



**ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 1**

Monday 5 November 2001 (afternoon)

45 minutes

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. In a demographic transition model
 - A. changes in birth rate lag behind changes in death rate.
 - B. changes in death rate lag behind changes in birth rate.
 - C. birth and death rates change together.
 - D. birth rates change in the opposite direction to death rates.

2. A *biome* is
 - A. a collection of ecosystems that contain the same species.
 - B. a collection of ecosystems sharing similar climatic conditions.
 - C. an ecosystem that is undergoing change.
 - D. a collection of populations living and interacting with each other.

3. The process of *subduction*
 - A. involves the transfer of material from the crust to the asthenosphere.
 - B. involves the transfer of material from the mantle to the core.
 - C. occurs only at mid-oceanic ridges.
 - D. occurs at both constructive and destructive margins.

4. A stable ecosystem will be in . . . (I) . . . equilibrium, achieved largely through mechanisms of . . . (II) . . . feedback.

Complete this statement.

- | | (I) | (II) |
|----|--------------|----------|
| A. | Steady state | Positive |
| B. | Static | Negative |
| C. | Steady state | Negative |
| D. | Static | Positive |

5. Which term could **not** be applied to an organism feeding on the biomass of a producer?

- A. Primary consumer
- B. Secondary consumer
- C. Herbivore
- D. Decomposer

6. Consider these statements concerning the flow of energy through ecosystems:

Statement 1: The amount of energy that is available to living things decreases as it is transformed and passed along food chains.

Statement 2: As energy is transformed along food chains, no energy is destroyed.

Which is a correct evaluation of these statements?

Statement 1

Statement 2

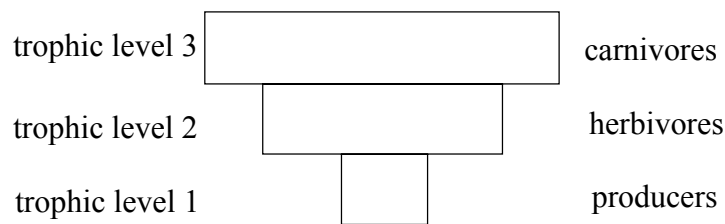
- | | |
|--|---|
| A. Demonstrates the first law of thermodynamics | Demonstrates the second law of thermodynamics |
| B. Is unrelated to the laws of thermodynamics | Demonstrates the second law of thermodynamics |
| C. Demonstrates the second law of thermodynamics | Demonstrates the first law of thermodynamics |
| D. Demonstrates the second law of thermodynamics | Is unrelated to the laws of thermodynamics |

7. Which statement relating to trophic levels is true?

- A. In a food chain there may be many species at each trophic level.
- B. The number of trophic levels is generally less in ecosystems with high primary productivity.
- C. Higher trophic levels always have fewer species than lower trophic levels.
- D. A single species may occupy more than two different trophic levels.

8. Recycling of a non-renewable resource can be of environmental value because it is likely to lead to
- I. a reduction in use of the resource.
 - II. a reduction in resource exploitation.
 - III. an increase in natural income.
 - IV. an increase in natural capital.
- A. I, II, III and IV
 - B. I, II and III only
 - C. I and III only
 - D. II only

Questions 9 and 10 refer to the diagram below which represents the pyramid of biomass for a certain ecosystem.



9. The most likely explanation for the biomass of trophic level 2 being greater than that of trophic level 1 is that the
- A. system shows seasonal fluctuations and the plants have died off before the herbivores.
 - B. number of plants is greater than the number of herbivores.
 - C. number of herbivores is greater than the number of plants.
 - D. productivity of the herbivores is greater than the productivity of the plants.

10. Species X and Y are both at trophic level 2 and species Z is at trophic level 3. Which are the most likely relationships between the species?

	Relationship between species X and Y	Relationship between species Z and X
A.	Parasitism	Predation
B.	Mutualism	Herbivory
C.	Mutualism	Competition
D.	Competition	Predation

11. An *ecological niche* is

- A. where a species lives and what it does in its environment.
- B. the specific location of a species.
- C. the general type of ecosystem where a species is found.
- D. the type of burrow where a species lives.

12. Which of the following correctly represents the energy transformations involved in respiration and photosynthesis?

	Respiration	Photosynthesis
A.	Heat to chemical	Light to chemical
B.	Chemical to heat	Heat to chemical
C.	Chemical to heat	Light to chemical
D.	Heat to chemical	Heat to light

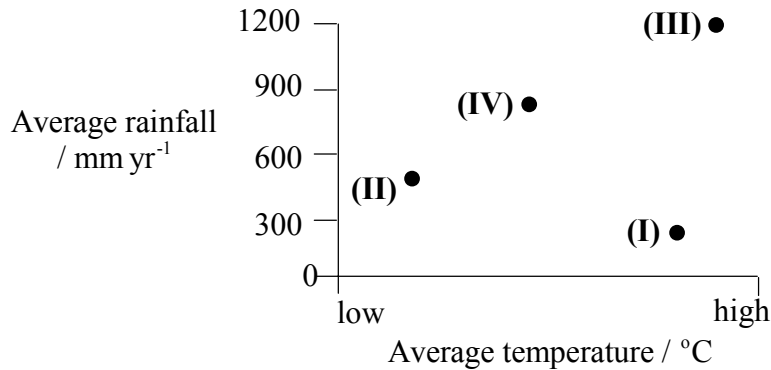
13. *Fertility rate* is

- A. the total number of births minus the total number of deaths in a country.
- B. the number of births per thousand individuals in a population per year.
- C. the number of births per thousand women of child-bearing age per year.
- D. the average number of children a woman has in her lifetime.

14. Which is a renewable resource?

- A. Soil in an agricultural region
- B. Ground water in an aquifer
- C. Fish in the sea
- D. Gold in the earth's crust

15. Biomes are largely determined by their prevailing climatic conditions. From the graph below identify the biomes most likely to be found in the given climatic conditions.



	(I)	(II)	(III)	(IV)
A.	Tropical rainforest	Coniferous forest	Temperate forest	Tropical savanna
B.	Desert	Tundra	Tropical rainforest	Temperate forest
C.	Tropical savanna	Coniferous forest	Tropical rainforest	Temperate forest
D.	Desert	Tundra	Temperate forest	Tropical grassland

16. Convection cells are found in the
- A. atmosphere only.
 - B. asthenosphere only.
 - C. atmosphere and hydrosphere only.
 - D. atmosphere, asthenosphere and hydrosphere.
17. Which process involved in the cycling of matter could be described as a transformation process requiring the input of solar radiation?
- A. Decomposition of organic matter releasing phosphates
 - B. Movement of water vapour inland from over the oceans
 - C. Conversion of nitrates into organic molecules containing nitrogen
 - D. Conversion of organic matter into fossil fuels
18. *Net primary productivity* is the total biomass
- A. made from inorganic matter that remains after respiratory losses.
 - B. obtained from other organisms that remains after respiratory losses.
 - C. obtained from other organisms before any respiratory losses.
 - D. made from inorganic matter before any respiratory losses.
19. A population has a Natural Increase Rate of 2.0 %. The crude birth and death rates (per thousand) for this population could be

	Crude birth rate	Crude death rate
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- | | | |
|----|----|----|
| A. | 12 | 32 |
| B. | 32 | 12 |
| C. | 12 | 14 |
| D. | 14 | 12 |

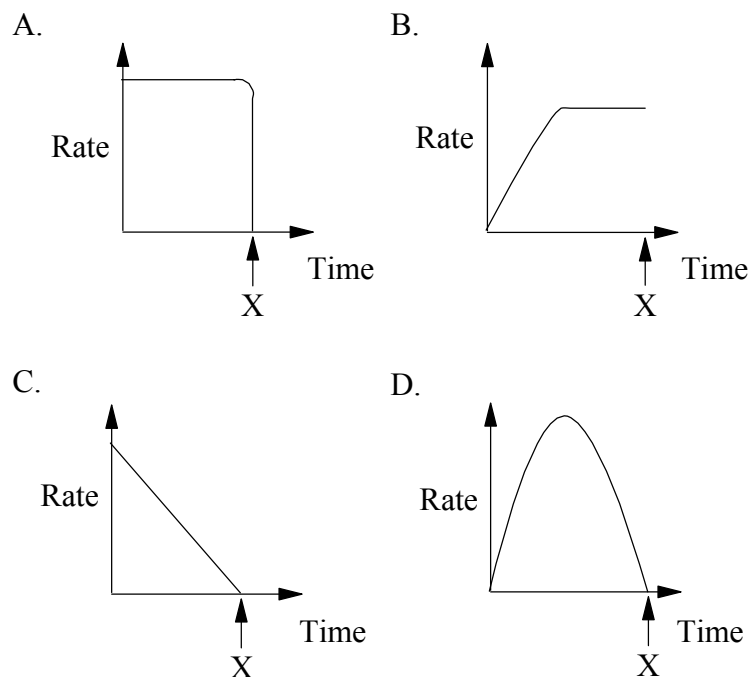
20. In the Hadley cell

- A. moist air rises at low latitudes and dry air descends at higher latitudes.
- B. dry air rises at low latitudes and moist air descends at higher latitudes.
- C. moist air rises at higher latitudes and dry air descends at low latitudes.
- D. dry air rises at higher latitudes and moist air descends at low latitudes.

21. As succession approaches a climax, which changes are likely to occur in an ecosystem?

	Gross productivity of whole ecosystem	Net productivity of whole ecosystem	Inorganic mineral storages
A.	Increase	Increase	Increase
B.	Decrease	Increase	Decrease
C.	Increase	Decrease	Decrease
D.	Increase	Decrease	Increase

22. Which graph best represents the change in growth rate of an S-shaped population growth curve?



X = time at which carrying capacity is reached

23. Which of these statements about ultra-violet (UV) radiation are true?

- I. It is absorbed by most greenhouse gases.
- II. It reduces productivity in phytoplankton.
- III. It is harmful long-wave radiation coming from the sun.

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

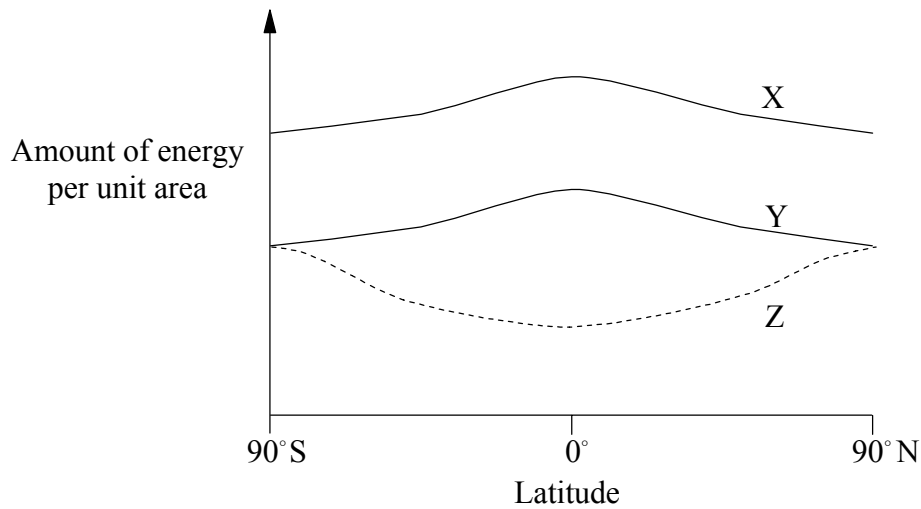
24. Which processes occur in the following regions of the atmosphere?

	Troposphere	Lower Stratosphere	Upper Stratosphere
A.	Natural formation of ozone	Destruction of ozone through human activity	Formation of ozone through human activity
B.	Formation of ozone through human activity	Destruction of ozone through human activity	Natural formation of ozone
C.	Destruction of ozone through human activity	Natural formation of ozone	Formation of ozone through human activity
D.	Formation of ozone through human activity	Natural formation of ozone	Destruction of ozone through human activity

25. Which is most likely to be an internal density dependent factor regulating a population of herbivores?

- A. An increase in predators as the herbivores increase in number
- B. An increased fertility rate as herbivores decrease in number
- C. An increased size of breeding territory when food *per capita* is high
- D. Less aggression leading to more mating success when population numbers are low

Questions 26 and 27 refer to the graph below, which represents the amount of energy coming from the sun and from the earth at different latitudes.



X = solar energy reaching atmosphere
 Y = solar energy reaching earth's surface
 Z = energy reflected from earth's surface

26. The shape of line Z shows a maximum at higher latitudes because
- A. the angle at which radiation strikes the surface is greater.
 - B. the snow and ice cover are greater.
 - C. the radiation passes through a thicker layer of atmosphere.
 - D. more radiation is absorbed by the vegetation.
27. All of the processes listed below lead to the difference between lines X and Y **except**
- A. reflection from vegetation.
 - B. absorption by vegetation.
 - C. reflection by clouds.
 - D. absorption by nitrogen in the atmosphere.

28. Which impact(s) on ecosystems may be associated with the release of sulfur oxides into the atmosphere?

- I. Increased uptake of aluminium ions by living organisms
- II. A decrease in certain mineral storages in the soil
- III. Reduced leaf surface area in coniferous forests

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

29. These statements describe changes taking place in the populations of two different countries:

- Country X begins to import a resource from another country.
- Country Y increases its birth rate through a population policy.

Which of the following predict the most likely effects these changes will have on the carrying capacity of each country?

	Increase in carrying capacity	Decrease in carrying capacity	No change in carrying capacity
A.	X	Y	—
B.	X	—	Y
C.	Y	—	X
D.	—	X, Y	—

30. Which of the following has been most effective in reducing growth rates in human populations?

- A. Improved sanitation and disease control
- B. Aid programmes which provide food to countries in famine
- C. Policies which improve agricultural development
- D. Policies which increase the economic independence of women