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**Environmental systems and societies**  
**Standard level**  
**Paper 2**

Wednesday 12 May 2021 (morning)

Candidate session number

2 hours

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**Instructions to candidates**

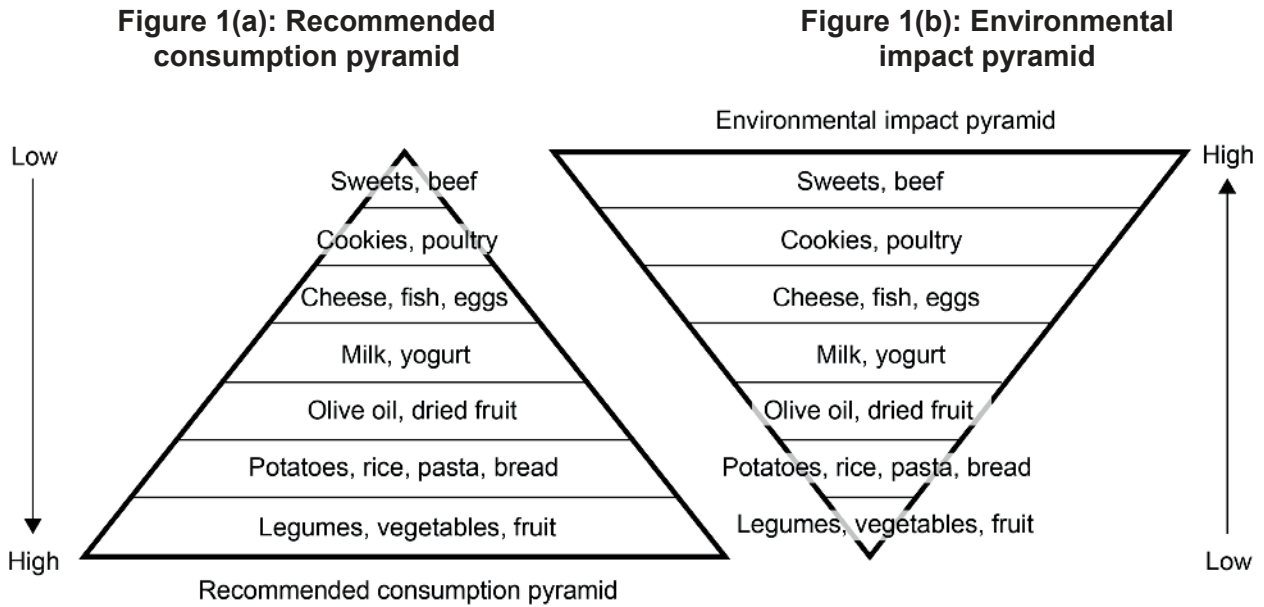
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer two questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[65 marks]**.



### Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

- 1. The figure refers to a typical Western European diet. This example shows recommended consumption of food types (on the basis of health) and the environmental impact of their production.



(a) With reference to **Figures 1(a)** and **1(b)**:

- (i) State the food that has the highest environmental impact. [1]

.....  
.....

- (ii) State the food that has the highest recommended consumption. [1]

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**(Question 1 continued)**

(b) Describe the relationship between both pyramids in **Figures 1(a)** and **1(b)**. [2]

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(c) Identify **two** environmental impacts associated with producing the foods near the base of the recommended consumption pyramid (**Figure 1(a)**). [2]

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(d) Describe how foods high on the environmental impact pyramid, shown in **Figure 1(b)**, are likely to affect the ecological footprint of global food production. [2]

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(e) Outline **two** reasons why the composition of a typical diet in other regions of the world may differ from the Western European diet shown in **Figure 1(a)**. [2]

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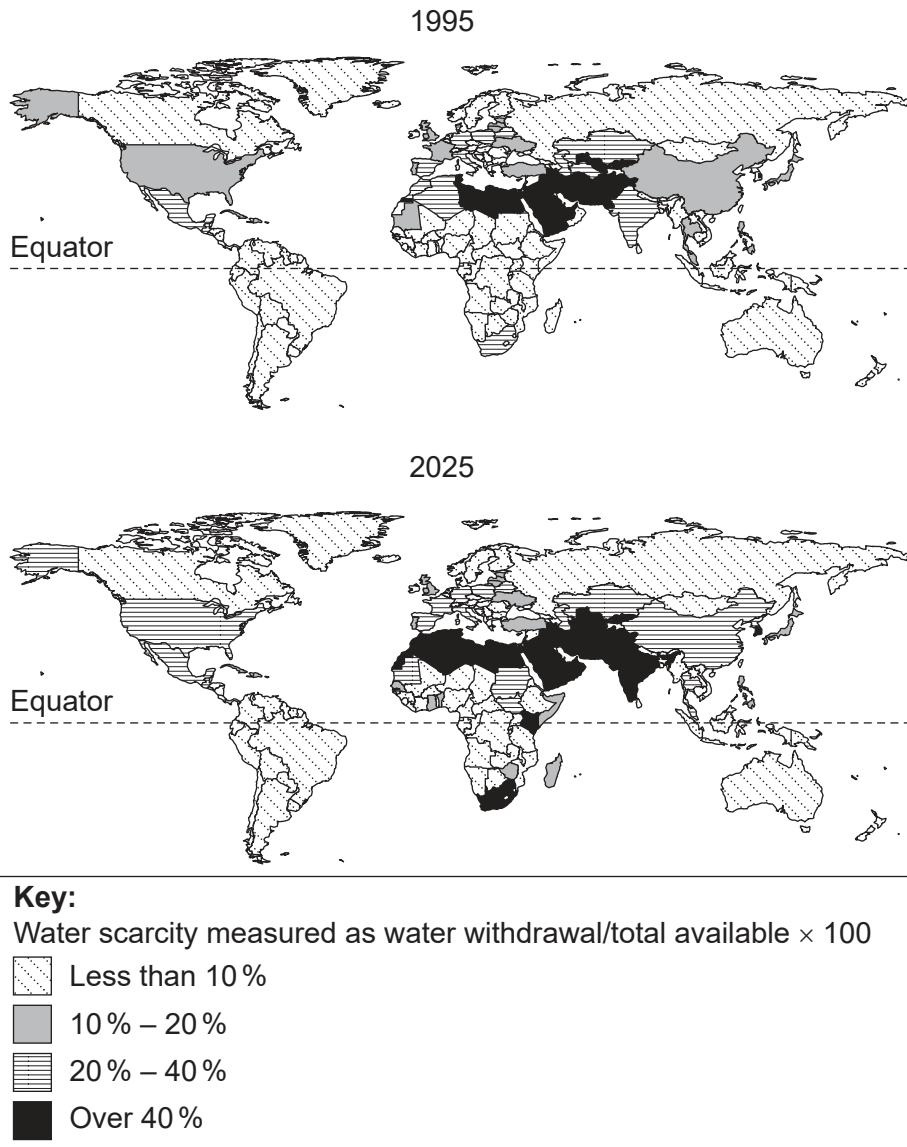
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Figure 2: Projected global water scarcity 1995-2025



[Source: With permission from GRID-Arendal. Source adapted.]

2. (a) State the general pattern of change in global water scarcity predicted from 1995 to 2025 as shown in **Figure 2**.

[1]

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(This question continues on the following page)



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**(Question 2 continued)**

(b) Identify **two** ways in which climate change may influence the predicted change shown in **Figure 2**. [2]

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(c) Identify **two** possible human influences, not related to climate change, that may cause the changes in water scarcity predicted for 2025. [2]

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(d) Outline **two** reasons why some countries are unlikely to experience water scarcity. [2]

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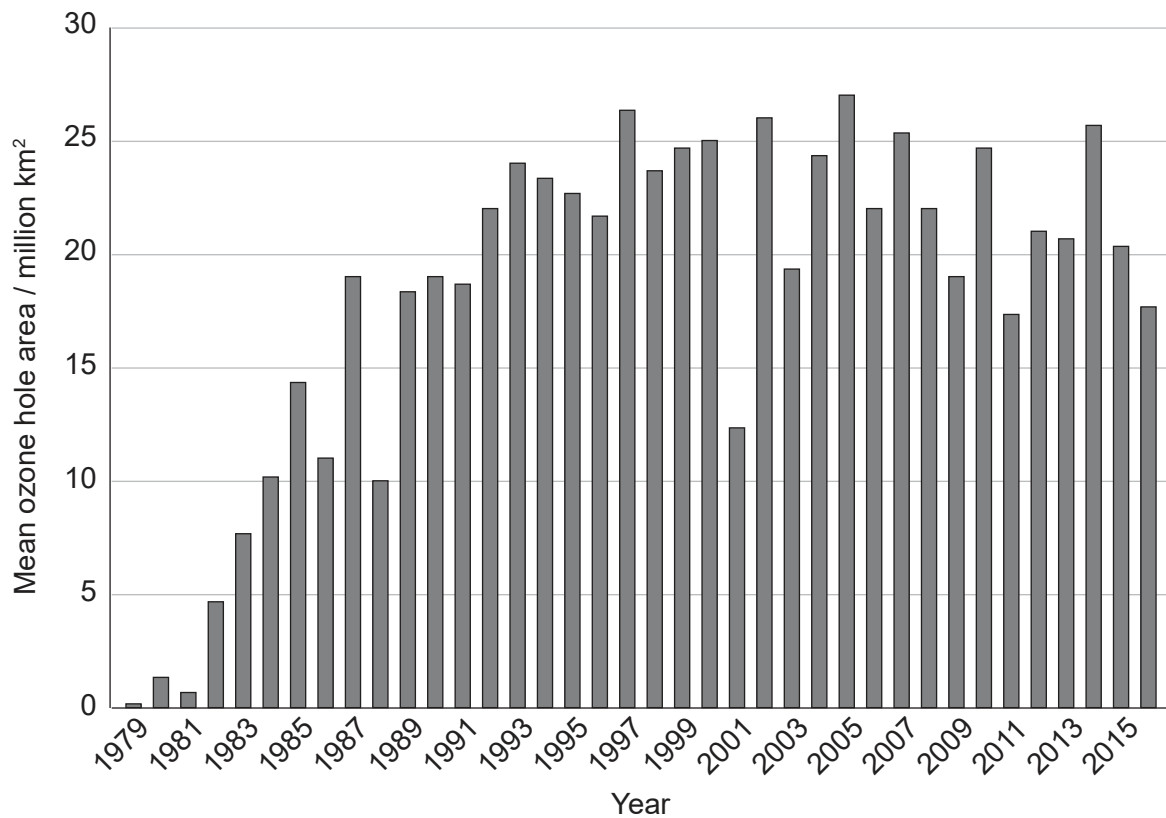
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Figure 3: Mean ozone hole area between 1979 and 2016



3. (a) State where the ozone hole referred to in **Figure 3** is located. [1]

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(b) Describe the changes in mean ozone hole area between 1979 and 2016. [2]

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**(Question 3 continued)**

(c) Identify **one** possible reason for the changes shown during the 1980s. [1]

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(d) Explain how the data in **Figure 3** can be used in judging the success of the Montreal Protocol in addressing ozone depletion. [4]

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## Section B

Answer **two** questions. Answers must be written within the answer boxes provided.

4. (a) Outline the processes by which a species may evolve a greater tolerance to higher temperatures. [4]
- (b) Explain how the atmosphere plays a role in maintaining life-supporting temperatures over the Earth’s surface. [7]
- (c) In addressing environmental issues, mitigation strategies may be seen as primarily ecocentric and adaptation strategies as primarily technocentric.
- To what extent is this view valid in the context of named strategies for addressing the issue of global warming? [9]
5. (a) Outline the procedures in a laboratory-based method to find the gross productivity for a population of named aquatic animals in terms of biomass per day. [4]
- (b) Explain how acid deposition falling on a forest may impact a nearby aquatic ecosystem. [7]
- (c) When harvesting is limited to the sustainable yield, associated processes involved in a food production system may still make the production unsustainable.
- In this context, to what extent can aquatic food production systems be truly sustainable? [9]
6. (a) With reference to **four** different properties of a soil, outline how each can contribute to high primary productivity. [4]
- (b) Explain how the level of primary productivity of different biomes influences their resilience. [7]
- (c) Discuss the role of feedback mechanisms in maintaining the stability and promoting the restoration of plant communities threatened by human impacts. [9]
7. (a) Identify **four** ways to ensure reliability of the mark–release–recapture method in estimating population size. [4]
- (b) Explain how the interactions between a species and its environment give rise to the S-shape of its population growth curve. [7]
- (c) The future growth of human populations is unlikely to be limited by the availability of energy resources. However, they could easily be limited by the impacts of energy production.
- Discuss the validity of this statement. [9]



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**References:**

**Figure 2** With permission from GRID-Arendal. Source adapted.

**Figure 3** NASA Ozone Watch.

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