



Environmental systems and societies

Standard Level

Paper 2 — Mock Examination

Mock Exam 3

Calculator required

Time allowed: **2 hours**

Maximum mark: **65 marks**

Candidate information

Candidate name:

Session number:

Date:

Topic emphasis: energy flow and productivity in ecosystems, ecological pyramids, urban air quality and photochemical pollutants, ecological footprints and biocapacity, ecosystem services and natural capital, stratospheric ozone, deforestation and the water and carbon cycles, aquaculture, zonation and succession.

Instructions to candidates

- Write your session number in the box on the cover.
- Do not open this examination paper until you are told 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]**.

The mark allocation is shown in square brackets at the end of each question or part question. Where a calculation is required, you should show your working; credit may be given for a correct method even if the final answer is incorrect. Where a question asks for a *named* example, marks are reserved for the use of a specific, real example.

Mark allocation

Section A (questions 1–3), all questions	[25 marks]
Section B (questions 4–7), two questions only, 20 marks each	[40 marks]
Total	[65 marks]

Command terms used in this paper

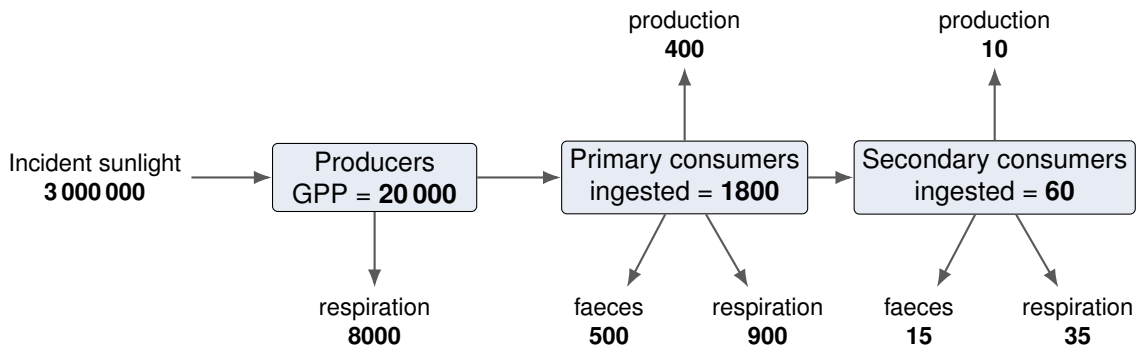
Identify / State	Give a brief answer; no explanation or supporting argument required.
Calculate	Obtain a numerical answer, showing the relevant working.
Describe	Give a detailed account of a pattern, trend or process.
Outline	Give a brief account or summary, with a little supporting detail.
Explain	Give a detailed account, including reasons or causes.
Evaluate	Make an appraisal by weighing up strengths and limitations.
Discuss	Offer a considered and balanced review including a range of arguments.
To what extent	Consider the merits or otherwise of an argument or concept.

All questions in this paper are original items written for revision purposes. They follow the style, structure and topic coverage of the Diploma Programme environmental systems and societies guide but are not reproduced from any past examination paper. All data presented in the figures are realistic but illustrative, and have been constructed for this mock examination.

Section A

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

Figure 1: Energy flow through a temperate grassland ecosystem
(all values in $\text{kJ m}^{-2} \text{yr}^{-1}$)



1. (a) Using **Figure 1**, calculate the percentage of the incident sunlight that is converted into gross primary productivity by the producers. [1]

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- (b) Using **Figure 1**, calculate the net primary productivity of the producers, in $\text{kJ m}^{-2} \text{yr}^{-1}$. [1]

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- (c) Using **Figure 1**, calculate the percentage of the net primary productivity of the producers that becomes production in the primary consumers. Show your working. [2]

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(Question 1 continued)

- (d) Outline **two** reasons why the transfer of energy between trophic levels is inefficient. **[2]**

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- (e) Explain why pyramids of energy are always upright, whereas pyramids of numbers may be inverted. **[3]**

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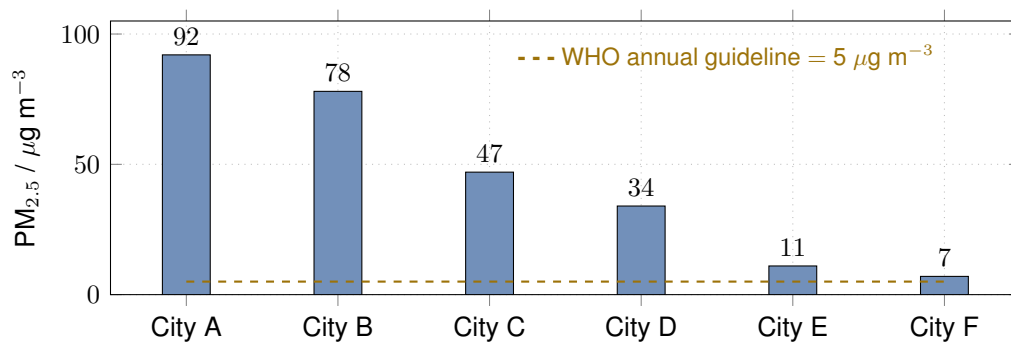
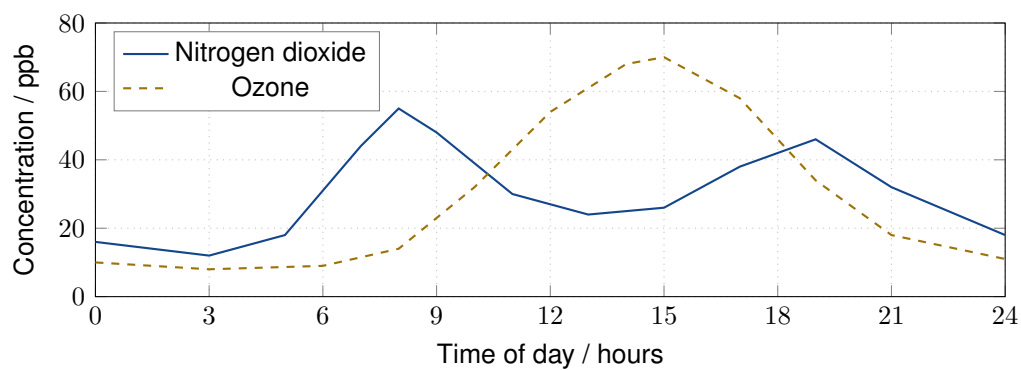
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Figure 2(a): Annual mean concentration of PM_{2.5} in six cities**Figure 2(b): Concentration of nitrogen dioxide and ozone over 24 hours in a large city on a sunny summer day**

2. (a) Using **Figure 2(a)**, calculate how many times greater the PM_{2.5} concentration of City A is than the WHO annual guideline value. **[1]**

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- (b) Outline **two** sources of PM_{2.5} in urban areas. **[2]**

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(Question 2 continued)

- (c) Using **Figure 2(b)**, describe the relationship between the concentrations of nitrogen dioxide and ozone over the 24-hour period. **[2]**

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- (d) State **one** reason why the ozone concentration reaches its maximum in the early afternoon. **[1]**

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- (e) Explain the effects of urban air pollution on human health and on vegetation. **[3]**

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Figure 3: Ecological footprint and biocapacity of four countries

Country	Ecological footprint / gha per capita	Biocapacity / gha per capita	Population / millions
A	8.1	3.6	38
B	4.7	1.2	68
C	1.6	2.9	34
D	0.9	0.6	21

gha = global hectares

3. (a) Using **Figure 3**, calculate the ecological deficit of Country B, in gha per capita. **[1]**

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- (b) Outline **two** factors that could explain why Country A has a large ecological footprint per capita. **[2]**

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- (c) Evaluate **one** strategy that Country B could use to reduce its ecological deficit. **[4]**

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Section B

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

4. (a) Outline **four** ecosystem services provided by a **named** ecosystem. [4]
- (b) Explain how the value that a society places on natural capital may change over time. [7]
- (c) “Continued economic growth and environmental sustainability are incompatible.” [9]
Discuss this statement.
5. (a) Outline **two** causes of stratospheric ozone depletion and **two** of its consequences. [4]
- (b) Pollution can be managed at three levels: altering human activity, controlling the release of the pollutant, and clean-up and restoration. Explain the strategies that have been used at each of these levels to address stratospheric ozone depletion. [7]
- (c) With reference to **named** examples, evaluate the effectiveness of international agreements in addressing transboundary environmental problems. [9]
6. (a) Outline **four** impacts of the large-scale clearance of tropical rainforest. [4]
- (b) Explain how the removal of tropical rainforest affects both the water cycle and the carbon cycle. [7]
- (c) Evaluate the strategies used by different societies to conserve and restore forest ecosystems. [9]
7. (a) Outline **two** advantages and **two** disadvantages of aquaculture as a method of food production. [4]
- (b) With reference to **named** examples, explain the difference between zonation and succession. [7]
- (c) “Human population growth is the main driver of environmental degradation.” Discuss this statement. [9]

Question numbers answered:

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[illegible]

End of examination

Total: 65 marks