Diploma Programme
Programme du diplôme
Programa del Diploma

Environmental systems and societies
Standard level
Paper 2

29 October 2024

Zone A morning | **Zone B** morning | **Zone C** morning

Candidate session number

2 hours

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]**.

8824 – 6503

23 pages

Section A

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

Figure 1(a): Municipal solid domestic waste (MSW) produced versus income level

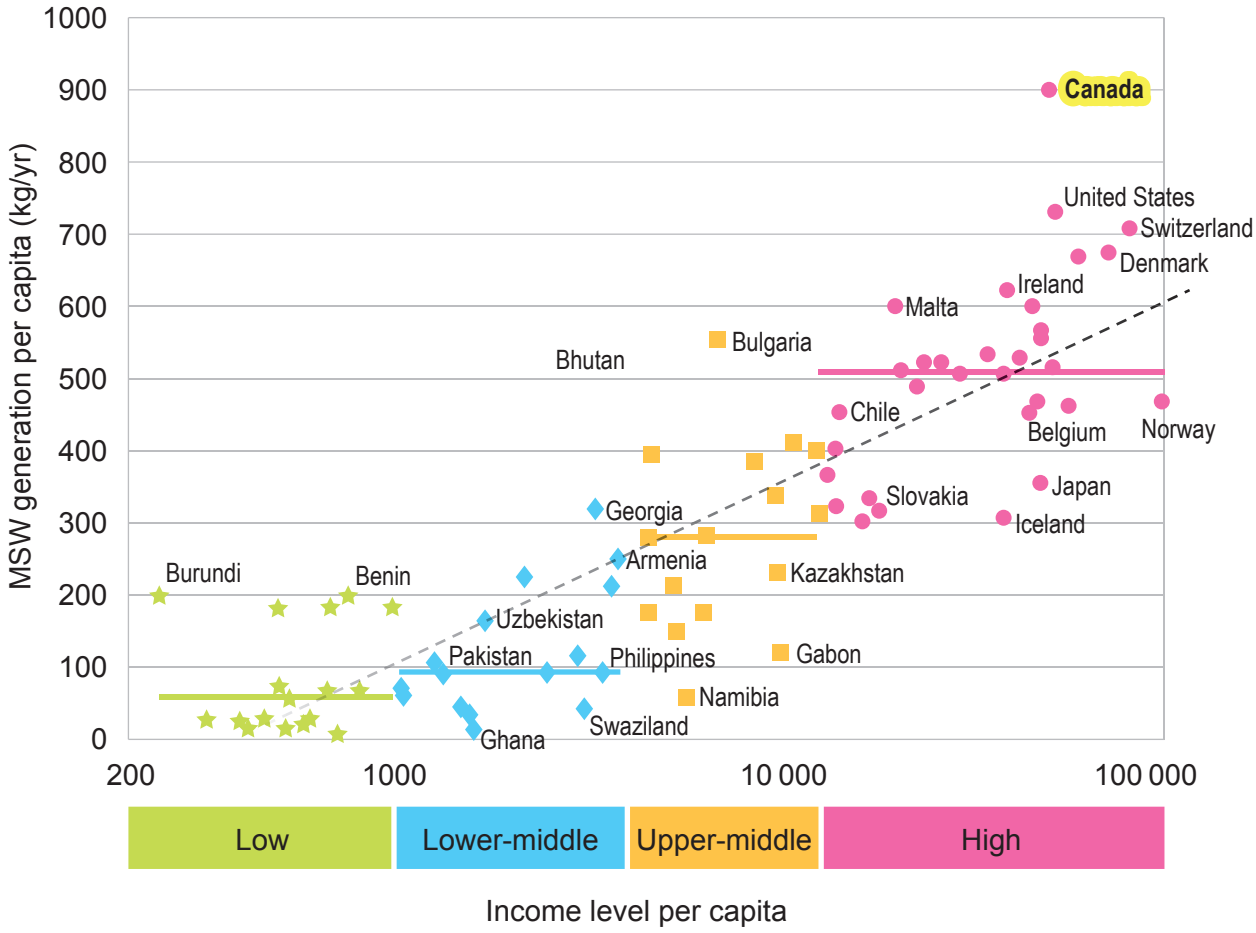
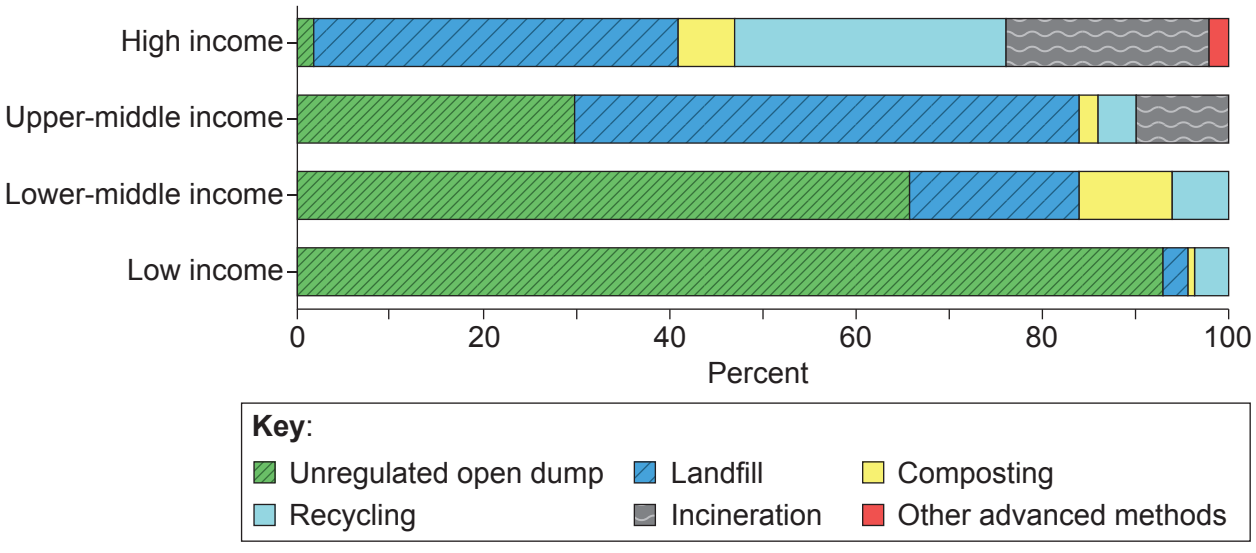


Figure 1(b): Waste disposal methods by per capita income



1. (a) Using **Figure 1(a)**, identify the amount of municipal solid domestic waste generated per capita in Canada. [1]

. . . . . .

. . . . . .

(b) Outline **two** strategies that Canada's government could use to reduce the country's per capita waste production. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(c) (i) Describe the trend shown in the use of landfills as income level increases in **Figure 1(b)**. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(ii) Suggest **two** reasons for the trend shown in the use of landfills as income level increases in **Figure 1(b)**. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(d) Outline **one** advantage and **one** disadvantage of using incineration instead of landfills. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Figure 2(a): Diagram showing the expanse of the Mississippi River basin draining into the Gulf of Mexico

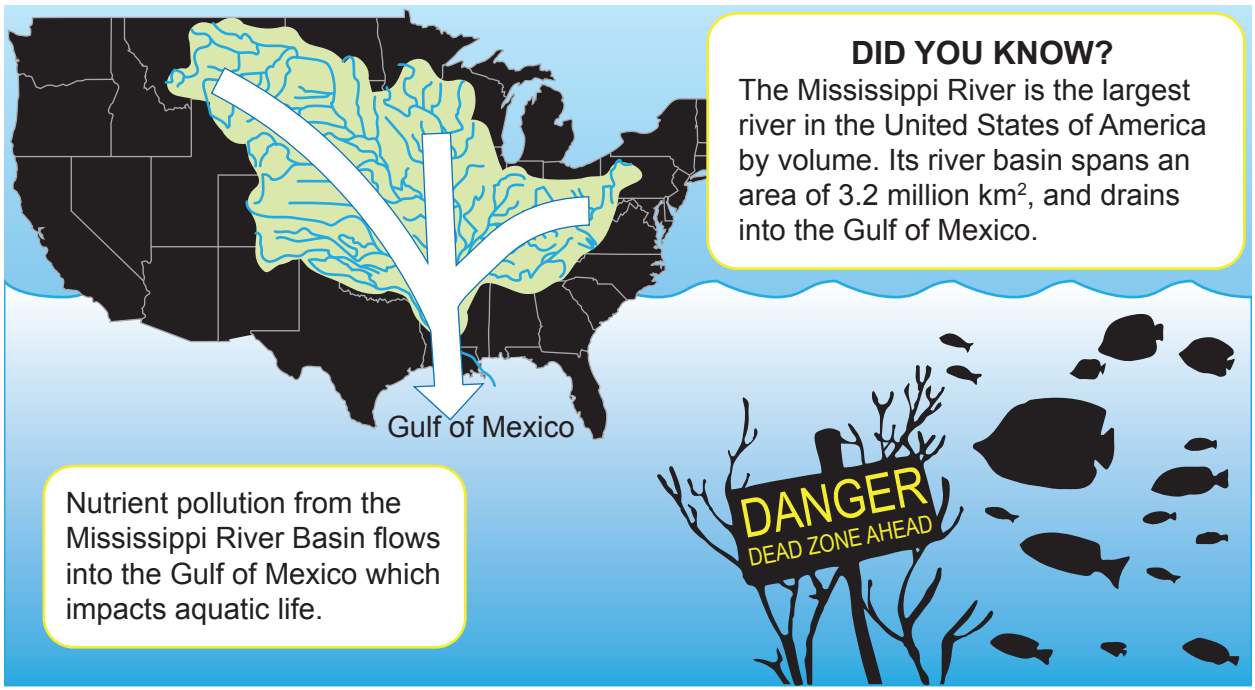
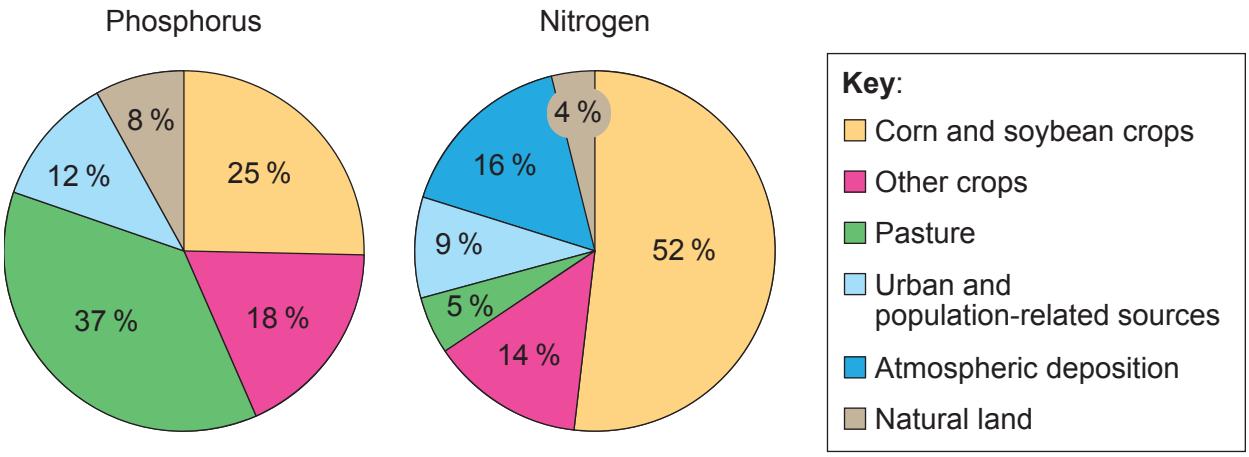


Figure 2(b): Pie charts showing sources of nutrients delivered to the Gulf of Mexico from the Mississippi River



2. (a) Using **Figure 2(b)**, state the source that has the highest contribution of phosphorus delivered to the Gulf of Mexico. [1]

. . . . . .

. . . . . .

(b) Using **Figures 2(a)** and **2(b)**, outline **two** reasons why nutrient pollution in the Gulf of Mexico is difficult to manage. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(c) Explain how nutrient pollution could impact aquatic food production in the Gulf of Mexico. [4]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(d) Outline **two** management strategies to prevent the release of nutrient pollution into the Mississippi River. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Figure 3(a): A simplified food web in a kelp forest ecosystem

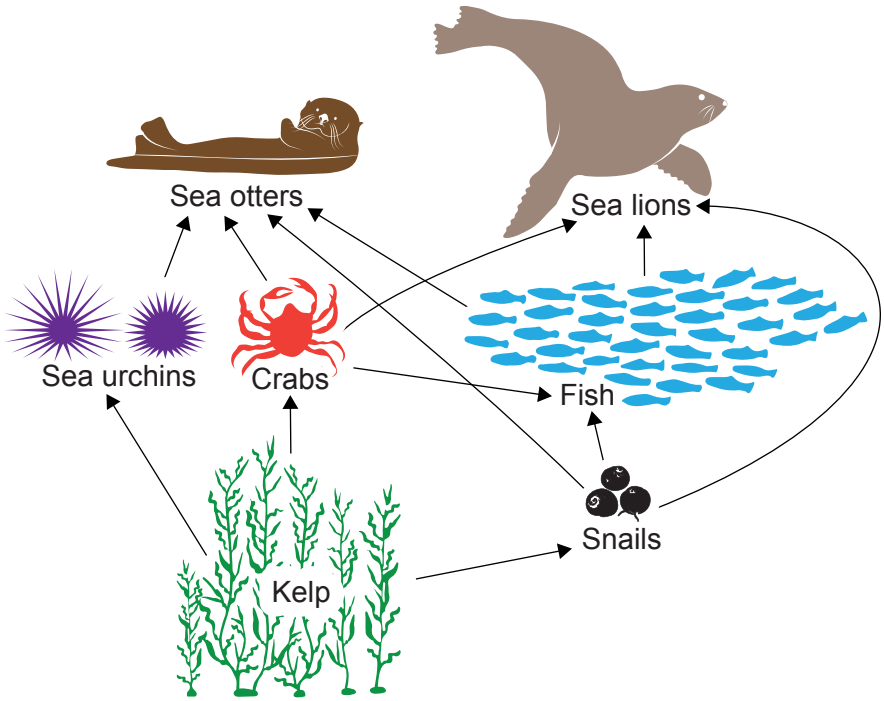
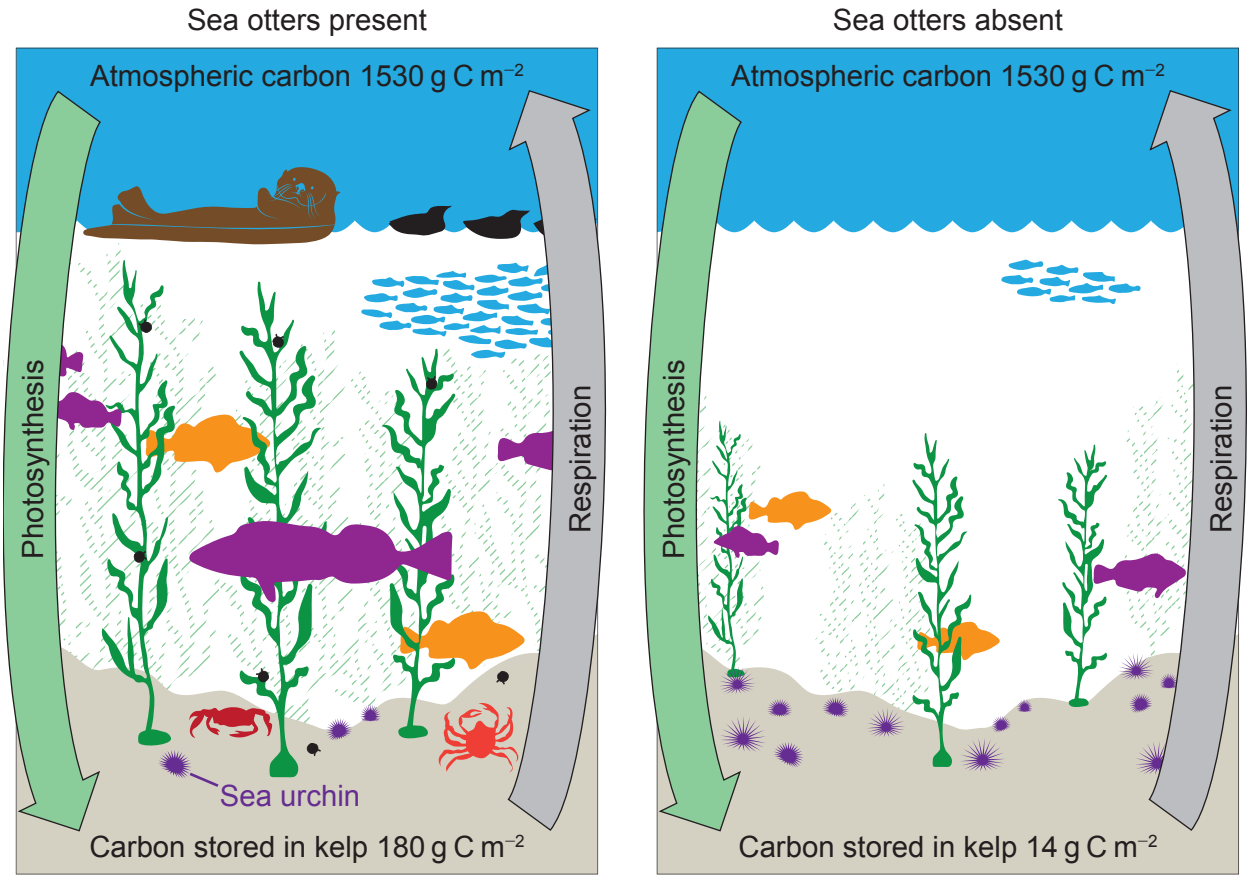


Figure 3(b): Kelp forest ecosystems with and without the presence of sea otters



The arrows indicate the flow of carbon between the atmosphere and the carbon stored in kelp.

3. (a) Calculate the difference between carbon stored in kelp in the ecosystem with and without sea otters. [1]

. . . . . .

. . . . . .

(b) Outline why sea otters are considered a keystone species. [1]

. . . . . .

. . . . . .

(c) Explain how sea otters contribute to the resilience of the kelp forest ecosystem. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(d) Outline how the protection of sea otters could help mitigate climate change. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Section B

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

4. (a) Outline **two** transfers and **two** transformations in soil systems. [4]

(b) Explain how anthropocentric and ecocentric value systems influence how soil resources are managed. [7]

(c) To what extent are human food production systems more greatly influenced by cultural factors than they are by political, environmental or economic factors? [9]

5. (a) Outline **four** ways in which ecological footprints (EFs) vary significantly by country. [4]

(b) Explain how life-supporting services provided by ecosystems may be impacted by human activity. [7]

(c) Human population growth always results in a loss of biodiversity.

Discuss the validity of this statement. [9]

6. (a) Outline the role of clouds in regulating global average temperature. [4]

(b) Explain how urban air pollution could lead to significant economic losses. [7]

(c) The *Montreal Protocol on Substances that Deplete the Ozone Layer* (1987) is one of the most successful international agreements on a major environmental issue.

Discuss the validity of this statement. [9]

7. (a) Outline how ocean circulation systems affect climate. [4]

(b) Explain how plate tectonics have impacted speciation of organisms. [7]

(c) To what extent could the changing value of freshwater resources lead to conflict between different societies? [9]

Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB.

References:

Figure 1(a) United Nations Environment Programme (2015). *Global Waste Management Outlook*. Nairobi.

Figure 1(b) Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development. © Washington, DC: World Bank. http://hdl.handle.net/10986/30317. Licensed under Creative Commons BY 3.0 IGO. https://creativecommons.org/licenses/by/3.0/igo/. Source adapted.

Figure 2(b) U.S. Geological Survey, Department of the Interior/USGS.

24EP24