Diploma Programme
Programme du diplôme
Programa del Diploma

Environmental systems and societies
Standard level
Paper 2

Monday 7 May 2018 (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]**.

2218 – 6303

24 pages

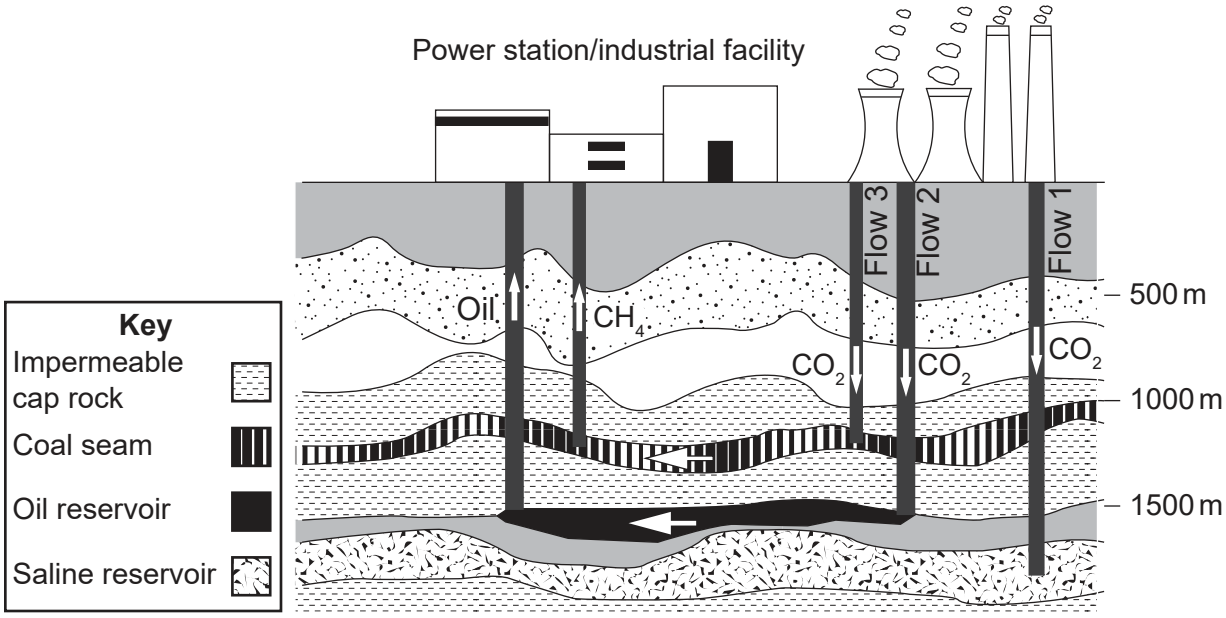
Section A

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

1. **Figure 1** shows the process of carbon capture and storage (CCS) that can be used to manage climate change. Carbon dioxide (CO_2) is pumped into three different underground locations, where it is stored.

Flow 1 pumps CO_2 into an underground saline reservoir.
Flow 2 pumps CO_2 into an oil reservoir; CO_2 replaces oil; oil is produced.
Flow 3 pumps CO_2 into a coal seam; CO_2 replaces methane (CH_4); methane is produced.

Figure 1: Carbon capture and storage flow chart



[Source: Adapted from http://www.wri.org/resources/charts-graphs/carbon-capture-sequestration-flow-chart. Licensed under CC BY 4.0 International https://creativecommons.org/licenses/by/4.0/]

(a) Outline the evidence that CO_2 acts as a greenhouse gas. [1]

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(Question 1 continued)

(b) State a greenhouse gas other than CO_2. [1]

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(c) Outline how the mitigation strategy shown in **Figure 1** is different to an adaptation strategy for managing climate change. [2]

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(d) Identify **two** mitigation strategies to manage climate change, other than carbon capture and storage. [2]

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(e) Outline how Flows 1 and 2 shown in **Figure 1** may contribute to the capture and storage of atmospheric carbon. [2]

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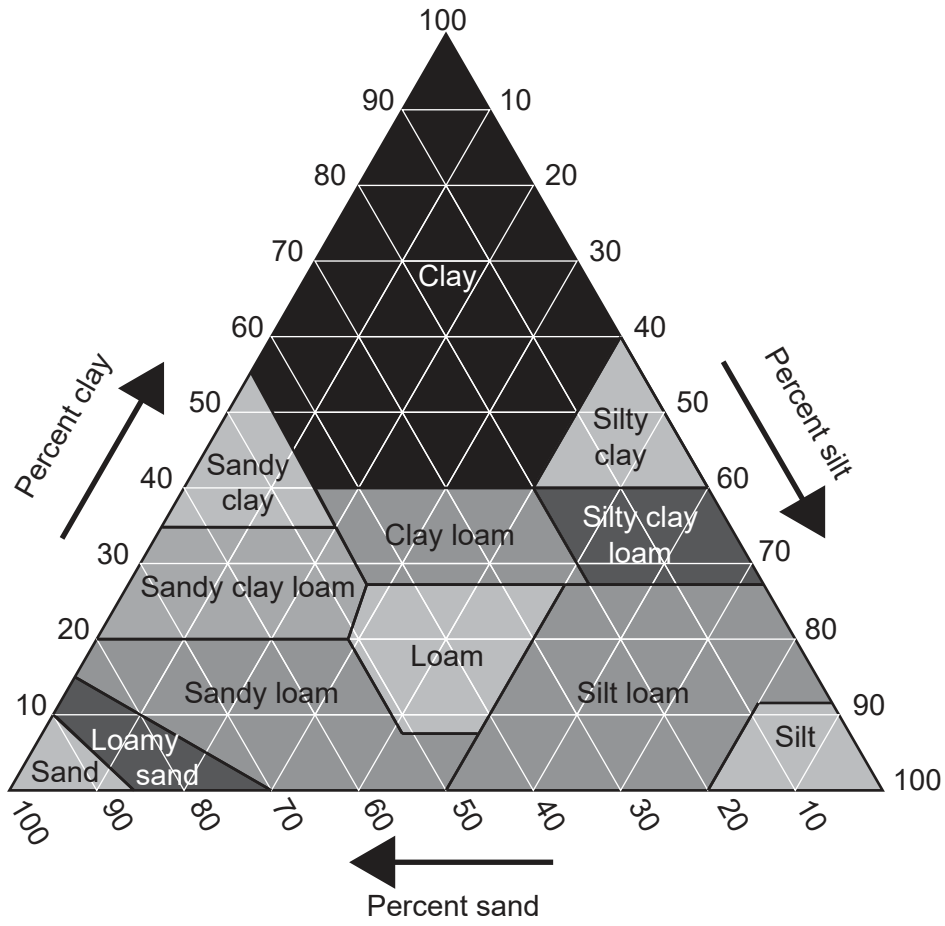
2. Soil quality is important for global food production systems.

Figure 2(a): Soil texture triangle



[Source: Courtesy of USDA]

(a) State the soil texture that has the following composition: 20 % clay; 55 % silt; 25 % sand. [1]

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(b) Describe how the addition of sand to a silty clay loam could alter its characteristics for healthy plant growth. [2]

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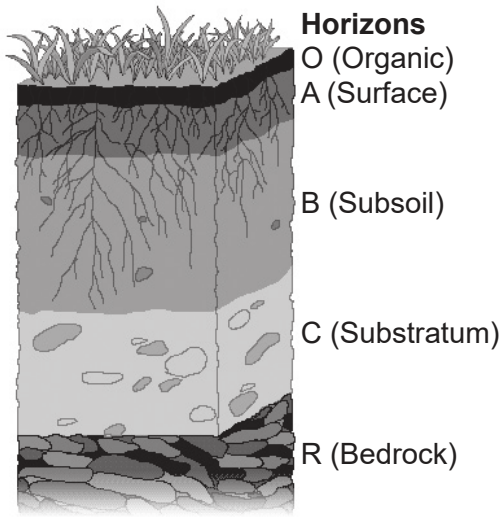
(Question 2 continued)

Figure 2(b): Horizons (layers) in a typical soil profile



[Source: Image adapted from Wikipedia/Hridith Sudev Nambiar. Licensed under CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0/deed.en)]

(c) (i) Draw a flow diagram to show the flows of leaching and decomposition associated with the mineral storage in the "A" horizon in **Figure 2(b)**. [2]

(ii) Identify **one** other input to the mineral storage in the "A" horizon. [1]

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(iii) Identify **one** other output from the mineral storage in the "A" horizon. [1]

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(Question 2 continued)

(d) Outline why leaving arable farmland fallow (unused) between growing seasons could lead to soil degradation. [2]

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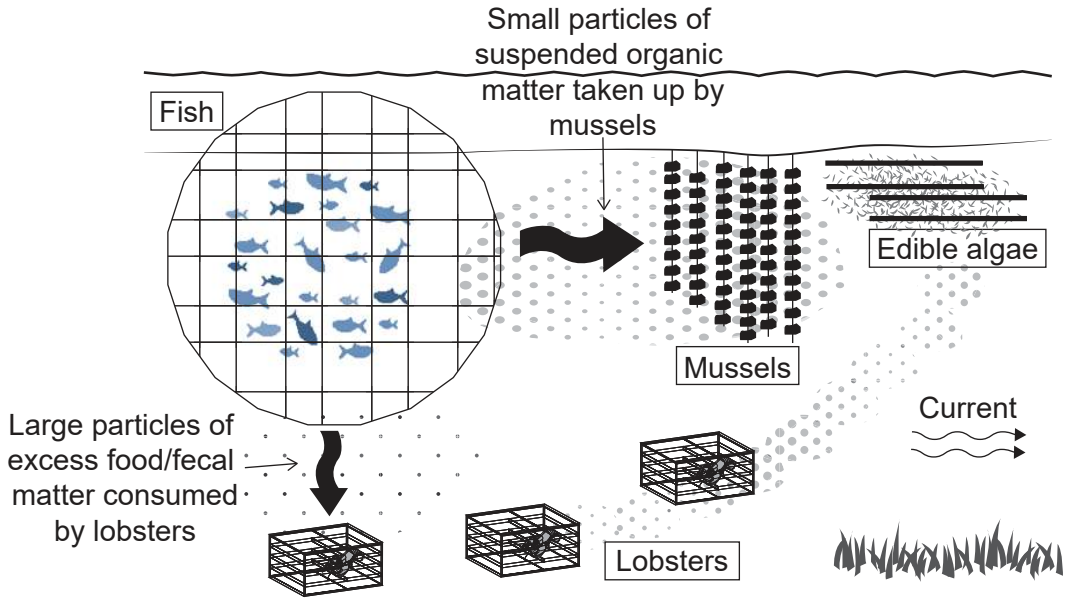
3. **Figure 3** represents a system of aquaculture with four groups of harvestable species.

Figure 3: Integrated aquaculture



[Source: Ocean Conservancy]

(a) Identify **one** producer in the system illustrated in **Figure 3**. [1]

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(Question 3 continued)

(b) Outline **one** reason why aquaculture production has increased globally. [1]

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(c) Describe **two** negative environmental impacts that may arise from integrated aquaculture. [2]

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(d) Explain why this system may cause fewer environmental impacts than systems that farm only fish. [4]

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Section B

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

4. (a) Outline how **four** different factors influence the resilience of an ecosystem. [4]

(b) Explain how a community of trees in a woodland may be considered a system. [7]

(c) Disturbance of the composition and processes of the atmospheric system through human activity always disturbs the equilibria of marine systems.

Discuss the validity of this statement with reference to named examples. [9]

5. (a) Distinguish between the terms *niche* and *habitat* with reference to a named species. [4]

(b) Suggest the procedures needed to collect data for the construction of a pyramid of numbers for the following food chain:

Plants → Snails → Birds [7]

(c) Quantitative models are frequently constructed to show the flow of energy and cycling of matter in natural systems.

To what extent can these models be useful in assessing the sustainability of named food production systems? [9]

6. (a) With reference to named examples, distinguish between a *primary* and *secondary* pollutant. [4]

(b) Explain how organic waste may be an effective fertilizer in terrestrial systems but a source of pollution in aquatic systems. [7]

(c) To what extent can different environmental value systems contribute to both causing and resolving the problem of water scarcity? [9]

7. (a) Outline **four** different ways in which the value of named resources have changed over time. [4]

(b) The use of renewable resources is not always sustainable due to the activities involved in their production.

Justify this statement for a named source of renewable energy. [7]

(c) Increasing concern for energy security is likely to lead to more sustainable energy choices.

Discuss the validity of this statement, with reference to named countries. [9]