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**ENVIRONMENTAL SYSTEMS  
STANDARD LEVEL  
PAPER 1**

Friday 2 November 2007 (afternoon)

45 minutes

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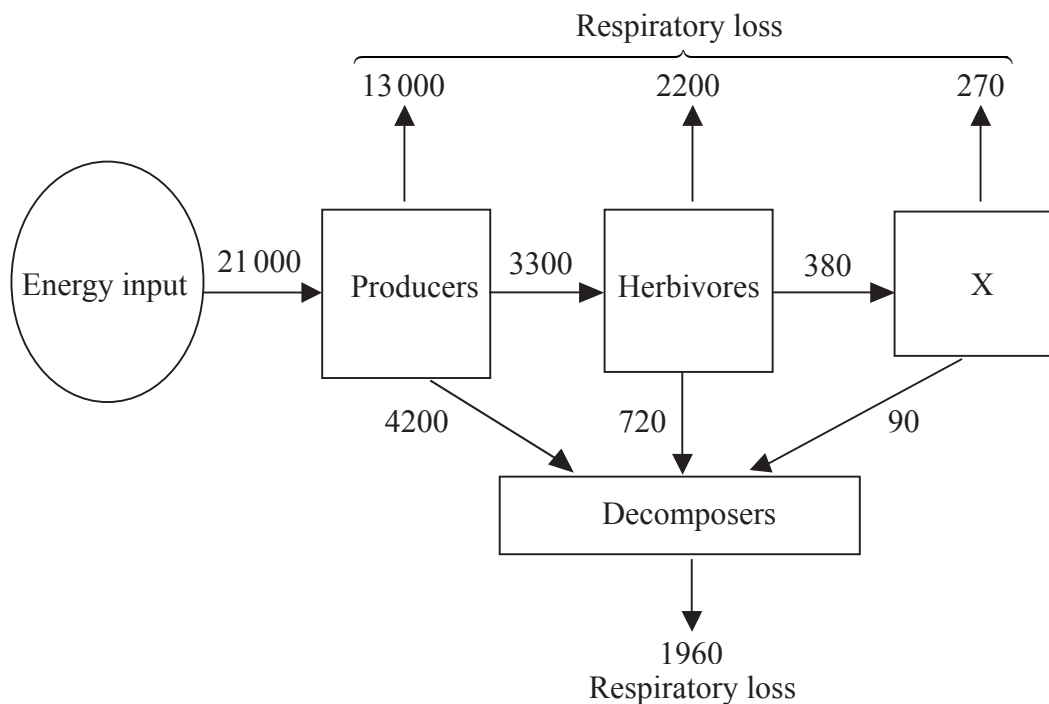
**INSTRUCTIONS TO CANDIDATES**

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. Which of the following can be considered an isolated system?
  - A. A rock in the bottom of the ocean
  - B. A small island
  - C. A spider on a tree
  - D. The entire cosmos
  
2. Over a long period of time, energy input to a system is
  - A. always equal to energy output.
  - B. usually greater than energy output.
  - C. always greater than energy output.
  - D. always less than energy output.
  
3. Which of the statements about negative feedback is correct?
  - A. Negative feedback amplifies or increases change in a system.
  - B. Negative feedback consumes energy from a system.
  - C. Negative feedback is undesirable for the environment.
  - D. Negative feedback counteracts deviation from equilibrium in a system.

4. Which of the following stages of the nitrogen cycle is a transfer process / are transfer processes?
- I. Specialized bacteria converting atmospheric nitrogen to ammonia ( $\text{NH}_3$ )
  - II. Dilute nitric acid ( $\text{HNO}_3$ ) falling as rain in a lake
  - III. Run-off of nitrogen fertilizers from land to rivers
  - IV. Decomposition of nitrogen-rich organic compounds into simpler nitrogen-containing inorganic compounds
- A. I only
- B. I and IV
- C. II and III
- D. I, II, III, and IV
5. Which statement is correct?
- A. All ecosystems have both biotic and abiotic components.
- B. Some ecosystems only have biotic components.
- C. Some ecosystems only have abiotic components.
- D. Producers (autotrophs) are biotic components and consumers (heterotrophs) are abiotic components of ecosystems.
6. Why do most marine food chains rarely have more than four trophic levels?
- A. Many species have become extinct.
- B. Fishing activities have increased significantly.
- C. There is great competition for food.
- D. Energy is transferred inefficiently as it moves along the food chain.

Questions 7 to 9 refer to the diagram below, which shows the main energy flows through an ecosystem. All units are  $\text{kJ m}^{-2} \text{yr}^{-1}$ .



7. What are the organisms in X?

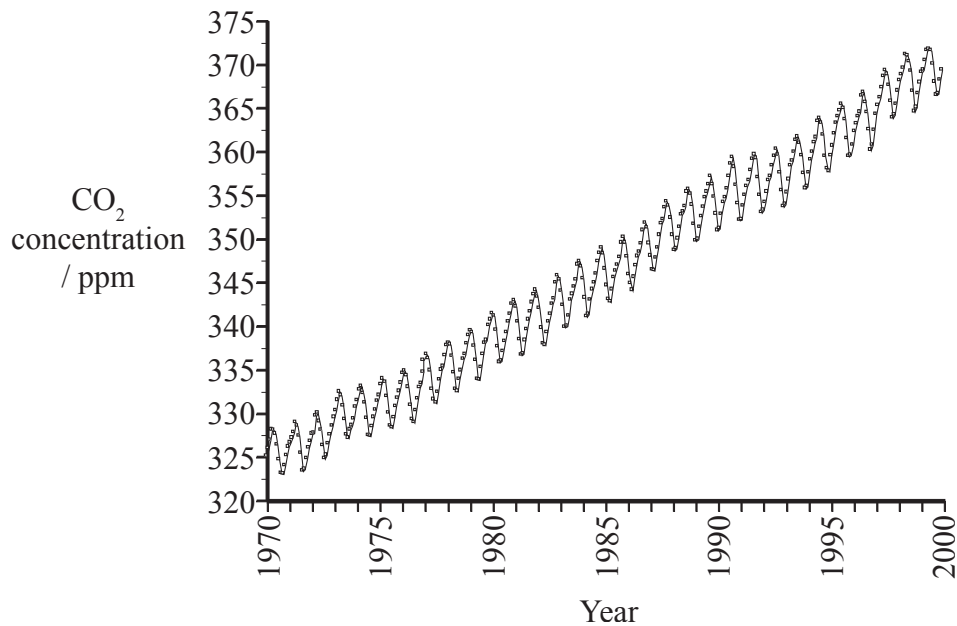
- A. Autotrophs
- B. Primary consumers
- C. Secondary consumers
- D. Tertiary consumers

8. What is the net productivity of the decomposers in  $\text{kJ m}^{-2} \text{yr}^{-1}$ ?

- A. 1960
- B. 3050
- C. 5010
- D. 6970

9. Which of the following could be deduced using the information in the diagram?
- A. Total biomass of the producers
  - B. Number of trophic levels of the ecosystem
  - C. Biodiversity of the ecosystem
  - D. Carrying capacity of the herbivores
10. What is an ecological niche?
- A. The biome where an organism lives
  - B. A collection of ecosystems sharing similar climatic conditions
  - C. A species' share of a habitat and the resources in it
  - D. A group of populations living and interacting with each other in a common habitat
11. What is the name of an interaction in which one organism feeds on another by living on or in it and harming it?
- A. Competition
  - B. Parasitism
  - C. Mutualism
  - D. Predation

The graph shows the variation in the concentration of atmospheric carbon dioxide since 1970 at the Mauna Loa Observatory, Hawaii.

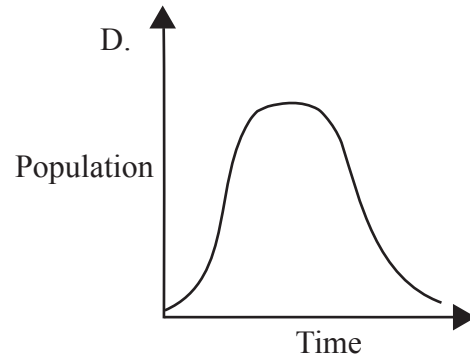
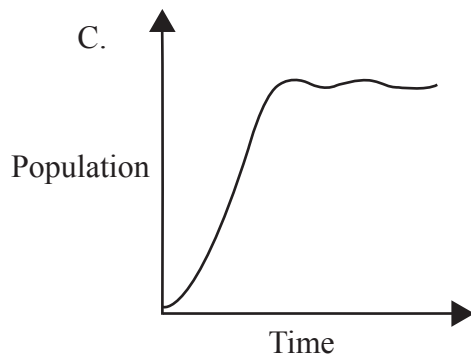
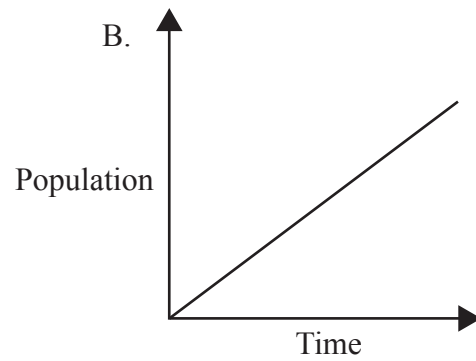
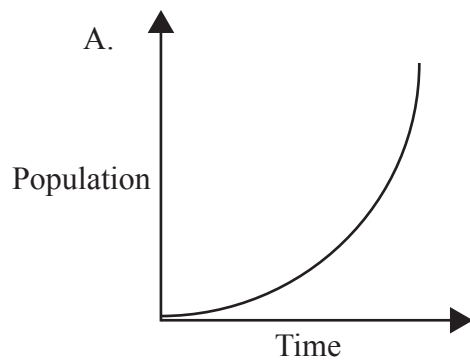


[Source: C D Keeling and T P Whorf (2004), *Atmosphere CO<sub>2</sub> concentrations (ppm) derived from in situ air samples, collected at Mauna Loa Observatory, Hawaii*]

12. What has caused the annual rise and fall of CO<sub>2</sub> levels shown in the graph?

- A. Seasonal functions of ozone in the troposphere
- B. Seasonal depletion of ozone in the stratosphere
- C. Seasonal variations in photosynthesis
- D. Seasonal variations in the numbers and intensity of forest fires

13. Which of the figures shows a population which has reached carrying capacity?



14. Which statement about *K*-strategists is correct?

- A. They are less adaptable than *r*-strategists.
- B. They have high genetic diversity.
- C. They exhibit fast rates of evolution.
- D. They live in a rapidly changing environment.

**15.** Which of the following statements about succession is/are correct?

- I. It is initiated by pioneer species.
- II. It often involves organisms changing the environment so that they are replaced by others.
- III. It generally results in more complex communities.

- A. I only
- B. I and III only
- C. II and III only
- D. I, II, and III

**16.** Which statement about the troposphere is correct?

- A. Oxygen is the main gas in the troposphere.
- B. The troposphere is above the stratosphere.
- C. The troposphere absorbs most of the outgoing short-wave radiation.
- D. Temperature decreases with altitude in the troposphere.

**17.** Which of these may transfer heat energy from tropical to temperate latitudes?

- A. Cold ocean currents
- B. Hadley cells
- C. Warm ocean currents
- D. Depressions

**18.** Which is the most likely to occur as a result of a reduction of stratospheric ozone?

- A. Decrease in the ultraviolet radiation reaching the Earth's surface
- B. Reduction of photochemical smog
- C. Reduction in the productivity of phytoplankton
- D. Increased leaching of aluminium ions attached to soil minerals

**19.** What is the natural trapping of heat in the troposphere called?

- A. Convection
- B. Greenhouse effect
- C. Lapse rate
- D. Insulation


**20.** Which of the following are greenhouse gases?

- I. Water vapour
  - II. Carbon dioxide
  - III. CFCs
  - IV. Methane
- A. I and II only
  - B. II and IV only
  - C. II, III and IV only
  - D. I, II, III and IV

21. Which row contains correct information on the causes and effects of acid rain?

	Caused by	Effect
A.	Halogenated gases and nitric acid	Decrease in oceanic uptake of CO <sub>2</sub> by phytoplankton
B.	Sulfuric acid and methane	Erosion of buildings and monuments
C.	Carbon dioxide and sulfur dioxide	Leaching of calcium ions from soil
D.	Carbon dioxide and nitric acid	Increase in skin cancer

22. Which row correctly shows the storages of the water in order of decreasing size?

	LARGEST  SMALLEST		
A.	Oceans	Groundwater	Glaciers and ice caps Lakes, rivers and atmosphere
B.	Oceans	Lakes, rivers and atmosphere	Glaciers and ice caps Groundwater
C.	Lakes, rivers and atmosphere	Oceans	Groundwater Glaciers and ice caps
D.	Oceans	Glaciers and ice caps	Groundwater Lakes, rivers and atmosphere

23. Which statement about ocean currents is correct?

- A. Cold currents flow near the surface because they are less dense than warm currents.
- B. The Earth's rotation plays an important role in the distribution of ocean currents.
- C. Ocean currents move matter but not energy.
- D. Wind does not usually affect ocean currents.

24. At a constructive plate margin

- A. new oceanic crust is formed.
- B. deep sea trenches and island arcs with volcanoes are formed.
- C. fold mountains are formed.
- D. crust is neither formed nor destroyed.

25. Which statement about soil is correct?

- A. Soil is a closed system because there is input, transfer and output of energy but not of matter.
- B. Soil consists only of minerals, water and air.
- C. The final stage in the formation of soil is the breaking down of the parent rock.
- D. Climate affects the rate of weathering and influences the distribution of soils on a global scale.

26. Which of the following most correctly represents characteristics of each type of soil?

	<b>Sandy soil</b>	<b>Clay soil</b>
A.	Good water-infiltration capacity	Good water-infiltration capacity
B.	Poor nutrient-holding capacity	Good nutrient-holding capacity
C.	Good aeration	Good aeration
D.	Good water-holding capacity	Poor water-holding capacity

27. How long would it take a human population with a natural increase rate of 2% to double?

- A. 10 years
- B. 20 years
- C. 35 years
- D. 70 years

- 28.** Which of the combinations in the table below correctly completes the following sentence?

Forests are forms of \_\_\_\_\_ I \_\_\_\_\_ and their timber is considered \_\_\_\_\_ II \_\_\_\_\_.

	I	II
A.	natural capital	replenishable
B.	natural capital	natural income
C.	sustainable yield	natural capital
D.	natural income	sustainable yield

- 29.** The population of carp in a small lake is estimated to be 7 000 fish. Each year an average of 1 000 die or are removed, and 3 000 are recruited. What is the sustainable yield?

- A. 2 000
- B. 3 000
- C. 5 000
- D. 9 000

- 30.** Which statement is correct?

- A. Only items with economic value can be considered natural capital.
- B. The ozone layer is a form of non-renewable natural capital.
- C. Aesthetic values of an ecosystem can be considered natural capital.
- D. The flood and erosion control carried out by trees are considered their sustainable yield.