Diploma Programme
Programme du diplôme
Programa del Diploma

Environmental systems and societies
Standard level
Paper 1

Friday 18 November 2016 (morning)

1 hour

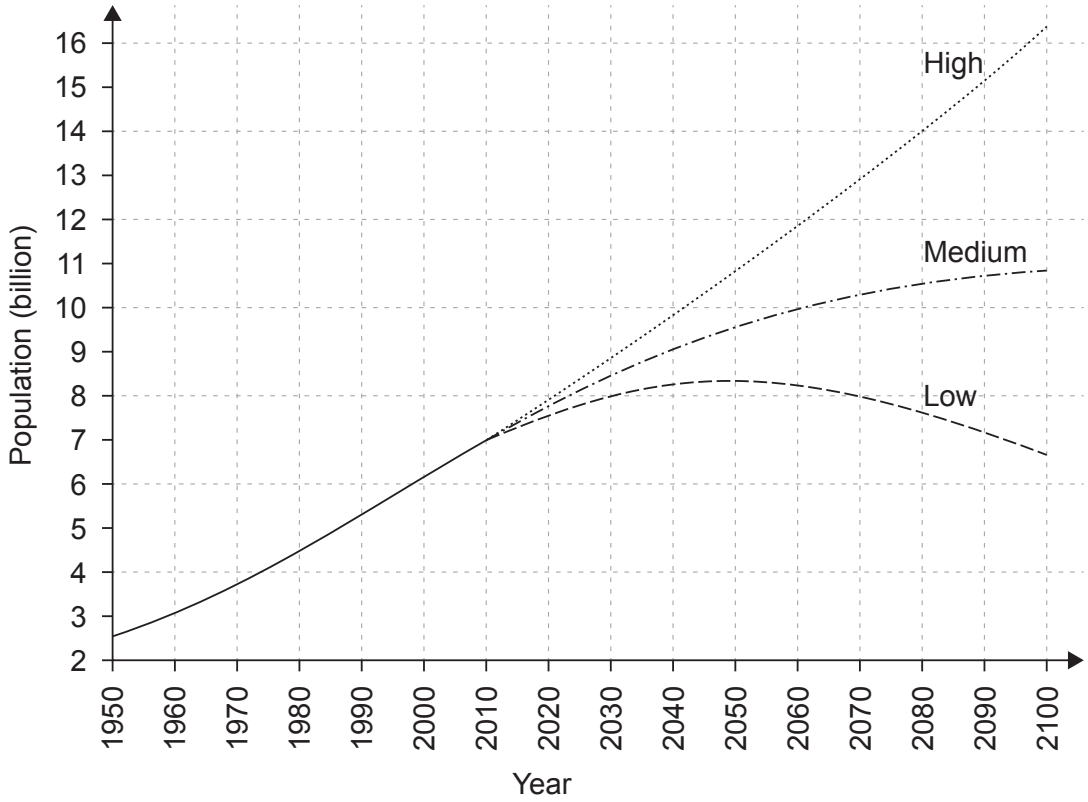
Candidate session number

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[45 marks]**.

8816–6301

1. **Figure 1:** Three projections for world population from the present day to 2100. The three lines indicate the high, medium and low projections for population size.



[Source: From World Population Prospects: the 2015 Revision, by UN Department of Economic and Social Affairs, Population Division, ©2015 United Nations. Reprinted with the permission of the United Nations.]

(a) Calculate the range between the highest and lowest projected population size for 2100. [1]

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(Question 1 continued)

(b) Identify **two** factors that could explain the variation in the projected population growth for the world. [2]

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(c) (i) Outline **one** economic implication of the highest projection for world population being realised. [1]

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(ii) Outline **one** environmental implication of the highest projection for world population being realised. [1]

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(d) (i) Outline **one** advantage of modelling future human population sizes. [1]

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(ii) Outline **one** disadvantage of modelling future human population sizes. [1]

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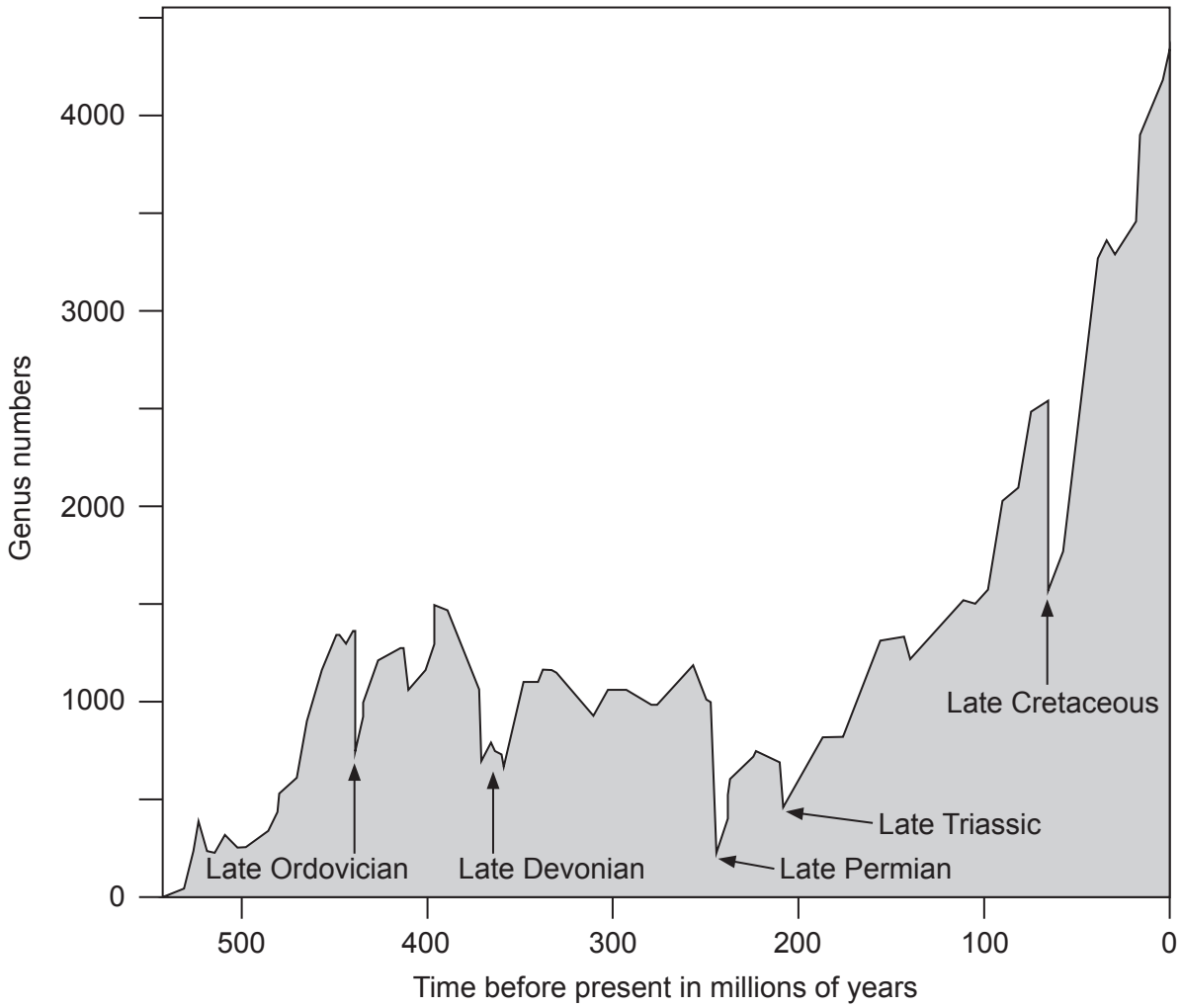
2. **Figure 2:** A graph showing past mass extinctions.



[Source: adapted from https://ontherocksgeoblog.files.wordpress.com]

(a) State **two** possible causes of these past mass extinctions. [2]

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(Question 2 continued)

(b) Identify **two** ways in which the current extinction differs from mass extinctions in the past. [2]

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(c) Explain **one** factor that may make a species less prone to extinction. [2]

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(d) Outline how the process of natural selection is a mechanism for evolution. [2]

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3. **Figure 3:** The number of plant species present on the slopes of two volcanoes, which erupted in the 1880s. Measurements were taken in 1930, 1975 and 2015.

Volcano	Latitude	Eruption date	Type of surface	Number of species (plants) recorded in three separate years		
				1930	1975	2015
Krakatau, Indonesia	6 degrees south	1883	Ash and lava	24	243	397
Tarawera, New Zealand	38 degrees south	1886	Lava	2	63	74

[Source: adapted from http://faculty.washington.edu]

(a) State the ecological processes illustrated by the data in **Figure 3**. [1]

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(b) Describe a method for measuring the abundance of plant species in volcanic areas. [3]

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(Question 3 continued)

(c) Suggest **two** reasons why there are differences in the number of plant species found on Krakatau and Tarawera. [4]

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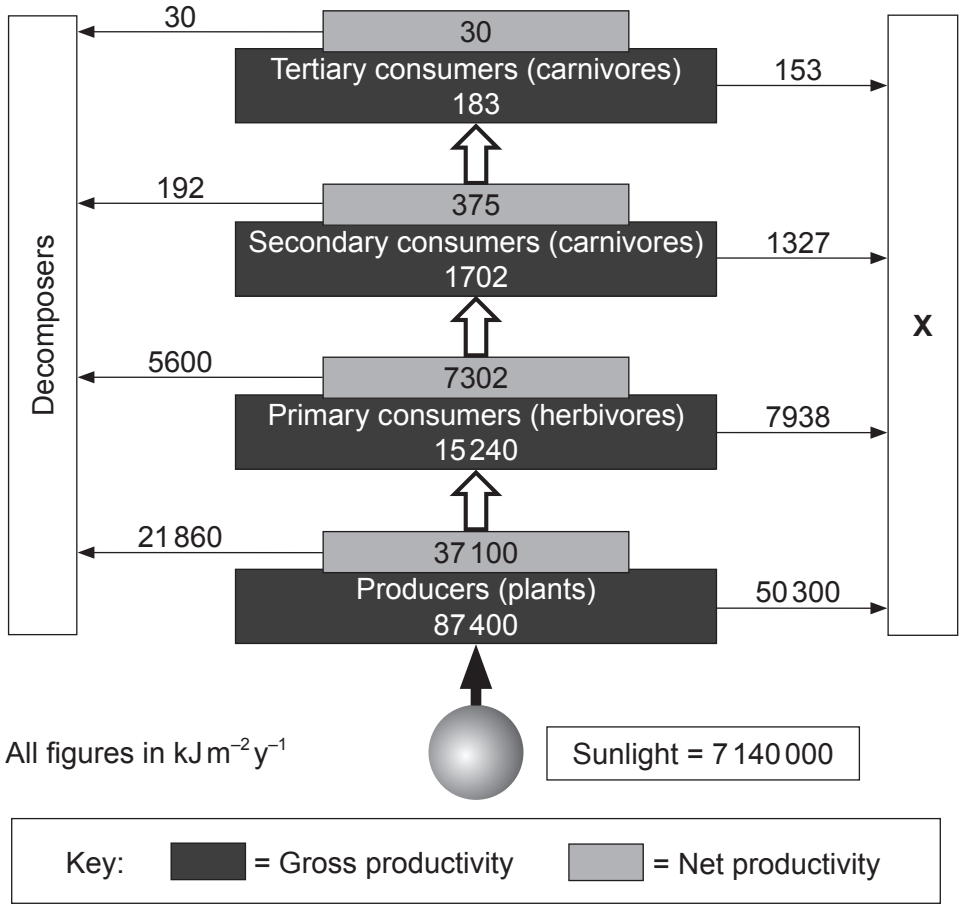
4. **Figure 4:** The gross and net productivity at different trophic levels within the Silver Springs, Florida, ecosystem.



[Source: adapted from http://users.rcn.com]

(a) State the process represented in the box labelled **X**. [1]

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(Question 4 continued)

(b) Define *net primary productivity*. [1]

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(c) Describe how the second law of thermodynamics operates in relation to the transfer of energy within the Silver Springs ecosystem. [2]

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(d) Distinguish between a pyramid of numbers and a pyramid of productivity. [2]

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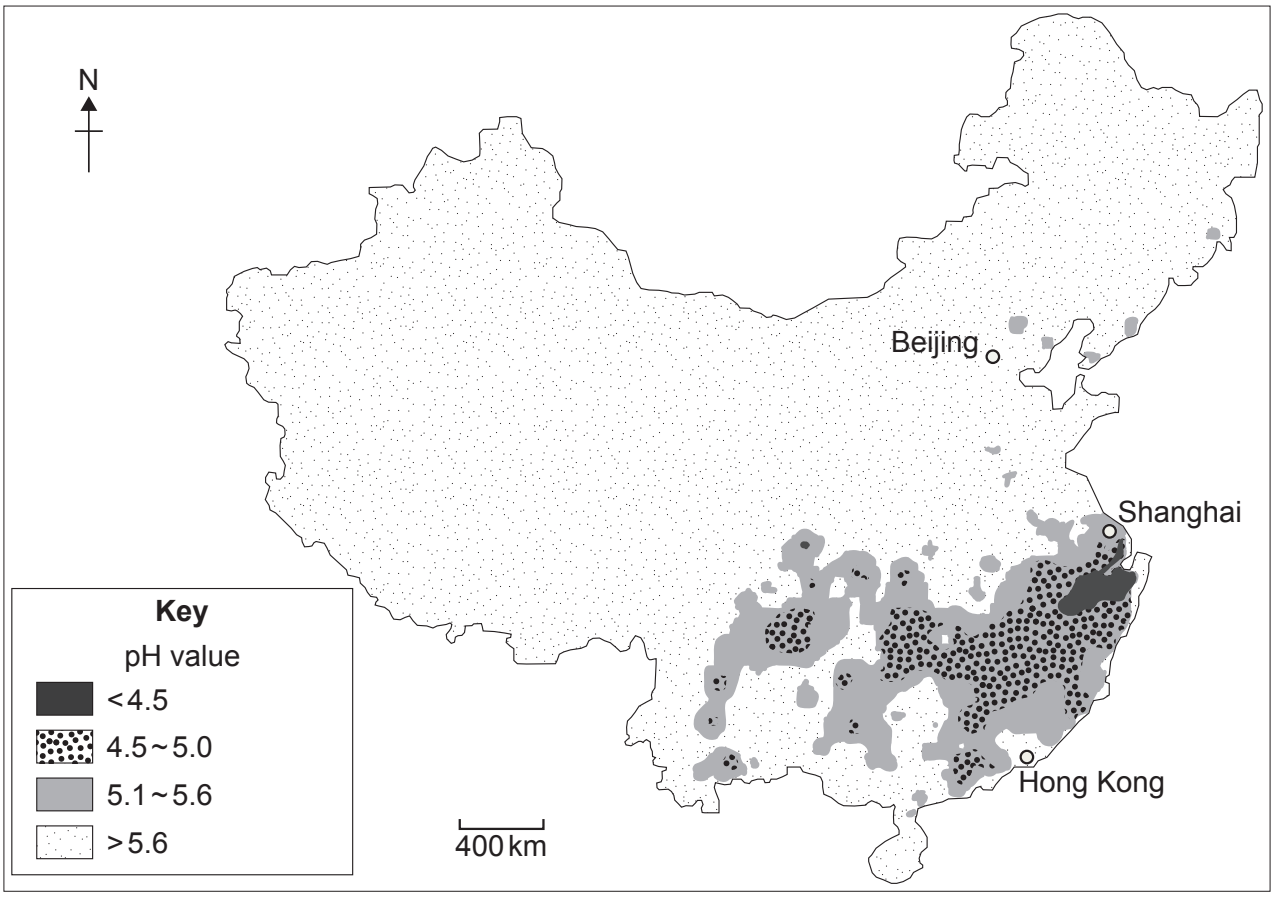
5. China has large reserves of coal and has used this to enable rapid economic development. This has led to environmental problems including acid deposition.

Figure 5: The average pH value of precipitation (acid deposition) for China in 2009.



[Source: adapted from http://english.mep.gov.cn]

(a) State **one** gas which contributes to acid deposition. [1]

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(Question 5 continued)

(b) Identify **two** possible reasons for the pattern of acid deposition in China. [2]

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(c) Outline **two** possible environmental effects of acid deposition on the areas with a pH of 5.0 or below. [2]

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(Question 5 continued)

(d) In 2014:
- China led the world in renewable energy production
- China became the world's leading importer of oil.

By 2020 the Chinese government's aim is to have 20 percent of their energy supplied by renewable energy sources.

Suggest why China is investing so heavily in renewable energy resources. [3]

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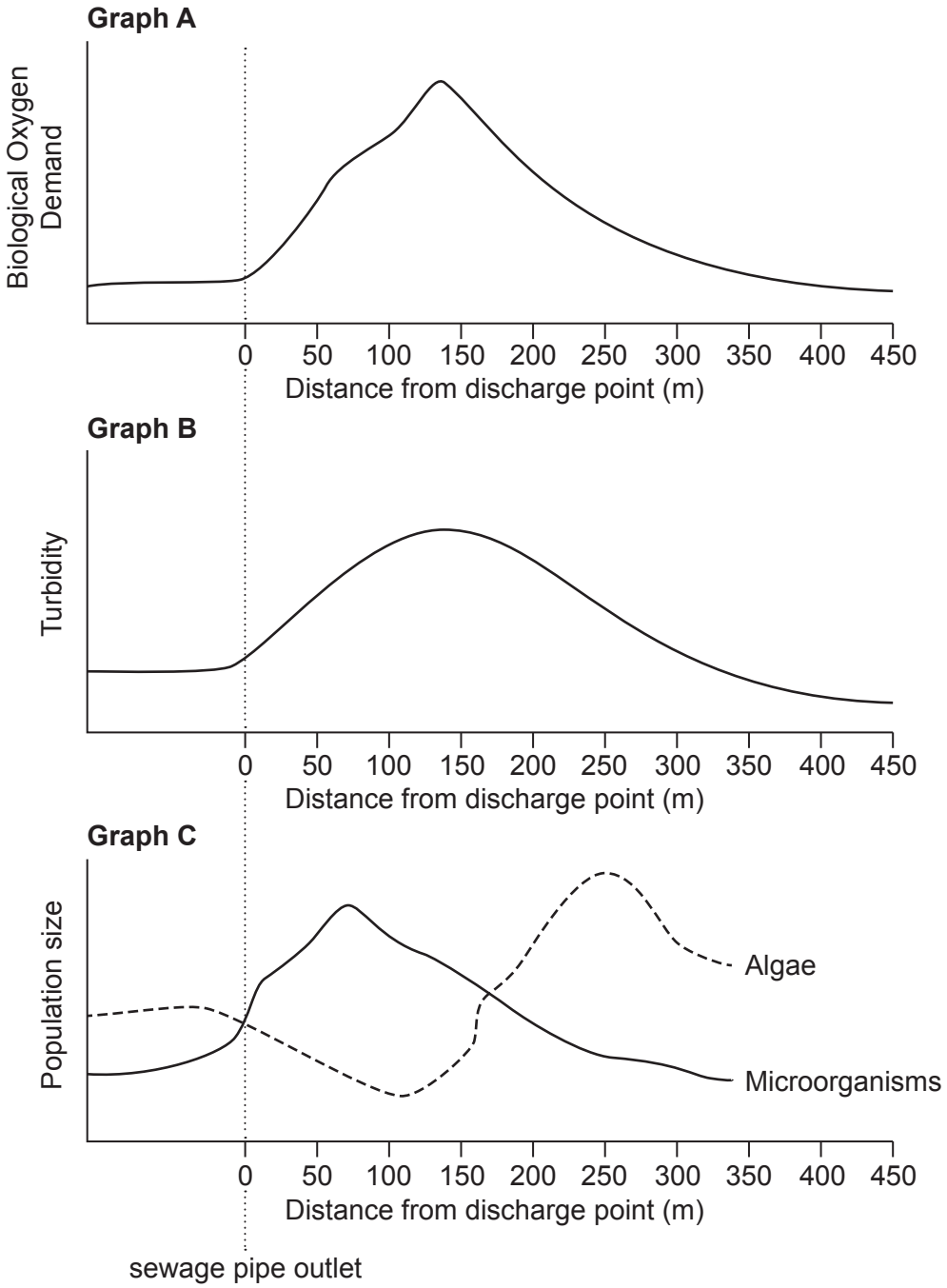
6. **Figure 6:** The effects of organic pollution (raw sewage discharged from a pipe) on a stream ecosystem.



[Source: Dr. Mel Zimmerman, Professor of Biology and Director of Clean Water Institute at Lycoming College]

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(Question 6 continued)

(a) Define *biochemical oxygen demand (BOD)*. [1]

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(b) Outline how turbidity changes after the raw sewage discharge point in **Graph B**. [2]

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(c) Suggest how the population growth curve for algae in **Graph C** would appear if the pollutant had been nitrates and phosphates from fertilizer run-off. [3]

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(Question 6 continued)

(d) Outline why point source pollution is often easier to manage than non-point source pollution. [2]

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Please **do not** write on this page.

Answers written on this page will not be marked.