Cambridge Assessment International Education

Cambridge International AS Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ENVIRONMENTAL MANAGEMENT **8291/21**

Paper 2 Management in Context **October/November 2025**

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 **24** pages. Any blank pages are indicated.

[Turn over

1 **(a)** Methane is a greenhouse gas. Greenhouse gases contribute to climate change.

(i) Define the term greenhouse gas.

.....

..... [1]

(ii) State **one** danger of a build-up of methane in the atmosphere other than climate change.

..... [1]

(b) Computer models are used to estimate the global atmospheric methane budget measured in teragrams, Tg. 1 Tg = 1×10^9 kg.

Sources add methane into the atmosphere and sinks remove methane from the atmosphere.

Fig. 1.1 shows data for the global atmospheric methane budget.

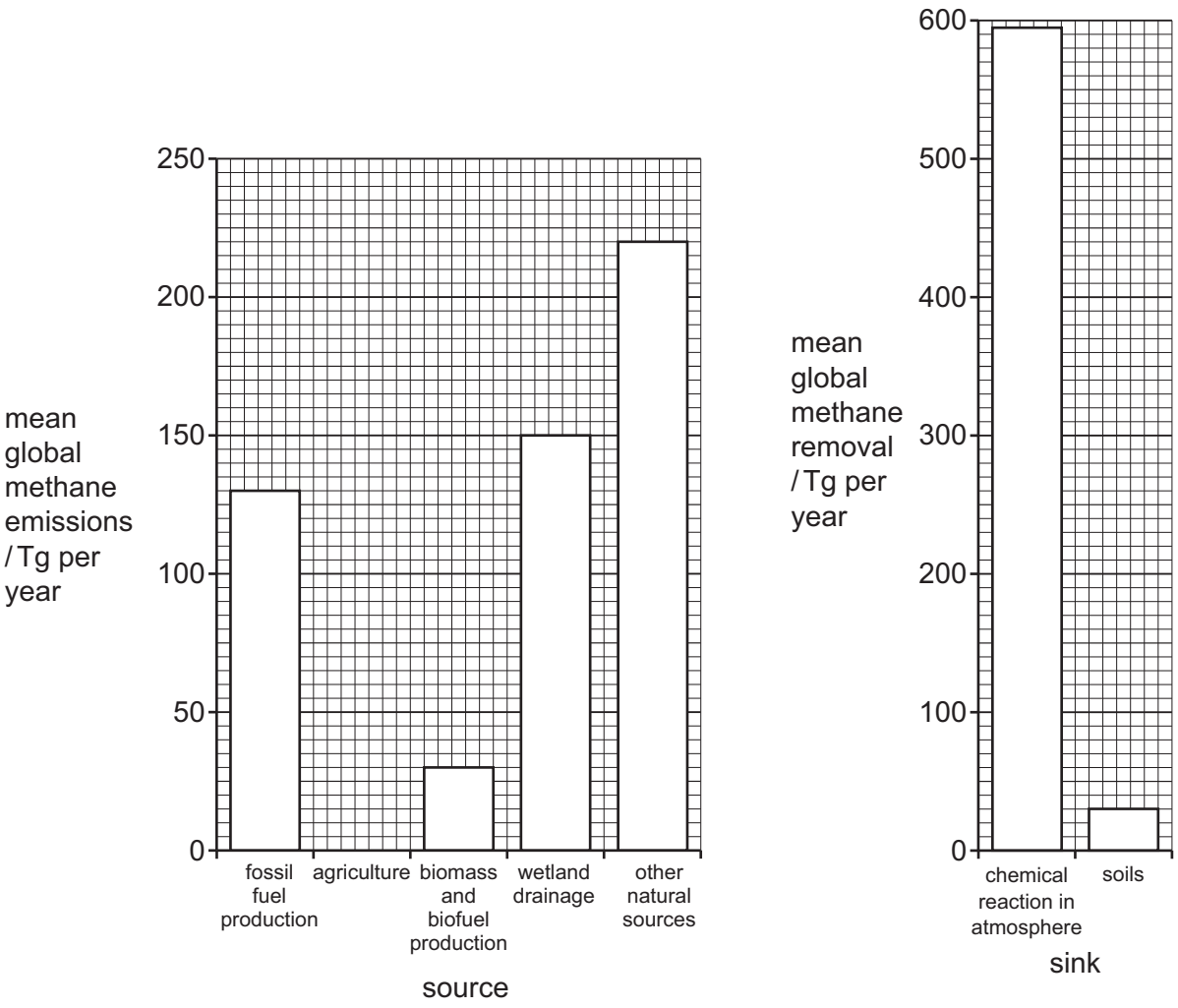

Fig. 1.1

(i) Complete the bar for agriculture to show a value of 205 Tg per year. [2]

(ii) The total methane emissions are 735 Tg per year.

Calculate the difference in total emissions and total removal of methane.

..... Tg per year [1]

(iii) Suggest **two** sources included within 'other natural sources' in Fig. 1.1.

1 .....

2 .....

[2]

(iv) Suggest **three** reasons why different computer models may give different values for methane removal.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

[Total: 10]

2 Rhinoceros are at risk from climate change.

(a) A scientist uses capture-mark-recapture to record the number of rhinoceros in an area.

(i) State **one** negative impact of this method of biodiversity investigation.

.....

..... [1]

(ii) The scientist uses the Lincoln index to estimate population size.

$$N = \frac{n_1 \times n_2}{m_2}$$

State what each of the letters represent in this formula.

n_1 .....

n_2 .....

m_2 .....

[3]

(b) Fig. 2.1 shows the distribution of black rhinoceros in 2021.

Fig. 2.1

Describe the distribution of black rhinoceros shown in Fig. 2.1.

.....

.....

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.....

..... [3]

(c) Fig. 2.2 shows the greater one-horned rhinoceros in Chitwan National Park in Nepal.

Fig. 2.2

Fig. 2.3 shows the number of rhinoceros in the Chitwan region from 1950 to 2000.

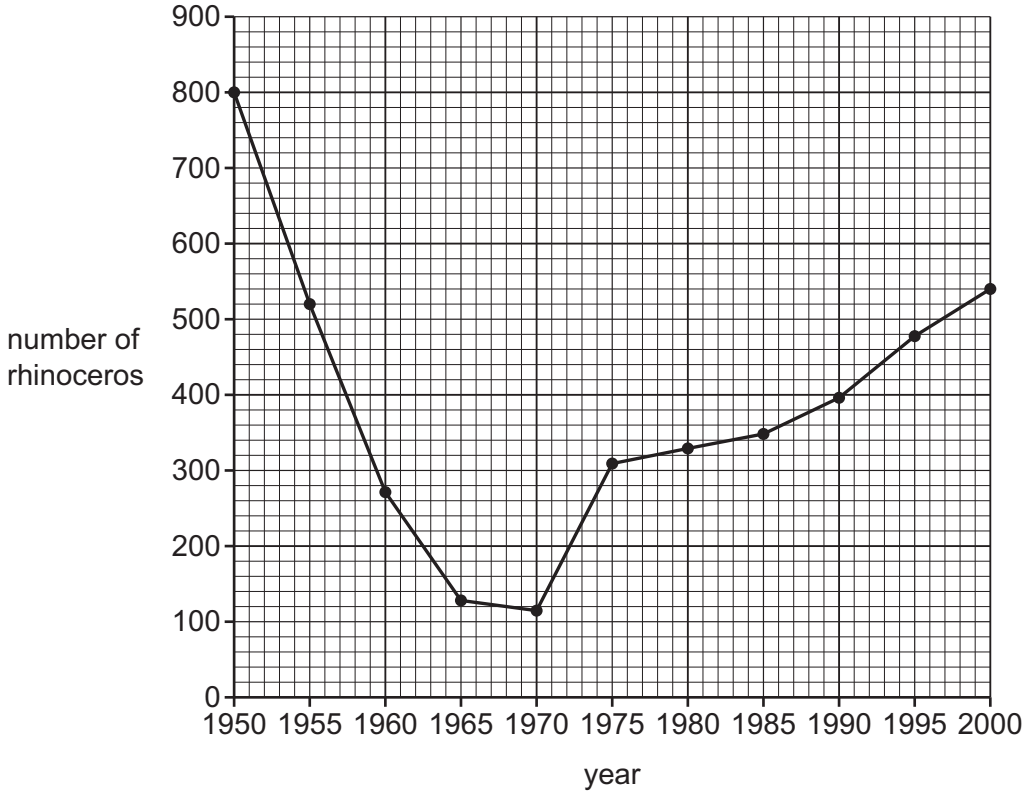

Fig. 2.3

(i) Use Fig. 2.3 to calculate the 5-year period with the greatest percentage change in the number of rhinoceros.

Circle your answer.

1950–1955 **1955–1960** **1970–1975** **1975–1980** [1]

(ii) Suggest **three** reasons for the change in the number of rhinoceros from 1970 to 2000.

1 .....

2 .....

3 .....

[3]

(d) Fig. 2.4 shows climate data for Chitwan National Park.

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Fig. 2.4

(i) Identify which month has the greatest range in temperature.

..... [1]

(ii) Calculate the temperature range for September.

..... °C [1]

(iii) Use Fig. 2.4 to suggest why death by drowning is common for the rhinoceros in the Chitwan region.

Explain your answer.

.....

.....

.....

.....

..... [3]

(iv) In 2020, mounds of soil 40 m × 30 m × 2 m were created in Chitwan National Park.

Suggest how these mounds reduce the number of deaths of rhinoceros by drowning.

.....

..... [1]

(v) Relocation of rhinoceros is a conservation strategy.

State **two** biotic factors that can negatively affect the success of this strategy.

1 .....

2 .....
[2]

[Total: 19]

3 Fig. 3.1 shows an Arctic walrus resting on sea ice.

Fig. 3.1

(a) Fig. 3.2 shows a food chain for an Arctic walrus.

phytoplankton → clams → Arctic walrus → polar bear

Fig. 3.2

(i) State the term given to phytoplankton in this food chain.

..... [1]

(ii) Identify a secondary consumer in this food chain.

..... [1]

(iii) Explain what happens to energy in this food chain.

.....

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.....

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.....

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..... [5]

(b) Walruses usually rest on sea ice between feeding.

However, in the last 10 years, large numbers of walrus have been seen to travel up to 200 km to rest on land.

(i) Suggest **one** reason for this change in behaviour.

.....

..... [1]

(ii) Suggest **two** negative impacts on walruses due to this change in behaviour.

1 .....

.....

2 .....

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[2]

(c) Fig. 3.3 is a drawing of a satellite image from a project called ‘walrus from space’.

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Fig. 3.3

The project counts populations of walrus using more than 540 000 satellite images.

Members of the public volunteer to help with the project. There are three stages to the project.

stage 1: A satellite image of an area where walrus are expected is given to a volunteer.
stage 2: The volunteer rejects any satellite image without a walrus.
stage 3: The volunteer puts an electronic dot on every walrus in the satellite image.

The dots are counted by a computer.

(i) Suggest **three** limitations of this project to count walrus populations.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(ii) Suggest **two** benefits of this project to count walrus populations.

1 .....

.....

2 .....

.....

[2]

(iii) State the name of this data collection method that uses data provided by members of the public.

..... [1]

[Total: 16]

4 **(a)** Fig. 4.1 shows a mayfly nymph in a river.

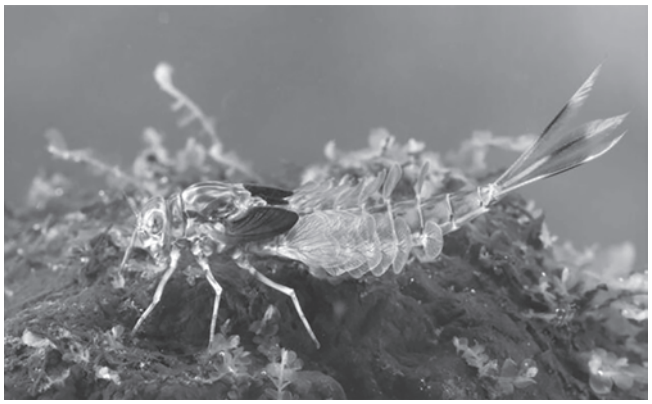

Fig. 4.1

A student wants to sample the population of mayfly nymphs in a river.

Fig. 4.2 shows the river.

Fig. 4.2

(i) Suggest **two** safety precautions the student should take before using this river to sample mayfly nymphs.

1 .....

.....

2 .....

.....

[2]

(ii) Describe how kick sampling is used to investigate the population of mayfly nymphs in the river.

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..... [5]

(b) The population of mayfly nymphs in river water is used as an indication of water quality.

Fig. 4.3 shows data for the population of mayfly nymphs in rivers in an area of India.

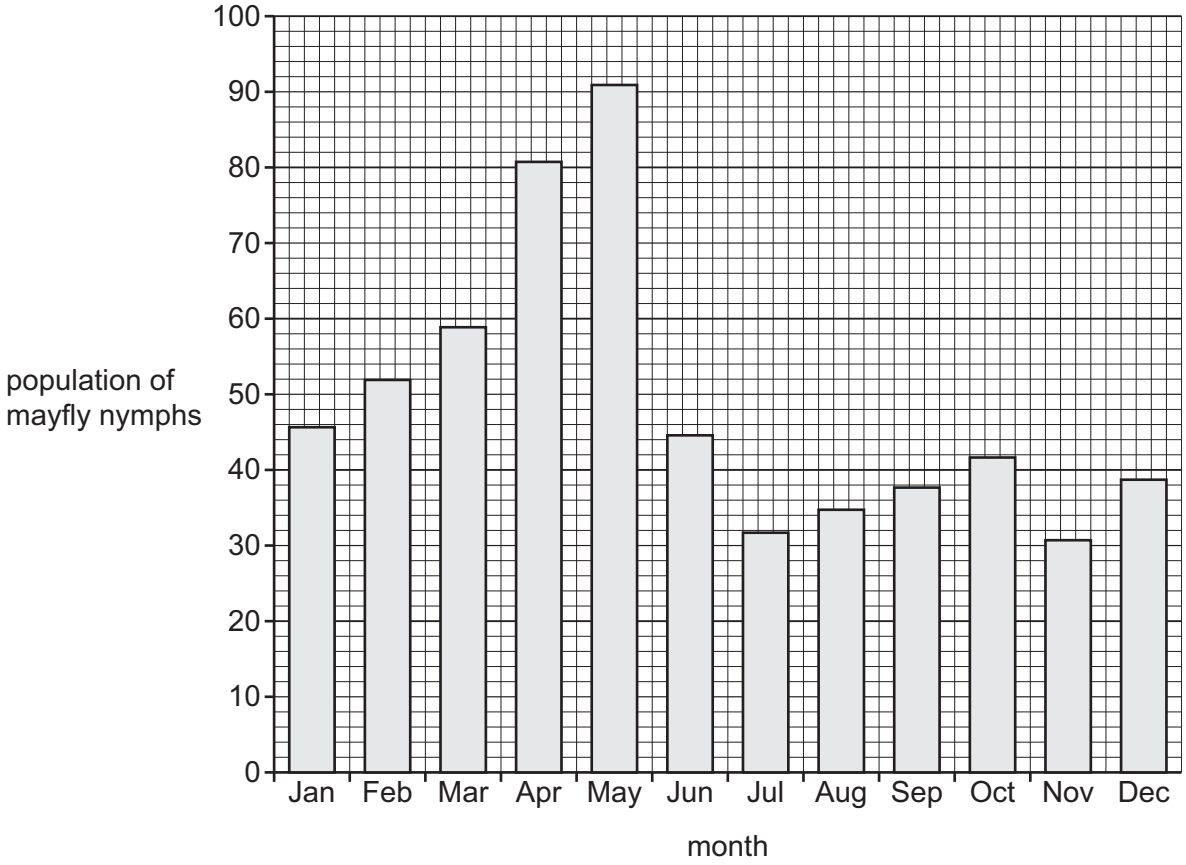

Fig. 4.3

Fig. 4.4 shows data for the mean monthly pH of water from the same rivers in India.

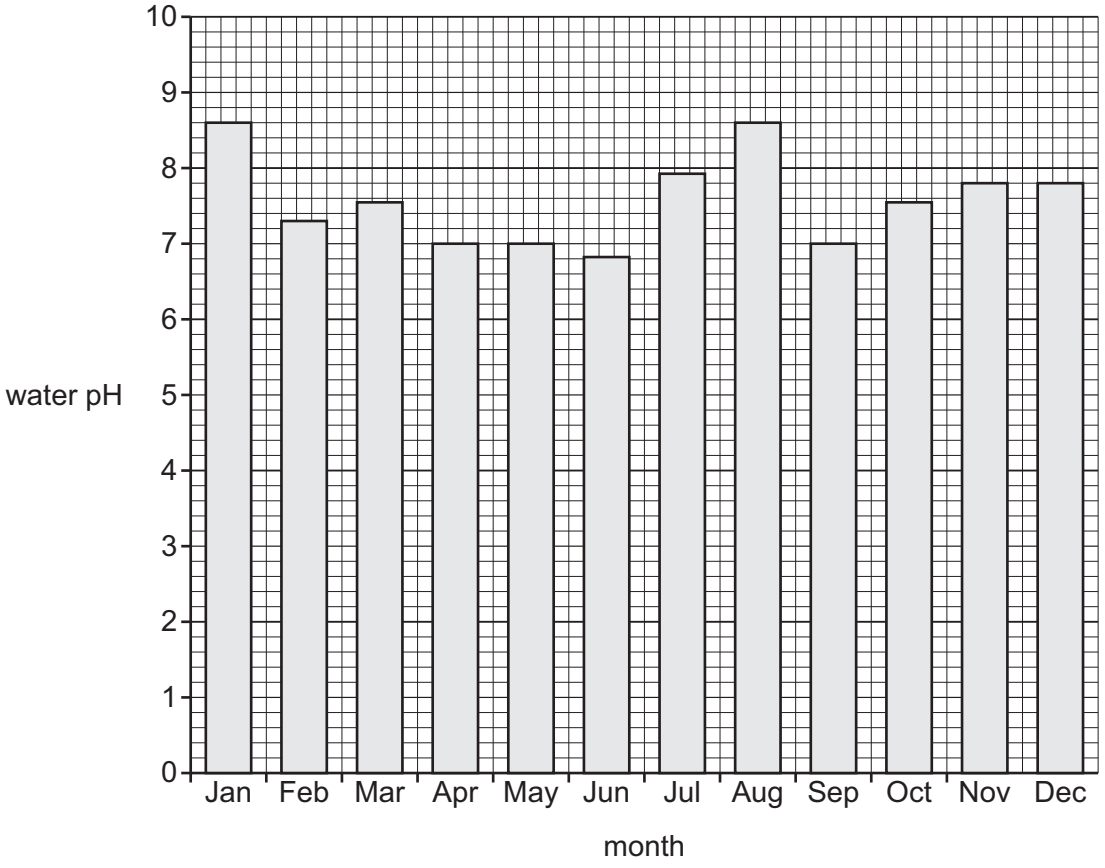

Fig. 4.4

The student concludes that a water pH value of 7 provides the best conditions for mayfly nymphs.

Discuss whether this conclusion is correct.

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..... [2]

(c) Acid deposition can affect aquatic environments.

(i) Outline the formation of acid deposition from the combustion of fossil fuels.

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.....

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..... [4]

(ii) State **two** impacts of acid deposition other than on aquatic environments.

1 .....

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2 .....

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[2]

[Total: 15]

5 **(a)** Fig. 5.1 shows the 'Firelight Toilet' system.

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Fig. 5.1

The system heats and dries toilet waste to very high temperatures.

Electricity is generated by burning the remaining solid toilet waste. This electricity is used to power the toilet and for household use. Excess water is recycled and used to flush the toilet waste.

(i) Suggest how the 'Firelight Toilet' system reduces water insecurity.

.....

.....

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.....

.....

..... [3]

(ii) Suggest **two** benefits of the 'Firelight Toilet' system other than reducing water insecurity.

1 .....

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2 .....

..... [2]

(b) Fig. 5.2 shows data on global clean water availability and demand.

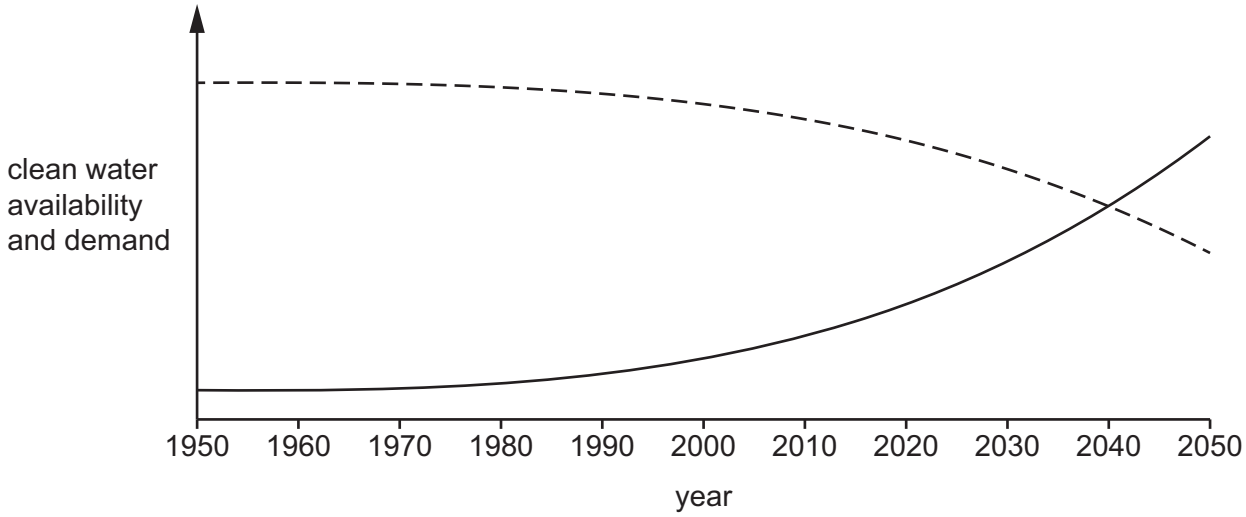


Fig. 5.2

Describe what the data in Fig. 5.2 shows for global clean water availability and demand.

.....

.....

.....

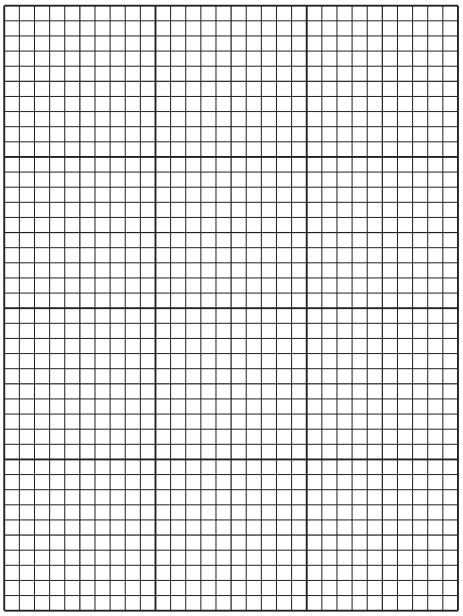
..... [2]

(c) Table 5.1 shows the annual volume of water used by industry in the USA from 1990 to 2010. The USA is a country with a high-income economy.

Table 5.1

year	volume of water / billion m^3
1990	304
1995	300
2000	298
2005	305
2010	248

(i) Plot a line graph of the data.



[3]

(ii) Suggest **two** limitations of using this data to predict the global water usage by industry for 2030.

1 .....

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2 .....

.....

[2]

(d) The agricultural industry accounts for 80% of the water used in the USA.

State **three** ways the agricultural industry can reduce water usage.

1 .....

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2 .....

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3 .....

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[3]

(e) Tick (✓) **all** the sources of sub-surface fresh water.

glaciers	☐
ground water	☐
permafrost	☐
swamps	☐

[1]

(f) Describe how a gravity-fed scheme is used to supply safe drinking water to a village.

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..... [4]

[Total: 20]

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