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CANDIDATE NAME

CENTRE NUMBER

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ENVIRONMENTAL MANAGEMENT

8291/21

Paper 2 Management in Context

May/June 2026

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. Do **not** use correction fluid or tape.
- 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 **28** pages. Any blank pages are indicated.

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1 Energy resources are classified as renewable or non-renewable resources.

(a) Describe what is meant by a renewable resource.

.....

..... [1]

(b) Electricity can be generated using wind and solar resources.

In 2020, China stated it would become carbon neutral by 2060.

Describe how investment in wind and solar resources can help a country become carbon neutral.

.....

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..... [3]

(c) Investment in wind and solar resources can increase energy security.

Define energy security.

.....

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..... [1]

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(d) Figure 1.1 shows the electricity generated from solar resources from 2011 to 2022 in China.

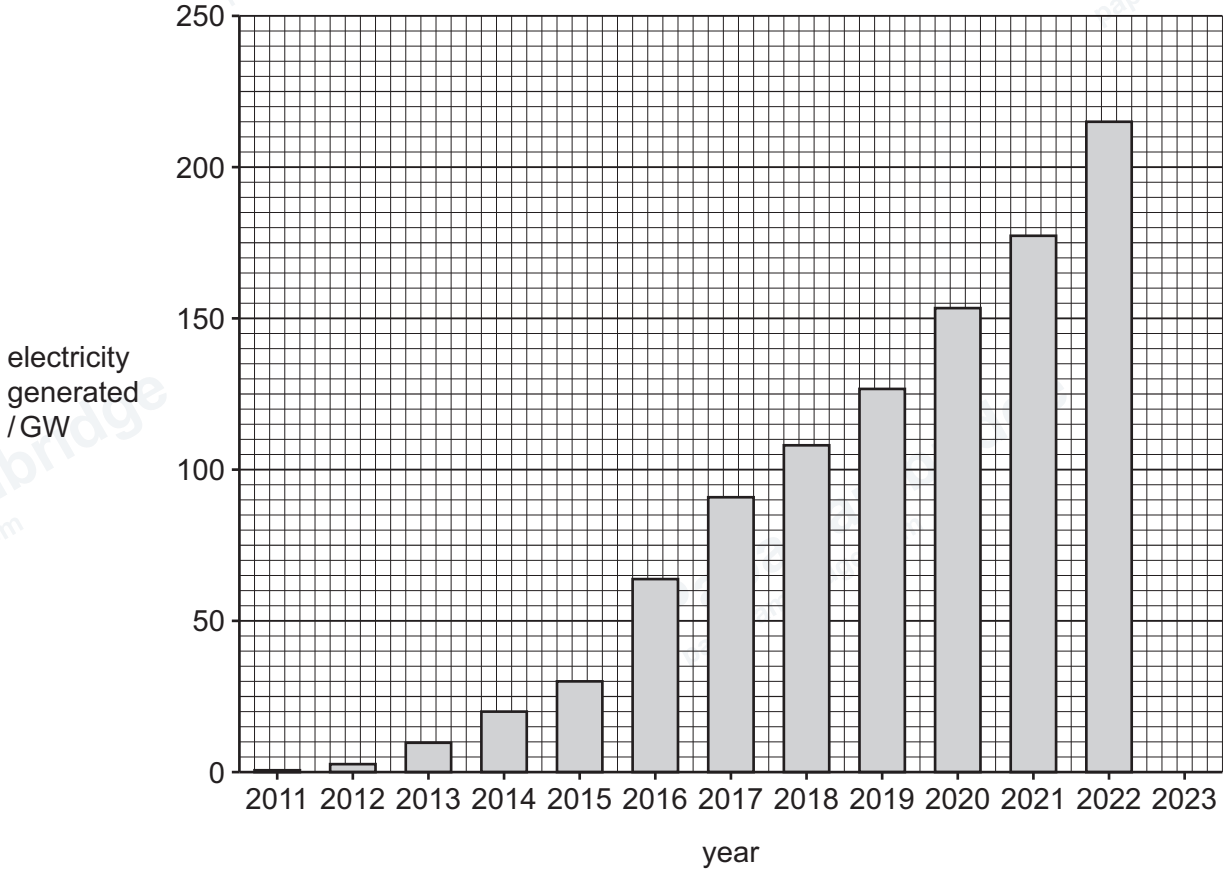

Figure 1.1

(i) Calculate the percentage increase in electricity generated from 2015 to 2022.

percentage increase = ...% [2]

(ii) The electricity generated for 2023 was 230 GW.

Plot this value on Figure 1.1. [2]

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(e) Figure 1.2 compares the predicted maximum quantity of electricity that could be generated from wind and solar resources for one year for China and the rest of the world.

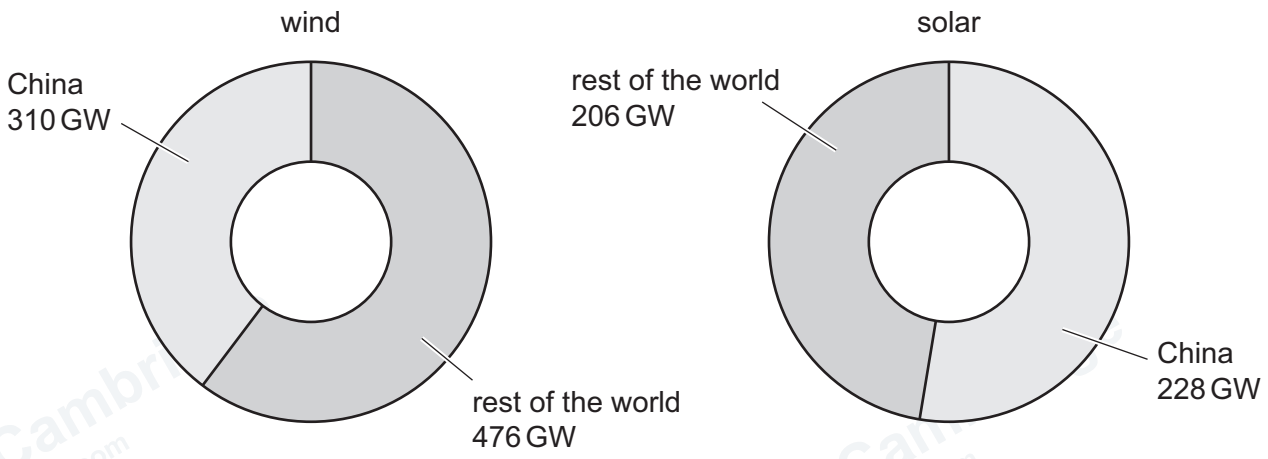

Figure 1.2

(i) Use Figure 1.2 to compare the predicted maximum quantity of electricity that could be generated from wind and solar resources for China and the rest of the world.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Suggest **two** reasons why the actual quantity of electricity generated from wind resources was less than the predicted maximum quantity.

1 .....

.....

2 .....

.....

[2]

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(f) The map in Figure 1.3 shows the location of electricity generation using solar energy in 30 regions of China in 2023.

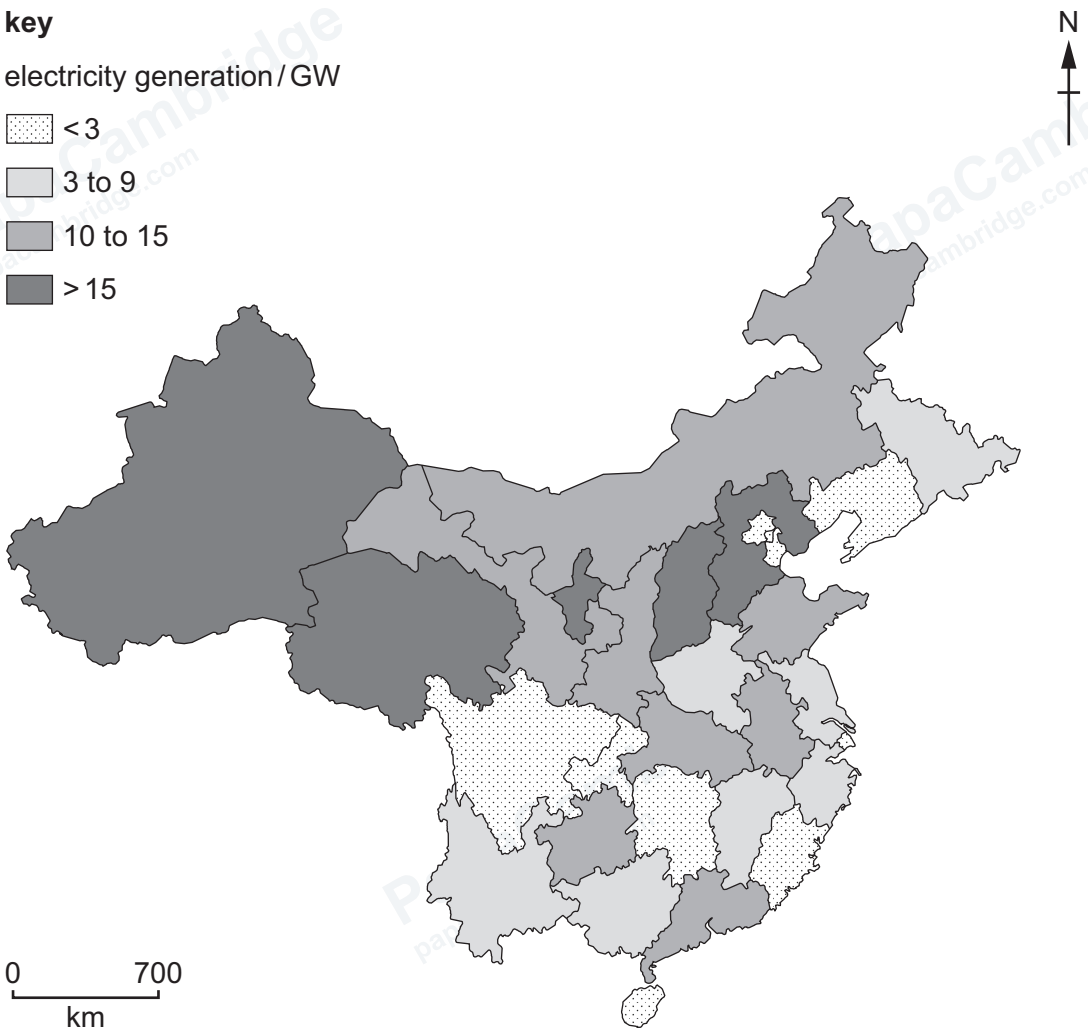

Figure 1.3

(i) Identify the number of regions that can generate at least 10 GW of electricity using solar energy.

number of regions = ... [1]

(ii) There are 10 regions shown in Figure 1.3 that generate less than 3 GW of electricity using solar energy.

Calculate the percentage of regions that generate less than 3 GW of electricity using solar energy.

Give your answer to **2** significant figures.

percentage = ...% [2]

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(iii) A report stated that China's electricity generation is mostly located in the northwest of the country. This is an area of low population density.

Suggest **one** benefit and **one** limitation of the location of this electricity generation.

benefit .....

.....

limitation .....

.....

[2]

[Total: 19]

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2 A report states that one third of global soils are degraded.

Degraded soil reduces the quality and quantity of crops and food produced.

Fertilisers are added to soil to improve soil fertility.

(a) Some artificial fertilisers are produced at high temperatures and pressures using natural gas as a reactant. Chemicals are then added to produce the fertiliser.

Suggest **three** negative impacts of producing fertilisers in this way.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) Polyhalite is a fertiliser. Polyhalite is obtained from rock below the Earth's surface.

Figure 2.1 shows a sample of crushed polyhalite rock. The crushed polyhalite rock can be applied directly to soil.

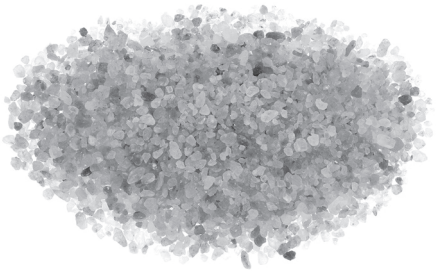

Figure 2.1

(i) The rock to final fertiliser product has approximately a 1 : 1 ratio.

Suggest **one** benefit of this 1 : 1 ratio.

.....

..... [1]

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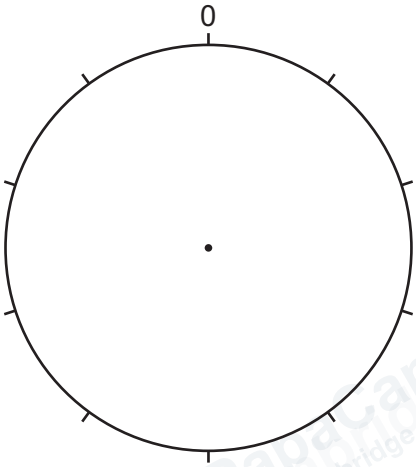
(ii) Table 2.1 shows the chemical composition of some polyhalite fertiliser.

Table 2.1

chemical	percentage
calcium	17
magnesium	6
other	15
potassium	14
sulfur	48

Draw a pie chart of the data in Table 2.1. Use a suitable key.



key

☐ .....

☐ .....

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☐ .....

☐ .....

[3]

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(c) Fertilisers can lead to good crop health.

A scientist compares the impact of a polyhalite fertiliser with other fertilisers on tomato plant height.

The tomato plants are grown in pots in a greenhouse. Different treatments are used on the soil at the start of the investigation.

The heights of the plants are measured after 88 days.

Figure 2.2 shows the results.

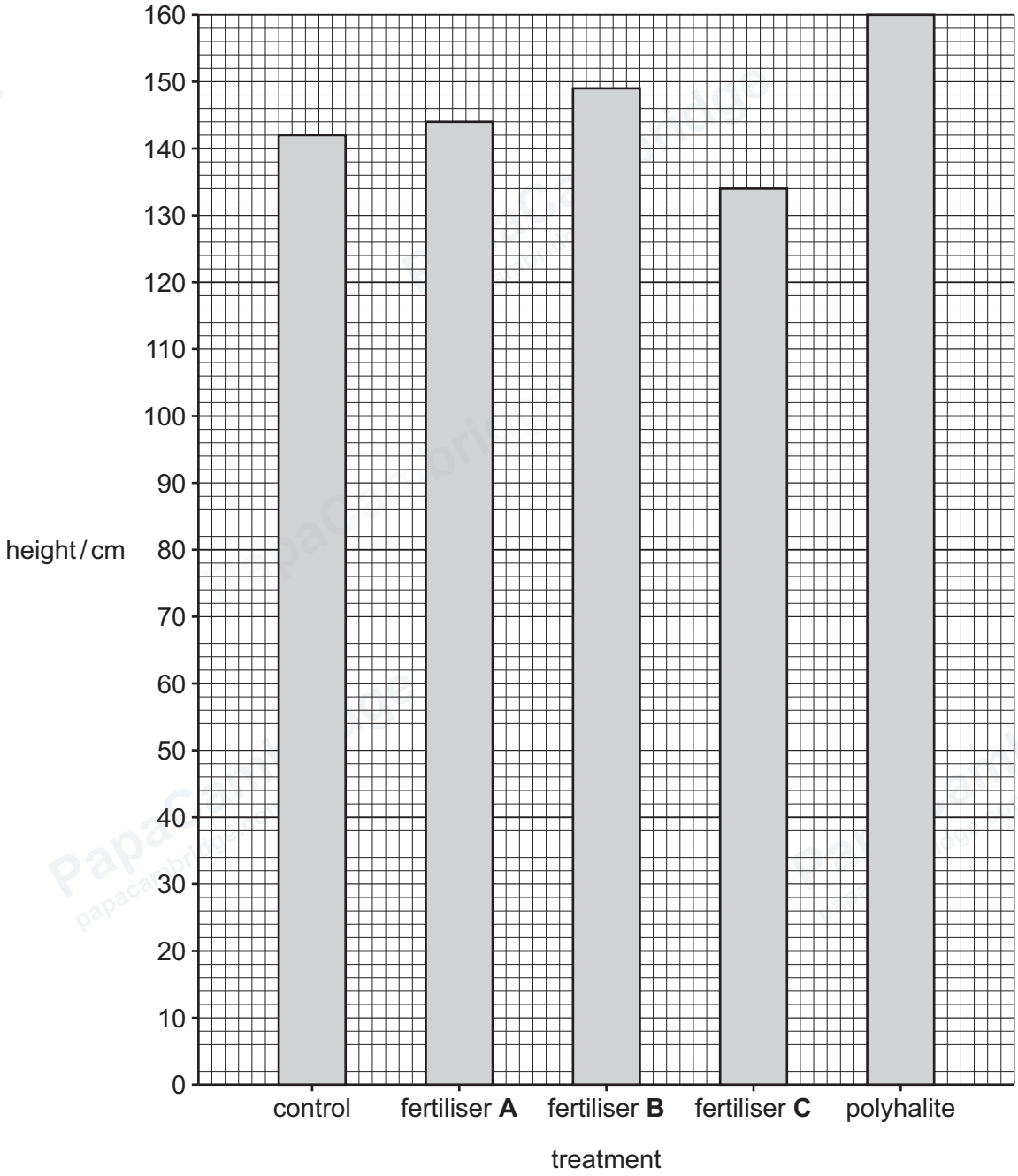

Figure 2.2

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(i) Suggest how the tomato plants in the control are treated differently from the other tomato plants.

.....

..... [1]

(ii) Suggest why the tomato plants are grown in a greenhouse rather than in a field.

.....

..... [1]

(iii) Use Figure 2.2 to describe the impact of using polyhalite fertiliser on plant height.

.....

..... [1]

(iv) Suggest why the scientist recommends that fertiliser **C** is **not** used to grow tomato plants.

.....

..... [1]

(v) The scientist repeats the investigation a total of 6 times.

Explain why repeating an investigation is good experimental practice.

.....

..... [1]

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(d) The scientist also investigates the severity of bacterial spot disease on tomato plants.

Bacterial spot causes leaf loss and low yield.

The same treatments, fertilisers **A**, **B**, **C**, polyhalite and the control, are used on the plants.

The severity of bacterial spot is measured after 78 days.

The plants that are affected the most are given a score of 100. Any plants that are **not** affected are given a score of 0.

Figure 2.3 shows the results.

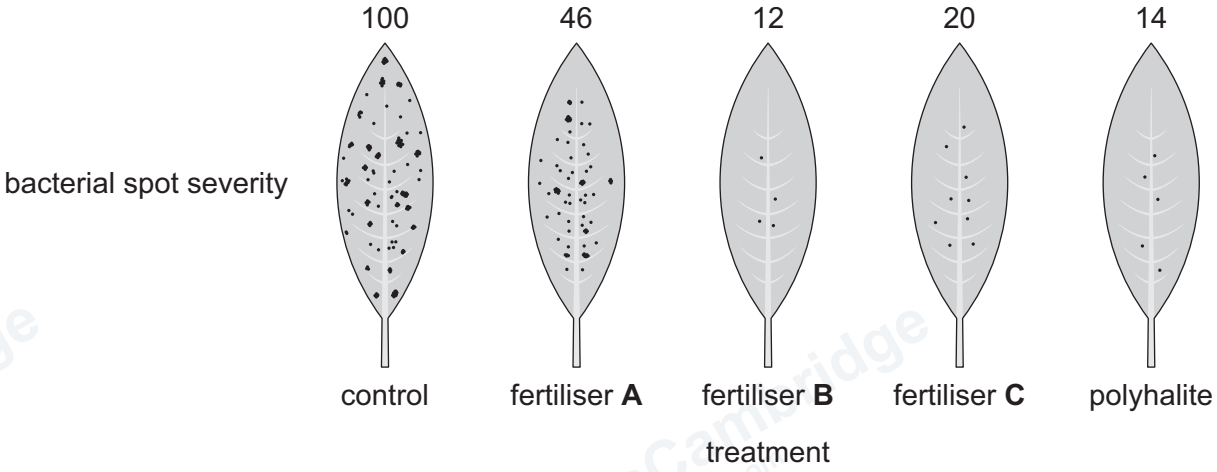

Figure 2.3

Rank the treatments, fertilisers **A**, **B**, **C**, polyhalite and the control, in order of how effective they are at preventing bacterial spot.

least effective .....

.....

.....

.....

most effective .....

[2]

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(e) In 2017, work to construct a new mine for obtaining polyhalite began in the northeast of England.

The mine is located in a national park. The mine is planned to operate for 100 years.

Some of the features of the new mine are:

- all of the mine buildings will be below ground and will not be visible on the surface
- the polyhalite will be transported out of the national park along a 37 km underground tunnel.

(i) Explain how these features of the mine protect the national park.

.....

.....

.....

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..... [3]

(ii) Suggest **two** benefits to local people of the mine.

1 .....

.....

2 .....

.....

[2]

[Total: 19]

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3 Climate change increases the frequency and severity of extreme weather events.

(a) Explain how climate change can increase the number of wild fires.

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..... [3]

(b) Figure 3.1 shows data for the area of land burned due to wild fires in Canada from 1983 to 2023.

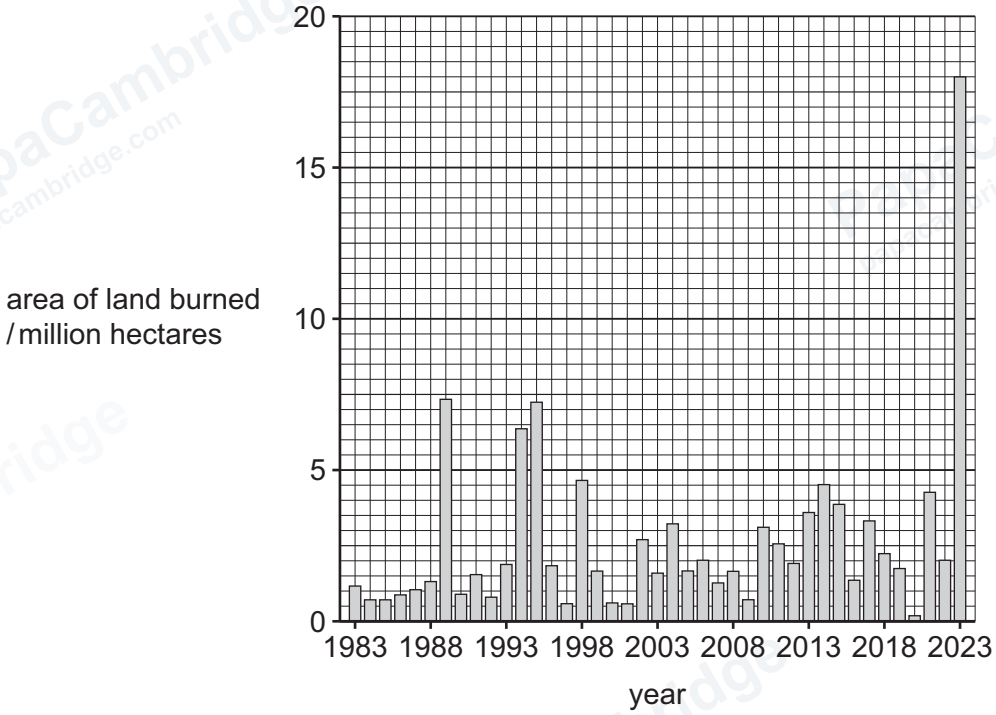

Figure 3.1

(i) Calculate the number of times greater the area of land burned in 2023 was compared to the area of land burned in 2022.

number of times greater = ... [1]

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(ii) Suggest **two** reasons why the data in Figure 3.1 does **not** support the conclusion that climate change causes wild fires.

1 .....

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2 .....

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.....

[2]

(c) Loss of life and harm to health are negative impacts of wild fires.

State **two** other negative impacts of wild fires.

1 .....

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2 .....

.....

[2]

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(d) Figure 3.2 compares the rainfall during a 20-year period in Australia with the average rainfall record from 1900.

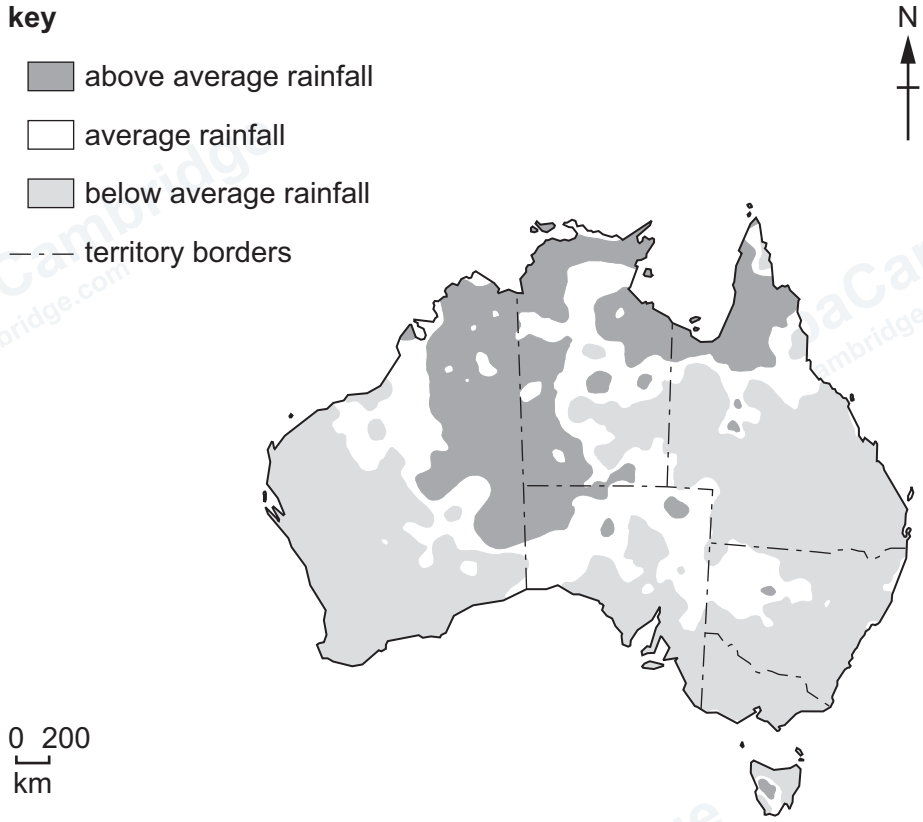

Figure 3.2

(i) Describe the distribution of rainfall shown in Figure 3.2.

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..... [2]

(ii) Above average rainfall can lead to flooding.

Describe how flooding can cause water insecurity.

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..... [3]

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(iii) Explain how planting trees can reduce the risk of flooding.

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..... [3]

[Total: 16]

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4 A scientist investigates insects in a forest.

The scientist:

- selects an area of the forest to sample using a random sampling strategy
- uses a beating tray and a pitfall trap to collect insects
- collects the insects on the first day of each month for a 12-month period.

(a) Describe how the scientist can select an area of the forest to sample using a random sampling strategy.

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.....

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..... [2]

(b) Describe a beating tray method the scientist can use to record the total number of individual insects and insect species collected over the 12-month period.

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..... [4]

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(c) The scientist compares the total number of individuals of each species collected using the two sampling methods.

Figure 4.1 is a bar chart of the results.

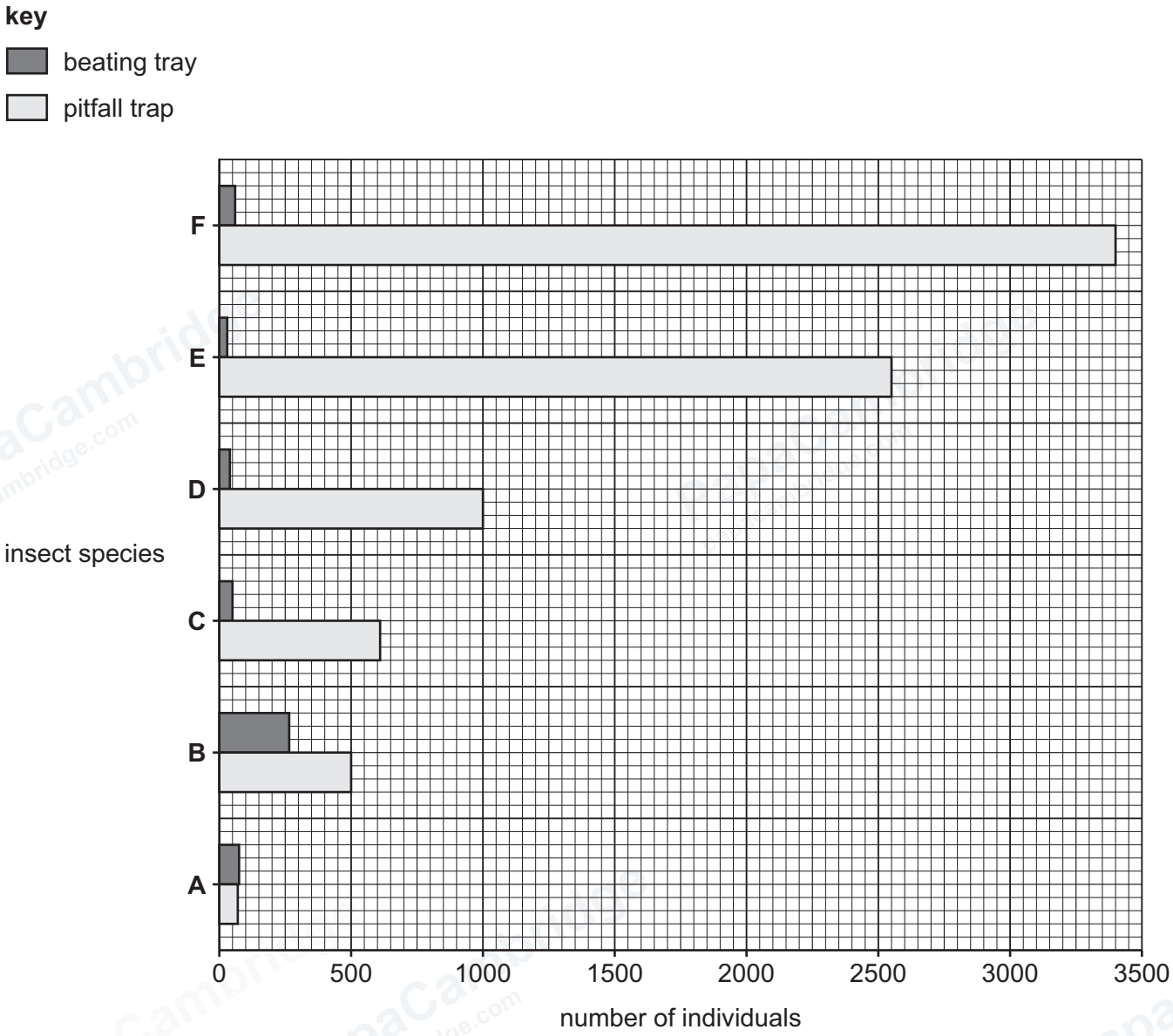

Figure 4.1

(i) Circle the difference in the number of individual insects of species **F** for the two sampling methods.

60 **3340** **3460** **3400**

[1]

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(ii) Suggest **two** reasons why the total number of individual insects collected using a pitfall trap is greater than using a beating tray.

1 .....

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2 .....

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..... [2]

(iii) Suggest **one** limitation of a pitfall trap.

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..... [1]

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(d) The scientist repeats the investigation in another forest.

Table 4.1 shows the results for the beating tray.

Table 4.1

insect species	number of individuals, *n*	$\left(\frac{n}{N}\right)^2$
A	55	0.0025
B	320	0.086
C	.....	0.0013
D	450	0.17
E	150	0.019
F	75	0.0047
the total number of individuals, *N*	1090	

(i) Complete Table 4.1. [1]

(ii) Calculate Simpson's index of diversity, *D*.

Use this equation:

$$D = 1 - \left(\Sigma\left(\frac{n}{N}\right)^2\right)$$

D = ... [1]

(iii) The scientist repeats the investigation after 5 years.

The value of *D* for this repeated investigation is lower than the initial value of *D*.

Suggest what a lower value of *D* shows.

.....

..... [1]

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(e) Explain how invasive species can reduce biodiversity.

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..... [3]

[Total: 16]

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5 Ozone depletion occurs in the atmosphere.

(a) State the layer of the atmosphere where ozone depletion occurs.

..... [1]

(b) Name **one** ozone depleting substance.

..... [1]

(c) Ozone concentration is measured using the Dobson Unit.

An ozone hole is an area where the average ozone concentration is below a certain value.

State this value.

..... Dobson Units [1]

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(d) International agreements banned the use of ozone depleting substances.

Depleted ozone leads to increased risk of skin cancer.

Figure 5.1 shows three predictions for cases of skin cancer per million people due to ozone depletion in the USA.

The three predictions were based on:

- no restrictions on ozone depleting substances
- implementation of the Montreal Protocol
- implementation of the Copenhagen Amendment.

key

———— no restrictions on ozone depleting substance

- - - - - - - - - Montreal Protocol

····· Copenhagen Amendment

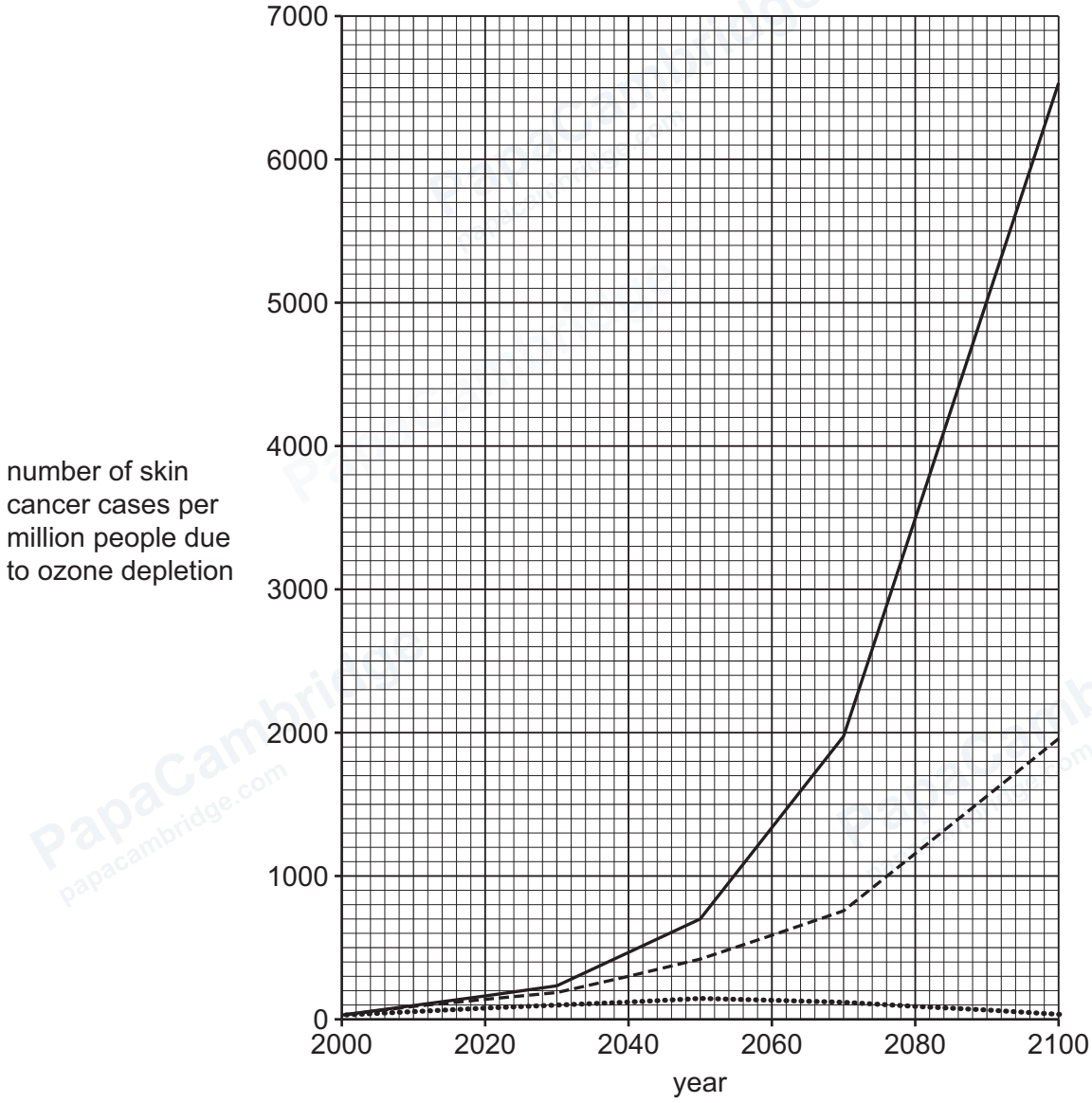

Figure 5.1

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(i) Use Figure 5.1 to evaluate the effectiveness of the two international agreements in reducing the impact of ozone depleting substances on cases of skin cancer.

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..... [4]

(ii) State **one** impact of ozone depletion on human health, other than cancer.

..... [1]

(e) Rowland-Molina were scientists who suggested a hypothesis for how ozone is depleted.

Explain why this hypothesis was **not** initially accepted by the scientific community.

.....

..... [1]

(f) Ozone depletion is greatest over Antarctica.

Suggest why the original Antarctic Treaty did **not** include any references to ozone depletion.

.....

..... [1]

[Total: 10]

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