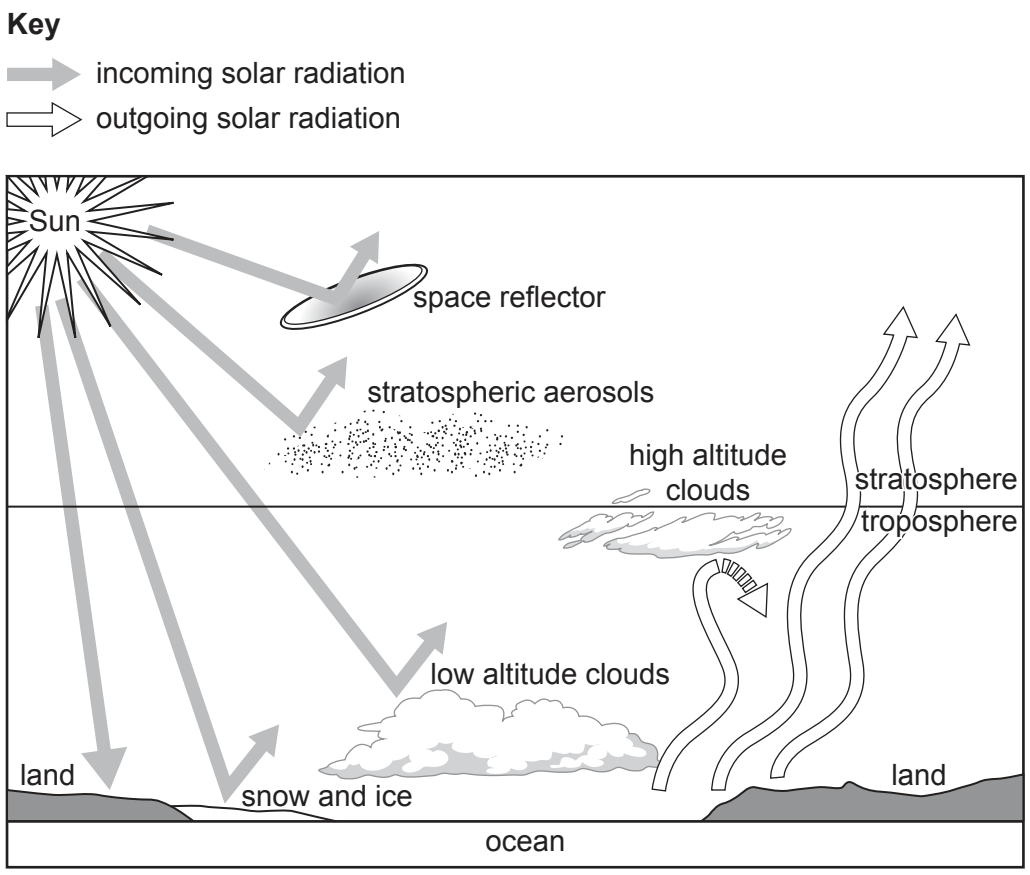

Fig. 3.1

(i) Name the layer of the atmosphere directly above the stratosphere.

..... [1]

(ii) Suggest why snow and ice increase surface albedo.

.....

..... [1]

(iii) Some of the Sun's energy is re-emitted back into the atmosphere as infrared radiation.

Explain how some of this infrared radiation is prevented from leaving the Earth's atmosphere.

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..... [2]

(iv) Suggest how a space reflector could counteract climate change.

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..... [2]

(b) Explain why eating a plant-based diet can reduce the impact of climate change.

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..... [2]

(c) State the **three** major gases in Earth's unpolluted atmosphere.

1 .....

2 .....

3 .....

[3]

(d) Explain why international agreements are needed to control air pollution.

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..... [2]

[Total: 13]

4 **(a)** **(i)** Define the term energy security.

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..... [3]

(ii) State **three** impacts of energy insecurity.

1 .....

2 .....

3 .....

[3]

(b) Fig. 4.1 shows a plan for a new house.

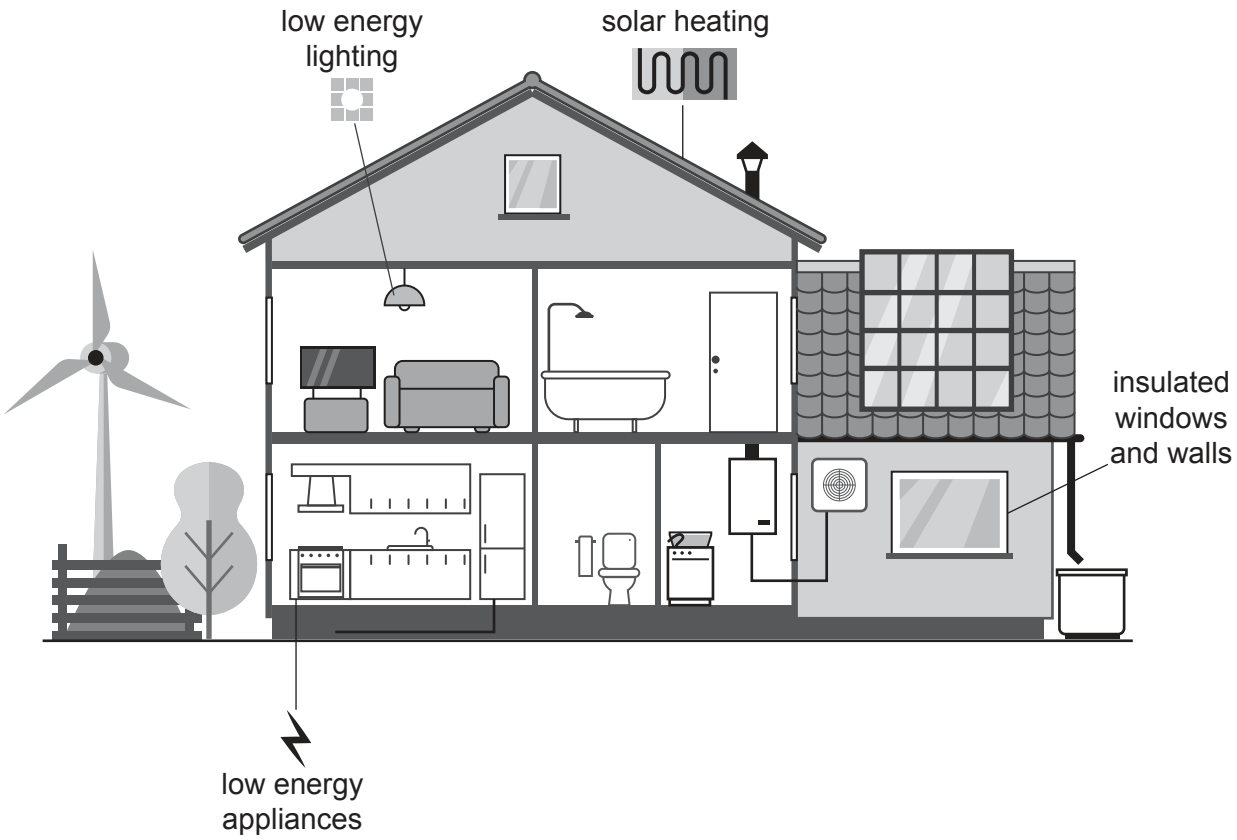

Fig. 4.1

(i) Explain how an energy efficient house reduces the impact on the environment.

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..... [5]

(ii) The roof of the house can be planted with grass.

Suggest **one** benefit of having a roof planted with grass.

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..... [1]

(iii) State the source of energy for plants.

..... [1]

[Total: 13]

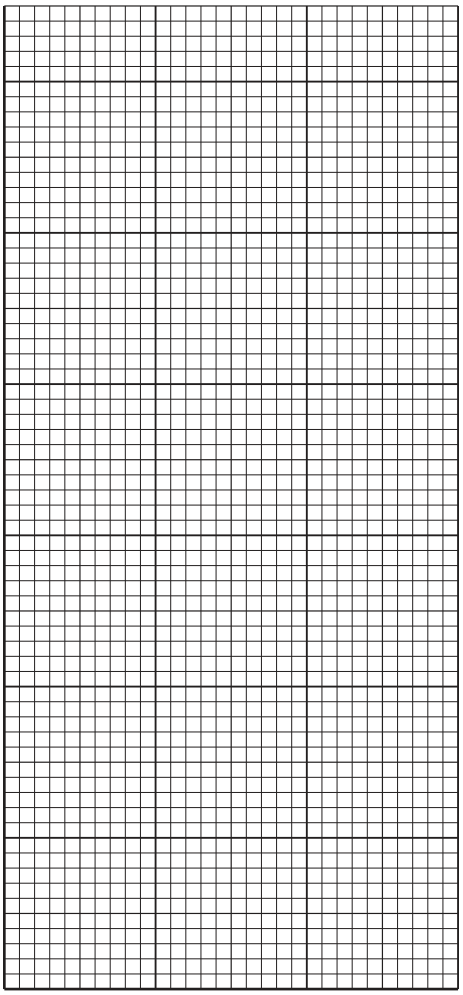
5 **(a)** A conservationist investigates the population of beetles in five different locations in Italy, Europe.

Table 5.1 shows the results.

Table 5.1

location	number of beetles
1	111
2	229
3	208
4	2
5	14

Plot a bar chart of the data.



[4]

(b) The conservationist used a grid quadrat to determine the number of beetles at each location.

Fig. 5.1 shows a grid quadrat on top of an area of grass.

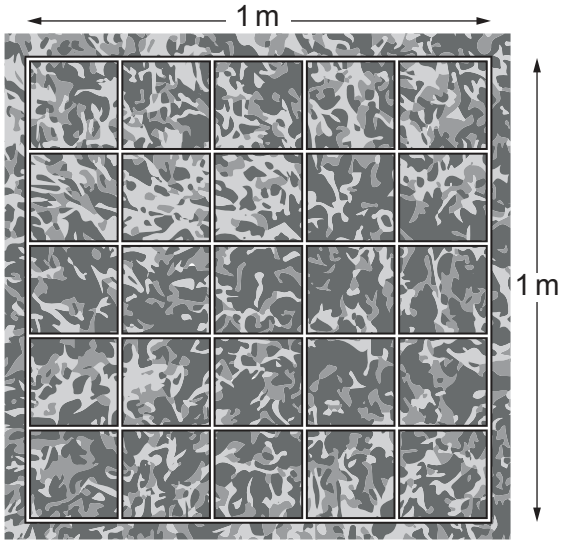


Fig. 5.1

(i) The conservationist counts two beetles in one of the small squares of the quadrat in Fig. 5.1.

Estimate the total number of beetles in the quadrat in Fig. 5.1.

..... [1]

(ii) Explain why the conservationist does **not** need to sample the whole area of each location when using a quadrat to estimate population.

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.....

.....

..... [2]

(iii) Suggest why using two different people to count the number of beetles in a quadrat can lead to inconsistent results.

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..... [1]

(iv) Quadrats are one technique for surveying beetle populations.

Suggest **one** other technique for surveying beetle populations.

..... [1]

(c) Fig. 5.2 shows a fox.

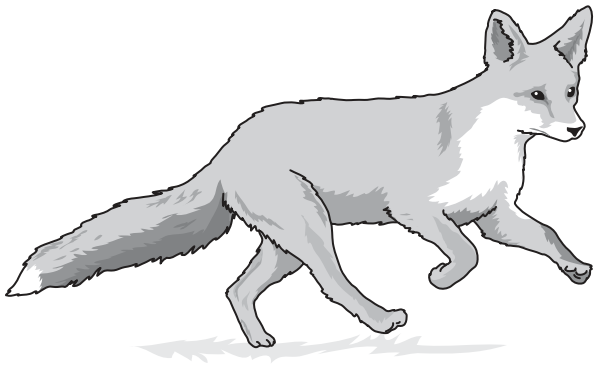

Fig. 5.2

The conservationist wants to estimate the population of foxes.

Suggest why a quadrat method is **not** a suitable method to use for this type of animal.

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..... [2]

(d) Fig. 5.3 shows a field.

Fig. 5.3

The conservationist uses the ACFOR scale to collect data on the abundance of plant species.

State **two** limitations of the ACFOR scale.

1 .....

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2 .....

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[2]

(e) The conservationist investigates how local habitat loss impacts the population of two beetle species, A and B.

Fig. 5.4 shows the percentage loss in beetle population against the percentage loss of local habitat.

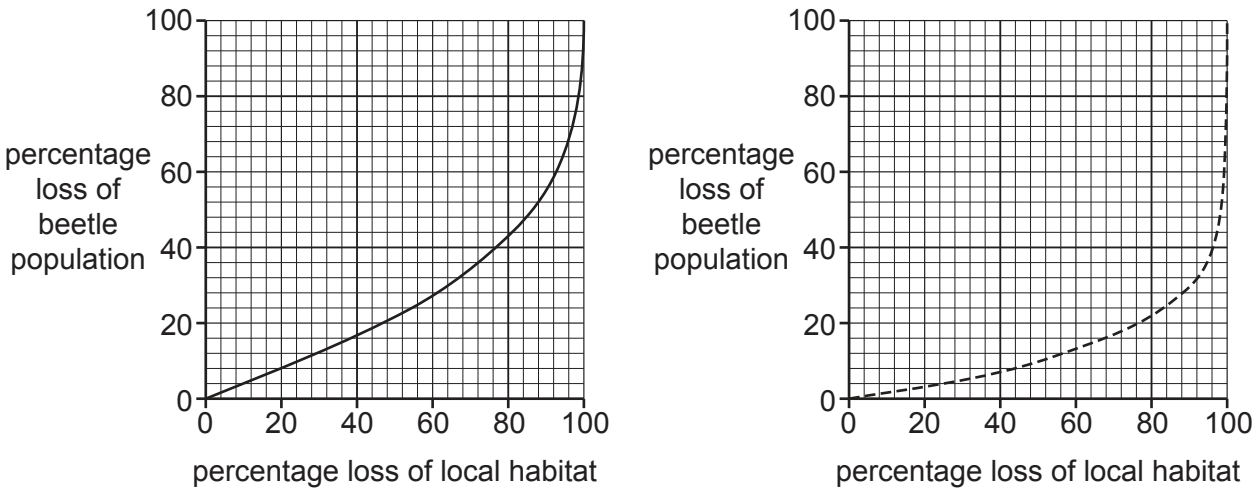

Fig. 5.4

Compare the percentage loss in the population of beetle species A and B when 25% of their local habitat is lost.

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..... [2]

(f) State **two** reasons why conserving biodiversity is beneficial.

1 .....

2 .....

[2]

(g) Fig. 5.5 shows a food chain.

grass → aphid → beetle → spider

Fig. 5.5

(i) State why the aphid is a primary consumer.

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..... [1]

(ii) Suggest the impact on local beetle populations if all the aphids in a location are killed by insecticide. Give a reason for your answer.

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..... [2]

(h) Fig. 5.6 shows the energy transferred from each trophic level in the food chain and the energy lost.

Key

→ energy transferred between trophic levels

- - - - - → energy lost

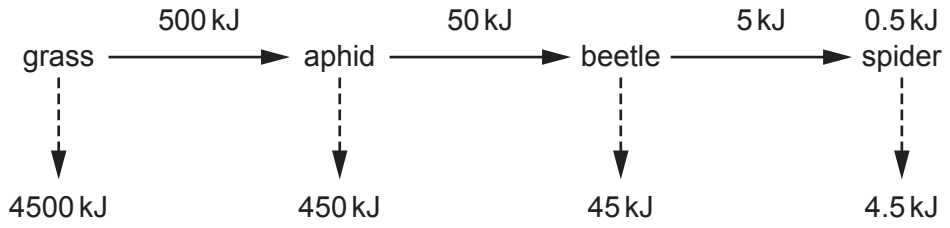

Fig. 5.6

Calculate the efficiency of the transfer from aphid to beetle using the equation shown.

$$\text{efficiency} = \frac{\text{energy transferred to next trophic level}}{\text{energy available from previous trophic level}} \times 100$$

efficiency = ... % [1]

[Total: 21]

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