



**ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 1**

Wednesday 6 May 2009 (afternoon)

45 minutes

INSTRUCTIONS TO CANDIDATES

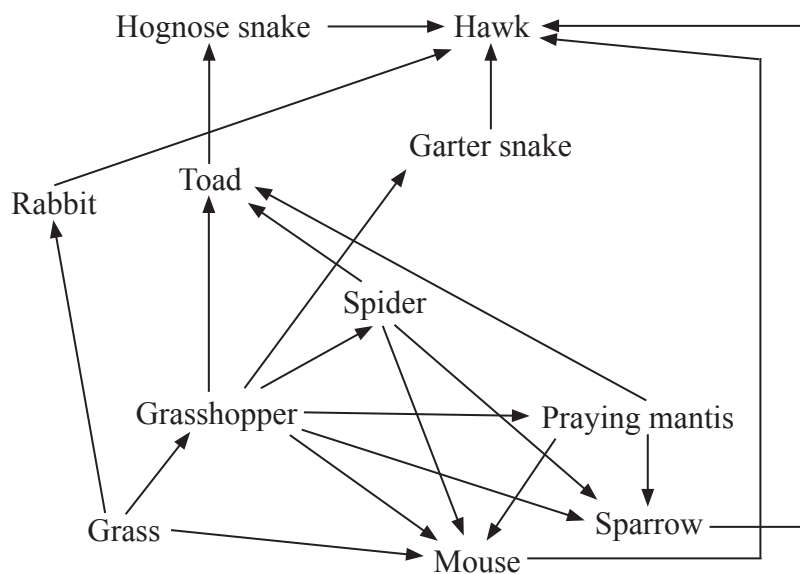
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. Which of the following could be described as an isolated system?
 - A. The entire universe
 - B. The planet Earth
 - C. The biosphere
 - D. A remote island

2. Which statement describes the result of the first law of thermodynamics?
 - A. The amount of energy available to do useful work in a system decreases over time.
 - B. Doing work always creates heat.
 - C. Total energy input is always equal to total energy output.
 - D. Energy cannot be recycled.

3. Which of the following is an essential feature of a system in steady-state equilibrium?
 - A. Unbalanced input and output of matter
 - B. Positive feedback mechanisms
 - C. Negative feedback mechanisms
 - D. Transfer processes

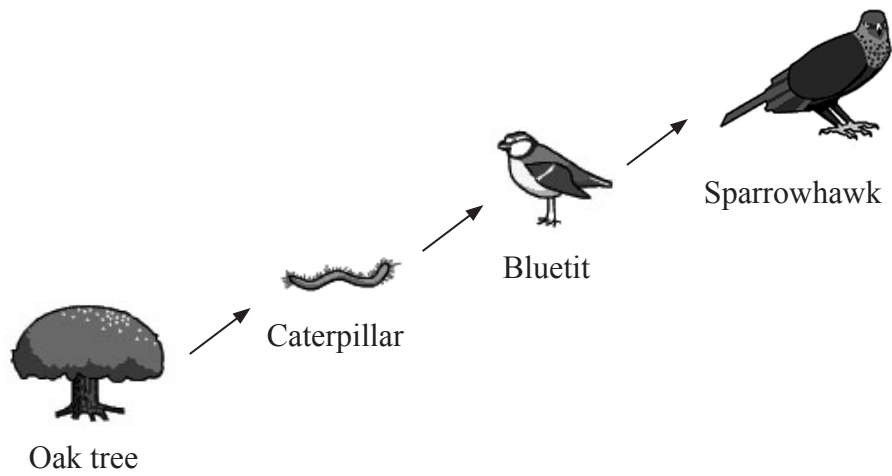
The diagram below refers to question 4 and question 5. It represents a terrestrial food web in the deserts of the south-west USA.



4. Which statement is a correct description of the **Hognose snake**?
 - A. It is a tertiary consumer only.
 - B. It is a quaternary consumer only.
 - C. It is a tertiary and quaternary consumer.
 - D. It is the top carnivore.

5. Which of the following organisms named below is part of the trophic level which makes most efficient use of energy input for that food chain?
 - A. Garter snake
 - B. Sparrow
 - C. Rabbit
 - D. Hognose snake

6. In a European forest, oak tree leaves are eaten by small caterpillars, which are eaten by small birds (Bluetit), that then are eaten by larger birds (Sparrowhawk).



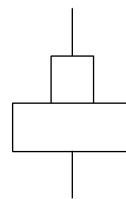
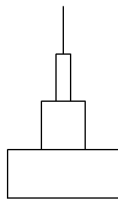
[Scale: not drawn to scale]

Which of the following pairs of pyramids are most likely to represent this food chain?

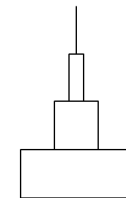
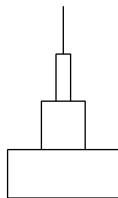
Pyramid of biomass

Pyramid of numbers

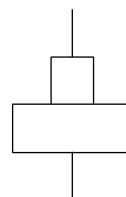
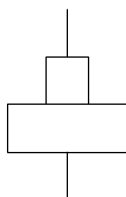
A.



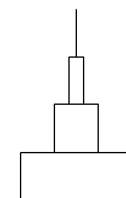
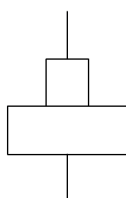
B.



C.

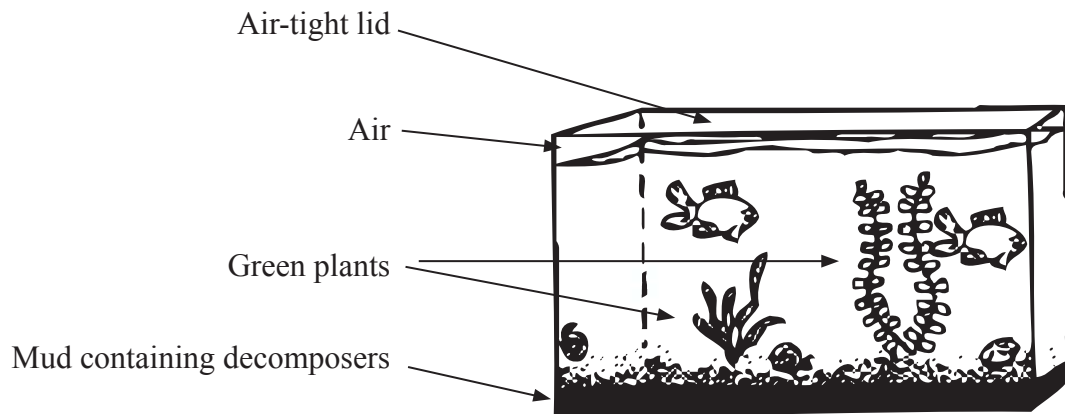


D.



7. Toxins such as heavy metals are more likely to kill top predators than organisms lower in the food chain. Which is the best explanation of this effect?
- A. Herbivores rapidly excrete heavy metals.
 - B. Top predators often eat dead animals which may have been poisoned.
 - C. The digestive system of top predators allows toxins to enter their bloodstream more readily.
 - D. Non-biodegradable toxins become more concentrated as they move up the food chain.
8. Which list shows the major biomes of the world in the correct order of increasing latitude?
- A. Hot desert, tropical rainforest, tundra, temperate forest
 - B. Tropical rainforest, hot desert, temperate forest, tundra
 - C. Tropical rainforest, temperate forest, hot desert, tundra
 - D. Tropical rainforest, hot desert, tundra, temperate forest

9. The diagram below represents a balanced model ecosystem.

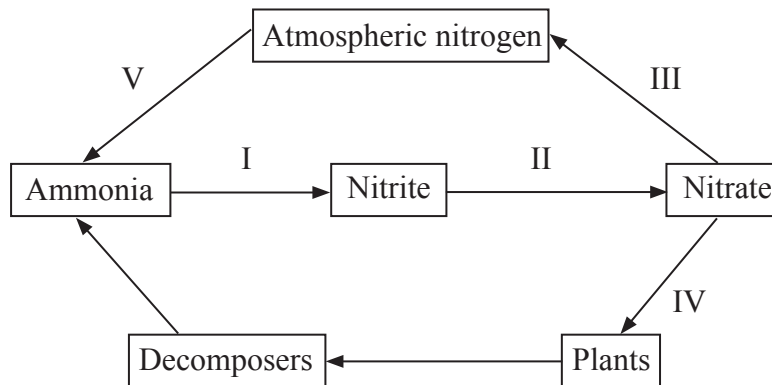


[Source: modified from www.ekcsk12.org/science/regbio/aquarium]

Which of the following would have to be supplied, from the outside, to enable the aquarium to act as a model for an ecosystem?

- I. Light
 - II. Carbon dioxide
 - III. Minerals
 - IV. Oxygen
- A. I only
 - B. II and IV only
 - C. I, II and III only
 - D. I, II, III and IV

10. The diagram below represents part of the nitrogen cycle.



Which process(es) represent/represents denitrification?

- A. I and II only
 - B. V only
 - C. III only
 - D. IV only
11. The biomass assimilated by heterotrophic organisms measured in units of mass per unit area per unit time is
- A. gross primary productivity.
 - B. net primary productivity.
 - C. carrying capacity.
 - D. gross secondary productivity.

12. To which of the following are populations with a J-shaped population growth curve better adapted?

- I. High competition
 - II. Low species diversity
 - III. Limited abiotic resources
 - IV. Newly formed habitats
- A. IV only
 - B. I and II only
 - C. II and IV only
 - D. I, II and III only

13. Density-dependent factors usually act as

- A. negative feedback mechanisms that lead to stability in a population.
- B. positive feedback mechanisms that lead to stability in a population.
- C. negative feedback mechanisms that lead to a permanent decline in a population.
- D. positive feedback mechanisms that lead to a rise in a population.

14. Which of the following pairs correctly identifies characteristics of pioneer and climax communities?

	Pioneer community	Climax community
A.	High species diversity	Constant total biomass
B.	Many <i>r</i> -strategists	Low species diversity
C.	Constant total biomass	<i>K</i> -adapted organisms
D.	Many <i>r</i> -strategists	High species diversity

- 15.** Which of these abiotic factors is characteristic of the temperate forest biome?
- A. High mean temperatures
 - B. Acid soils
 - C. Steep slopes
 - D. Moderate annual rainfall
- 16.** In which of the following processes is energy stored as latent heat?
- A. Transfer of energy from the oceans to the atmosphere through evaporation
 - B. Storage of heat in the tropical oceans as they are warmed by solar radiation
 - C. Radiation of heat from oceans to the atmosphere during winter months
 - D. Rain that has been warmed by the atmosphere, falling into the oceans
- 17.** Tropical cyclones are
- A. intense circular winds caused by upwelling cold ocean currents occurring in equatorial regions.
 - B. low pressure areas, often associated with high winds, forming over the oceans at low latitudes.
 - C. convection cells of air in the upper atmosphere that give rise to mid-latitude depressions.
 - D. regions of relatively high pressure in middle latitudes in which strong winds spiral counter-clockwise in the southern hemisphere.

- 18.** Which row contains the appropriate words or phrases to correctly complete the following statement about ozone?

Ozone is _____ I _____ in the _____ II _____ through the action of _____ III _____, causing _____ IV _____.

	I	II	III	IV
A.	formed	troposphere	CFCs	global warming
B.	destroyed	stratosphere	CFCs	an increase in damaging radiation
C.	formed	stratosphere	CO ₂	an increase in damaging radiation
D.	destroyed	stratosphere	CO ₂	global warming

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

- A. Increase in irritation of eyes and breathing difficulties in humans
- B. Reduction in ultraviolet radiation reaching the Earth's surface
- C. Reduction in phytoplankton productivity
- D. Reduction of photochemical smog

- 20.** Which of the following lists contains only gases described as “greenhouse gases”?

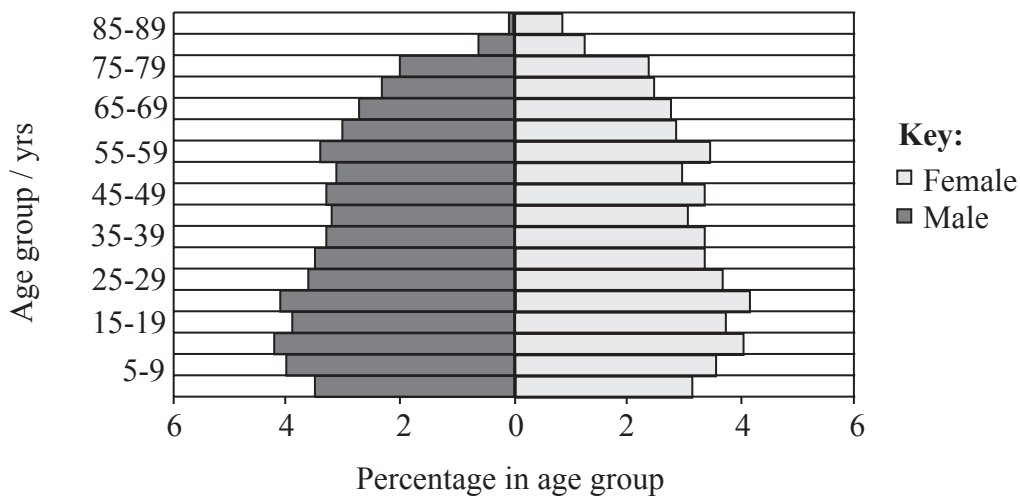
- A. Nitrogen, carbon dioxide, oxygen
- B. Carbon dioxide, water vapour, methane
- C. CFCs, methane, oxygen
- D. Nitrogen, CFCs, water vapour

- 21.** Some areas in eastern North America have rain about 1000 times more acidic than normal rain. Which of the following statements is correct?
- A. This is a natural process mainly caused by local forest fires and lightning.
 - B. This phenomenon has increased in the last two decades due to the expansion of the ozone hole.
 - C. The source could be located hundreds of kilometres from the affected areas.
 - D. This is caused primarily by high levels of CO₂ released from the burning of fossil fuels.
- 22.** Which of the following contains the greatest proportion of the world's freshwater?
- A. Photosynthetic organisms
 - B. The troposphere
 - C. Ice-caps and glaciers
 - D. Streams, rivers and lakes
- 23.** Which of the following statements is correct?
- A. The bulk of thermal energy in the biosphere is stored in the oceans.
 - B. Solar energy input is uniform over the Earth's surface because it is a sphere.
 - C. Along the Equator, descending dry and warm air masses give rise to cloudless skies and hot climates.
 - D. Warm surface waters, driven by the wind, sink at the Equator creating an ocean circulatory system.
- 24.** Volcanic activity occurs
- A. only in association with constructive margins of tectonic plates.
 - B. only in association with destructive margins of tectonic plates.
 - C. in association with both constructive and destructive margins of tectonic plates.
 - D. only on plate margins carrying a continental mass.

25. Argentina has a crude birth rate of 16.6 per thousand and a crude death rate of 7.6 per thousand. Which of the following correctly expresses the natural increase rate for this population?

- A. 0.9 per thousand
- B. 0.9 %
- C. -9 per thousand
- D. -0.9 %

26. What is the population pyramid diagram below most likely to represent?



- A. A developed country with high birth rate and high death rate
 - B. A less developed country with high birth rate and high death rate
 - C. A less developed country with low birth rate and low death rate
 - D. A developed country with low birth rate and low death rate
27. Which of the following statements about natural capital is correct?
- A. Coal and timber are examples of non-renewable natural capital.
 - B. Replenishable natural capital cannot be naturally replaced at a rate comparative to its consumption.
 - C. Metals are renewable natural capital because they are not destroyed and can be recycled.
 - D. Carbon dioxide and oxygen are examples of replenishable natural capital.

28. Sustainable yield can be defined as

- I. (annual growth and recruitment) – (annual death and emigration).
- II. the gain in biomass (or energy) per unit time remaining after subtracting metabolic and other natural losses.
- III. the highest rate at which natural capital can be exploited without reducing its original stock.

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

29. Which of the following make it almost impossible to make reliable estimates of the carrying capacity of particular areas for humans?

- I. Resource requirements differ greatly from population to population.
- II. Technological developments can dramatically alter the efficiency of resource consumption.
- III. Number of offspring varies a great deal among human populations.
- IV. Death rates depend heavily on levels of economic development which change with time.

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

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

- A. Urbanization measures and improved sanitation
- B. Policies which prevent child labour
- C. Policies which increase the economic independence of women
- D. International donations of food and medicines