



# **Cambridge International AS Level**

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# 375406976

#### **ENVIRONMENTAL MANAGEMENT**

8291/11

Paper 1 Principles of Environmental Management

May/June 2025

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

#### **INSTRUCTIONS**

- Section A: answer all questions.
- Section B: answer one question.
- 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.

## **Section A**

2

Answer all questions in this section.

| 1 ( | a) | Evaporation is a process in the water cycle. |
|-----|----|--|
|     |    | State what is meant by evaporation of water. |
|     |    |  |
|     |    | [1]  |

(b) Fig. 1.1 shows interception of water.



Fig. 1.1

| escribe now interception affects the water cycle. |
|---|
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|   |
|   |
|   |
|   |
| [2]   |

(i)



(ii) Table 1.1 shows processes in the water cycle.

Place a tick (✓) in Table 1.1 to show which processes add water to ground water stores.

Table 1.1

3

| process         | add water to ground water stores |
|-----------------|----------------------------------|
| evaporation     |                                  |
| infiltration    |                                  |
| precipitation   |                                  |
| surface run-off |                                  |
| transpiration   |                                  |

(c) Table 1.2 shows the percentage of fresh water withdrawn from water sources by industry in countries from different income groups.

Table 1.2

| country  | percentage of fresh water withdrawn by industry | income group |
|----------|---|--------------|
| China    | 22  | MIC          |
| France   | 71  | HIC          |
| Germany  | 81  | HIC          |
| Haiti    | 4   | LIC          |
| Malaysia | 30  | MIC          |
| Rwanda   | 11  | LIC          |

| (i)  | se Table 1.2 to describe the relationship between income group and the percentage of esh water withdrawn from water sources by industry. |  |  |
|------|--|--|--|
|      |  |  |  |
|      | [1]  |  |  |
| (ii) | Mongolia is a MIC.   |  |  |
|      | Predict the percentage of fresh water withdrawn from water sources by industry in Mongolia.  |  |  |
|      | Use Table 1.2 to explain your prediction.  |  |  |
|      | prediction   |  |  |
|      | explanation  |  |  |
|      |  |  |  |
|      |  |  |  |

[2]



Permafrost is a water source.

Permafrost can be classified as continuous and discontinuous.

#### A location with:

- continuous permafrost has 90% of the area with permafrost
- discontinuous permafrost has between 50% and 90% of the area with permafrost.

Fig. 1.2 shows the distribution of permafrost in the Arctic in 2015.

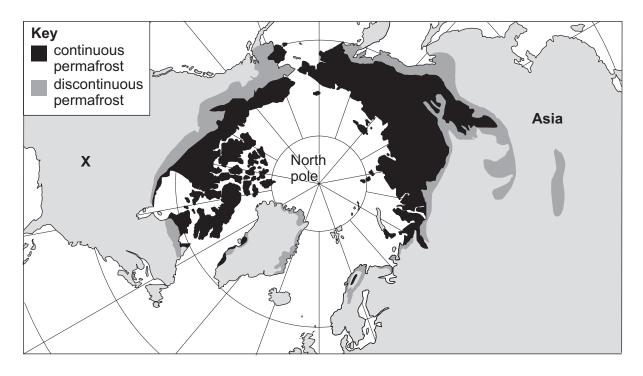


Fig. 1.2

| (i)  | Identify continent X.                                      |
|------|--|
|      | [1]  |
| (ii) | Describe the distribution of permafrost shown in Fig. 1.2. |
|      |  |
|      |  |
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|      |  |
|      | [3]  |



(iii) Global temperatures are predicted to increase.

Predict the distribution of permafrost in the Arctic in 2035.

Use the key to draw your prediction on Fig. 1.3. Label the distribution.

5

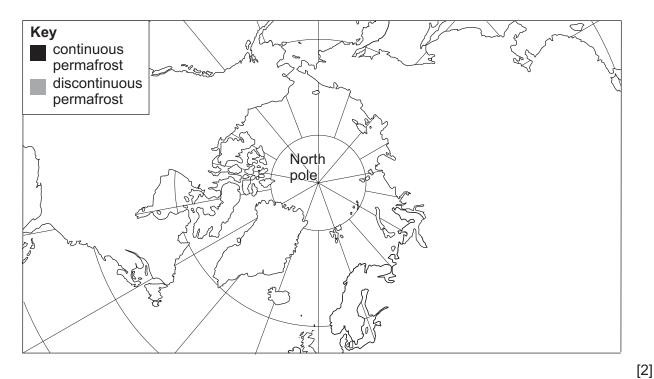


Fig. 1.3

(iv) Methane is trapped in permafrost.

| Explain how methane increases global temperatures. |
|--|
|  |
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| [3]  |

[Total: 17]

[2]

6

- 2 (a) A scientist investigates the biodiversity of a grassland biome.
  - (i) Describe how a quadrat is used in a random sampling strategy to estimate the populations of plant species in a 1 km<sup>2</sup> area.

In your answer include:

- how you will randomly sample the area with a quadrat
- the variables to control
- how to ensure the results are reliable

| how the total population will be estimated.   |
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| [6]   |
| State <b>two</b> limitations of using a quadrat to estimate the populations of plant species in random sampling strategies. |
| 1   |
|   |
|   |
| 2   |
|   |

(ii)



Table 2.1

**(b)** Table 2.1 shows the populations of the plant species in the grassland biome.

7

| species          | population<br>(number of<br>individuals<br><i>n</i> ) | <u>n</u><br>N | $\left(\frac{\boldsymbol{n}}{\boldsymbol{N}}\right)^2$ |
|------------------|---|---------------|--|
| shiny star grass | 35  |               |  |
| butter gerbera   | 360   |               |  |
| heart vine       | 95  |               |  |
| sheepfig         | 230   |               |  |
| hairy crabgrass  | 120   |               |  |
|                  | N =   |               | $\Sigma \left(\frac{n}{N}\right)^2 =$                  |

n = number of individuals

**N** = total number of individuals

(i) Complete Table 2.1.

[4]

(ii) Calculate Simpson's index of diversity, D, using the formula:

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

(iii) The scientist compared the Simpson's index of diversity of a different grassland biome to a tundra biome. The values are shown in Table 2.2.

Table 2.2

| biome     | Simpson's index of diversity |
|-----------|------------------------------|
| grassland | 0.81                         |
| tundra    | 0.33                         |

Compare the biodiversity of the two biomes.

8||| 88||8|| 18||| 88||| 88||| 88||| 88||| 88||| 88||| 88||| 88|| 18||

(iv) Table 2.3 describes the climate, soil type and vegetation in grassland and tundra biomes.

Complete Table 2.3.

Table 2.3

8

|            | biome  |  |  |  |
|------------|--|--|--|--|
|            | grassland                                    | tundra                                 |  |  |
| climate    | different seasons with moderate temperatures |  |  |  |
| soil type  |  | thin (shallow) soil with few nutrients |  |  |
| vegetation | grasses, shrubs and<br>small trees           |  |  |  |

[3]

[Total: 17]



(a) Table 3.1 shows information about three cities in China in 2022. 3

Table 3.1

9

|  | city     |         |         |  |  |
|--|----------|---------|---------|--|--|
|  | Shanghai | Tianjin | Beijing |  |  |
| population<br>/million people                      | 28.517   | 13.866  | 21.893  |  |  |
| area of city<br>/km²                               | 6340     | 11 946  | 16410   |  |  |
| population<br>density<br>/ people km <sup>-2</sup> |          | 1161    | 1334    |  |  |

Calculate the population density of Shanghai in 2022.

Give your answer as a whole number.

|      | people km <sup>-2</sup> [2]   |
|------|---|
| (ii) | Suggest <b>three</b> factors that explain the difference in population density between Beijing and Tianjin. |
|      | 1   |
|      |   |
|      | 2   |
|      |   |
|      | 3   |
|      | [3]   |



**(b)** Fig. 3.1 shows the annual percentage population change against median age for ten countries.

10

The median age has the same number of people above and below that age.

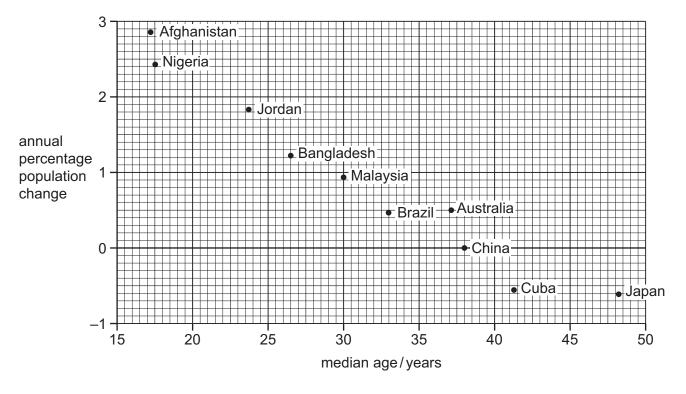


Fig. 3.1

| (i) | Use Fig. 3. | 1 to determine | the |
|-----|-------------|----------------|-----|
|-----|-------------|----------------|-----|

| median | age | TOT | China |
|--------|-----|-----|-------|
|        |     |     |       |

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| • 6 | annual | percentage | population | change i | for Australia. |
|-----|--------|------------|------------|----------|----------------|
|-----|--------|------------|------------|----------|----------------|

| [2] |
|-----|

| (ii) | Describe the relationship between the annual percentage population change and the | ne |
|------|---|----|
|      | median age for the countries shown in Fig. 3.1.                                   |    |

|--|--|

(d)

11

| (c) | State | three | factors | that | affect | population | change. |
|-----|-------|-------|---------|------|--------|------------|---------|
|-----|-------|-------|---------|------|--------|------------|---------|

| 1   |     |
|---|-----|
| 2   |     |
|   |     |
| 3   |     |
|   | [3] |
| Japan has an ageing population.                   |     |
| State <b>three</b> impacts of ageing populations. |     |
| 1   |     |

[Total: 14]

[3]



4 (a) Fig. 4.1 shows a crop grown for biofuel.



12

Fig. 4.1

The biofuel crop is combusted to release thermal energy.

|       | Name <b>two</b> other types of biofuel.   |
|-------|---|
|       | 1   |
|       | 2[2]  |
| (ii)  | Explain why biofuels are a renewable energy resource.   |
|       |   |
|       |   |
|       |   |
|       | [2]   |
| (iii) | State <b>two</b> benefits of using biofuel as an energy resource, other than being renewable. |
|       | 1   |
|       |   |
|       | 2   |
|       | [2]   |

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| (iv) | Explain how the biofuel crop in Fig. 4.1 reduces biodiversity. |
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|      | [2]  |
| (v)  | Explain how biofuels decrease food security.                   |
|      |  |
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|      | [3]  |

(b) Table 4.1 shows the global production of energy from biofuels between 2000 and 2022.

Table 4.1

| year | production of energy from<br>biofuels<br>/10 <sup>9</sup> kilowatt hours |
|------|--|
| 2000 | 110  |
| 2005 | 230  |
| 2010 | 700  |
| 2015 | 900  |
| 2020 | 1050   |
| 2022 | 1020   |

Use Table 4.1 to identify the 5-year period with the greatest increase in energy production from biofuels.

[Total: 12]

# Section B

## Answer one question.

## **EITHER**

|    | ·· <del></del> ·   |
|----|--|
| 5  | 'Generating electricity using nuclear energy is the most effective strategy for managing energy security.' |
|    | To what extent do you agree with this statement?   |
|    | Give reasons and include information from relevant examples to support your answer. [20]                   |
| OR |  |
| 6  | Evaluate the success of strategies for managing air pollution.   |
|    | Give reasons and include information from relevant examples to support your answer. [20]                   |
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