INTERNATIONAL ENVIRONMENTAL SCIENCE OLYMPIAD

Battery Examination – Part 2
High School Division
Friends and Family Adult Division

Name _____

Country OR State _____

ID Number _____

Instructions – Mark your answers on the scantron provided. Correct answers are worth 2 points. Incorrect answers are worth –1 point. Questions left blank are worth 0 points.

Questions 1-10 are on ecosystems.

1. What is the primary source of energy for most ecosystems on Earth?
   A. geothermal heat
   B. solar radiation
   C. wind energy
   D. decomposition

2. Which of the following would likely lead to an increase in biodiversity within an ecosystem?
   A. habitat fragmentation
   B. introduction of invasive species
   C. restoration of degraded ecosystems
   D. an increase in acid rain

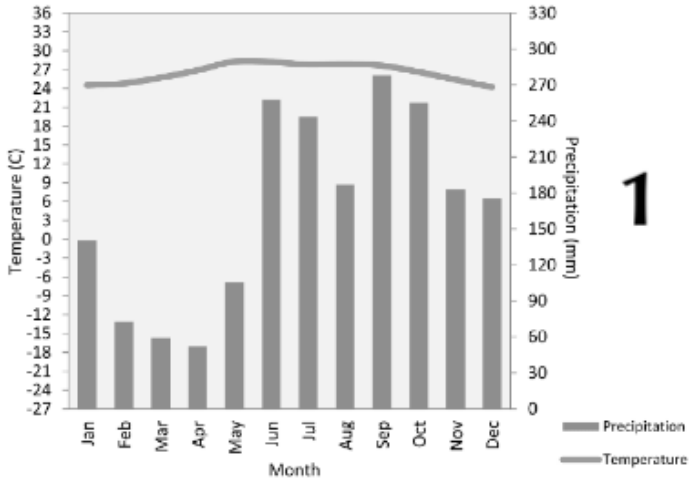
3. A keystone species is one that does which of these?
   A. has a disproportionate impact on ecosystem structure and function
   B. has the largest population in an ecosystem
   C. is always a top predator
   D. is the most abundant producer in the ecosystem

4. Which term describes organisms that obtain energy by consuming both plants and animals?
   A. herbivores
   B. carnivores
   C. omnivores
   D. detritivores

5. Which of the following is the correct order of energy flow in a typical food chain?
   A. Producers → Secondary Consumers → Primary Consumers → Decomposers
   B. Primary Consumers → Producers → Secondary Consumers → Decomposers
   C. Producers → Decomposers → Primary Consumers → Secondary Consumers
   D. Producers → Primary Consumers → Secondary Consumers → Decomposers

6. Which of the following best describes an ecosystem?
   A. a community of species interacting with each other and their physical environment
   B. a single population of organisms
   C. all living organisms within a biome
   D. the abiotic components of the environment

Use these images to answer questions 7 to 10.



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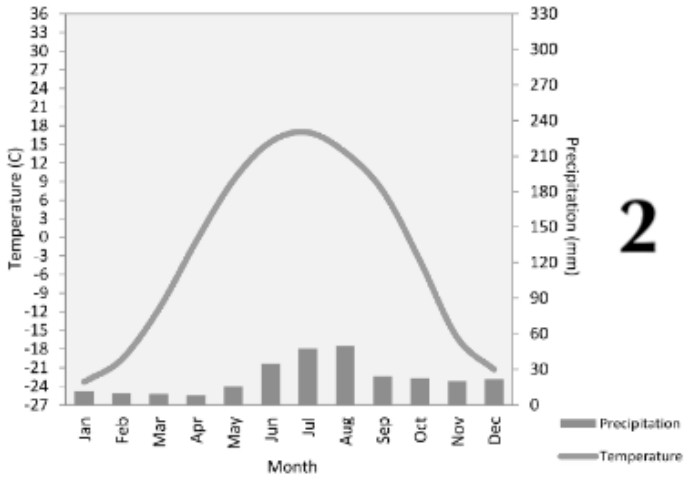


2

7. Which of these most accurately describes the temperature range shown in graph 2?
   A. high of 28C and low of 24C
   B. high of 17C and low of -23C
   C. high of 24C and low of -18C
   D. high of 55C and low of 3C

8. Which of these biomes is shown in graph 2?
   A. xeric shrubland
   B. taiga
   C. subtropical moist broadleaf forest
   D. Mediterranean forest

9. The city shown by graph 1 would most likely be located in which of these areas?
   A. Central America
   B. Western Canada
   C. the Great Plains region of the US
   D. Western Alaska

10. Which of these would NOT be true of the graph of a city in the tundra biome when compared to graph 2?
   A. it would have lower average rainfall
   B. it would have lower average temperature
   C. it would have fewer months with an average temperature above freezing
   D. it would have higher average temperatures in the summer and lower in the winter

Questions 11-20 are on biodiversity.

11. Which of the following is NOT a direct driver of biodiversity loss?
   A. overexploitation of natural resources
   B. pollution from industrial waste
   C. natural disasters
   D. introduction of invasive species

12. Which of the following best describes an invasive species?
   A. it has a mutualistic relationship with native species
   B. it competes with native species for resources and has no natural predators
   C. it is highly dependent on a specific habitat
   D. it is always introduced intentionally by humans

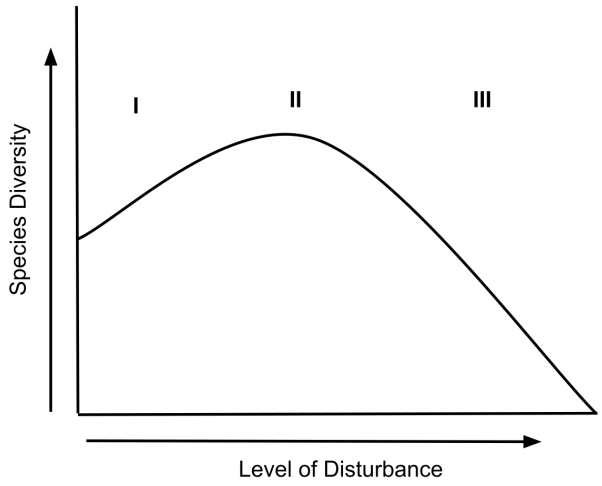
13. What is the primary purpose of a biodiversity hotspot designation?
   A. to prioritize conservation efforts in areas with unique species
   B. to identify areas with the highest economic value
   C. to track invasive species' spread
   D. to increase tourism in ecologically significant regions

14. Which of these is NOT an ecosystem service provided by biodiversity?
   A. cultural and recreational value
   B. oxygen production through photosynthesis
   C. climate stabilization by industrial processes
   D. pollination of crops by insects

15. Which of the following is an example of an ecosystem with high functional diversity?
   A. a coral reef with species performing various ecological roles
   B. a field of monoculture crops with uniform genetic traits
   C. a boreal forest with limited variation in tree species
   D. a savanna dominated by a single predator species

16. How does deforestation typically affect biodiversity?
   A. it increases species richness by creating new habitats
   B. it has no impact on biodiversity if done sustainably
   C. it increases genetic diversity by forcing species to adapt
   D. it reduces biodiversity by destroying habitats and causing species loss

Use this image to answer questions 17 to 20.



17. This graph is an illustration of which of the following principles of biodiversity?
   A. artificial selection
   B. intermediate disturbance hypothesis
   C. ecological succession
   D. ecological impact

18. Which of these is likely to happen if an ecosystem frequently experiences high levels of disturbance?
   A. species diversity will decline but eventually increase
   B. all species are at risk of extinction
   C. species diversity will remain high with little to no decrease
   D. species diversity will be unaffected

19. In environments with low levels of disturbance, which of these is likely to occur?
   A. less competitive species will flourish and drive out more competitive species
   B. less competitive species will flourish and attract predators
   C. more competitive species will dominate the ecosystem leading to lower diversity
   D. more competitive species will attract less competitive species leading to higher diversity

20. At the point labeled II on the graph, which of these is most likely to occur?
   A. r-selected species dominate
   B. K-selected species dominate
   C. K- and r-selected species are able to coexist
   D. both K- and r-selected species are driven out

Questions 21-30 are on populations.

21. Which of the following is a key characteristic of a K-selected species?
   A. rapid reproduction and short lifespans
   B. high parental investment and low reproductive rates
   C. adaptation to disturbed environments
   D. early maturity and high offspring mortality

22. What is the primary goal of family planning programs?
   A. to promote emigration
   B. to control population distribution
   C. to regulate fertility rates and reduce unplanned pregnancies
   D. to increase the crude birth rate in developed countries

23. Which of the following is most likely to occur in a population experiencing exponential growth?
   A. rapid increase in population size over a short period
   B. rapid population decline
   C. sudden increase in carrying capacity
   D. a shift to a Type I survivorship curve

24. Which of the following best describes the industrial stage of the demographic transition model?
   A. high birth rates and low death rates
   B. high birth and death rates
   C. low birth rates and low death rates
   D. declining birth rates and stable death rates

25. Which of the following factors is most likely to lead to a population overshooting its carrying capacity?
   A. sudden increase in predation
   B. lag between resource depletion and population decline
   C. high emigration rates
   D. decreased reproductive rates

26. Which of the following is NOT a consequence of rapid population growth in developing countries?
   A. strain on natural resources
   B. decreased biodiversity
   C. decreased infant mortality rates
   D. increased urbanization

27. What is the relationship between education levels for women and population growth rates?
   A. higher education levels lead to higher population growth rates
   B. higher education levels lead to lower population growth rates
   C. there is no relationship between education and population growth rates
   D. education increases fertility rates in developing countries

28. In human populations, which factor is the strongest determinant of life expectancy?
   A. access to healthcare and sanitation
   B. availability of natural resources
   C. presence of natural disasters
   D. cultural traditions

29. What does crude death rate measure?
   A. the number of deaths compared to births in a given year
   B. the percentage of the population that dies each year
   C. the number of deaths among infants under one year old per 1,000 live births
   D. the number of deaths per 1,000 individuals in a population per year

30. Which of these best defines population momentum?
   A. the continued growth of a population after replacement-level fertility is reached
   B. the rapid decline of a population after a natural disaster
   C. the stabilization of population size when immigration matches emigration
   D. the growth of a population due to immigration

Questions 31-40 are on earth systems and resources.

31. Which of the following is the primary source of energy driving the rock cycle?
    A. solar radiation
    B. geothermal energy
    C. gravitational pull of the moon
    D. wind erosion

32. Which type of soil particle is the smallest?
    A. sand
    B. silt
    C. clay
    D. gravel

33. Which of the following is an example of a negative feedback mechanism in the Earth's climate system?
    A. increased cloud cover reflecting sunlight, reducing temperatures
    B. melting ice exposing dark ocean water, which absorbs more heat
    C. forest fires releasing carbon dioxide into the atmosphere
    D. rising global temperatures causing more permafrost to melt

34. Which of the following best describes the Hadley cell?
    A. a system of deep ocean currents driven by temperature and salinity differences
    B. a seasonal wind pattern associated with monsoons
    C. a region of tectonic activity at subduction zones
    D. a large-scale atmospheric circulation pattern near the equator

35. Which of the following best describes an aquifer?
    A. a layer of soil rich in organic material
    B. a layer of permeable rock that stores groundwater
    C. a surface water feature, such as a river or lake
    D. a region where tectonic plates meet

36. What is the role of the Earth's atmosphere in the water cycle?
    A. storing water in the form of ice caps
    B. preventing condensation from occurring
    C. blocking precipitation from entering oceans
    D. facilitating the evaporation and transport of water vapor

37. Which layer of the Earth is composed mostly of silicate rocks and is the least dense?
    A. inner core
    B. outer core
    C. mantle
    D. crust

38. In areas of upwelling, the water is usually which of these?
    A. warm and lacking in nutrients
    B. warm and high in nutrients
    C. cold and high in nutrients
    D. cold and lacking in nutrients

39. Which of these gives the three factors necessary for thunderstorm formation?
    A. moisture, oceans, heat
    B. moisture, stability, front boundary
    C. moisture, lifting mechanism, instability
    D. heat, lifting mechanism, front boundary

40. What is the main characteristic of an El Niño event?
    A. increased atmospheric pressure in the eastern Pacific
    B. warm surface waters in the eastern Pacific
    C. abnormally cold water in the eastern Pacific
    D. reduced rainfall in the western Pacific

Questions 41-50 are on land and water use.

41. Which of the following land management practices is most effective at reducing soil erosion on sloped terrain?
    A. clear-cutting
    B. terracing
    C. center-pivot irrigation
    D. monocropping

42. Which of the following is a primary purpose of wildlife corridors?
    A. to connect fragmented habitats and promote biodiversity
    B. to prevent invasive species from spreading
    C. to concentrate wildlife into specific areas for management
    D. to increase urban development

43. Which of these best describes the tragedy of the commons?
    A. overexploitation of shared resources due to individual self-interest
    B. the failure to maximize economic growth in developing nations
    C. the inability of ecosystems to recover from natural disasters
    D. excessive regulation of private resources

44. Which of the following is a potential effect of excessive groundwater extraction?
    A. increased soil fertility
    B. reduced urbanization
    C. increased crop diversity
    D. land subsidence

45. Which of the following is a common result of overirrigation in agriculture?
   A. soil erosion
   B. increased soil fertility
   C. salinization of soil
   D. decreasing prevalence of insects

46. What is a potential environmental consequence of clear-cutting forests?
   A. increased biodiversity
   B. reduced soil erosion
   C. disruption of carbon storage and sequestration
   D. greater groundwater infiltration

Use this image to answer questions 47 to 50. The images show the change in Lake Urmia over a 30-year period (1984 to 2014).

47. Based on the photographs, which of these is true of Lake Urmia?
   A. it is an endorheic salt lake
   B. it is a tidal estuary
   C. it is a rift lake
   D. it is a reservoir created by a hydroelectric project

48. Which of the following is the most likely cause of the changes seen in these images?
   A. extensive use of lake water for irrigation
   B. diversion of water from rivers feeding the lake and increased use of surrounding groundwater
   C. a major flood in the region
   D. a major earthquake

49. Based on the images, how has the surface area of the water of Lake Urmia changed since 1984?
   A. increased by 10%
   B. decreased by 10%
   C. decreased by 30%
   D. decreased by 90%

50. What other major body of water has suffered the same fate as Lake Urmia over the last 50 years for very similar reasons?
   A. the Aral Sea
   B. the Black Sea
   C. Lake Michigan
   D. Lake Erie

Questions 51-60 are on energy resources and consumption.

51. Which factor makes geothermal energy location-dependent?
   A. accessibility to fossil fuels
   B. availability of solar radiation
   C. proximity to tectonic plate boundaries or hotspots
   D. dependence on atmospheric temperatures

52. What is a primary advantage of using hydrogen fuel cells for energy?
   A. it has zero emissions at the point of use
   B. the low cost of hydrogen production
   C. abundance of natural hydrogen reserves
   D. high efficiency compared to all other energy sources

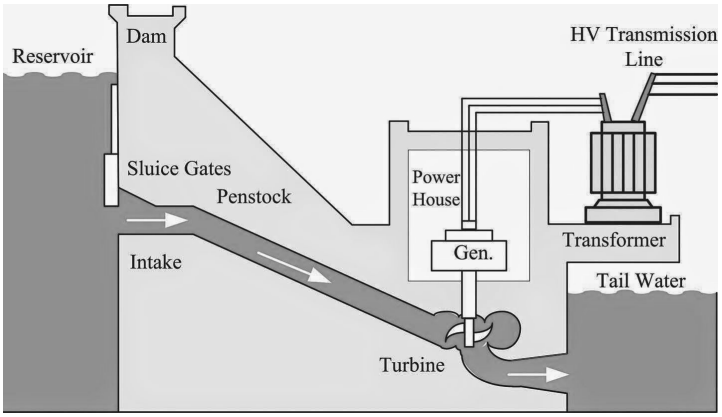
53. Which energy source is most commonly used for electricity generation in the United States?
   A. solar
   B. coal
   C. nuclear
   D. natural gas

54. What is the primary purpose of carbon capture and storage technology?
   A. increase energy production from coal
   B. reduce carbon dioxide emissions from power plants
   C. eliminate the need for renewable energy
   D. generate energy directly from carbon dioxide

55. What is the purpose of cogeneration systems?
   A. to separate fossil fuels from renewable sources
   B. to use waste heat from electricity generation to improve efficiency
   C. to replace nuclear power with renewable energy
   D. to increase the lifespan of fossil fuel reserves

56. Which of the following is an example of a secondary energy source?
   A. electricity
   B. wind
   C. coal
   D. natural gas

Use this image to answer questions 57 to 60.



57. The percentage of the world's electricity produced by hydroelectric power is closest to which of the following?
- A. 10%
- B. 15%
- C. 25%
- D. 30%

58. Which of the following determines the amount of energy produced by a hydroelectric plant like the one pictured in the image?
- A. the distance the transmission lines travel from the plant
- B. the volume of the water flow reaching the turbine
- C. the elevation distance the water travels
- D. a combination of both the volume and the elevation distance

59. Which of these is NOT a disadvantage posed by the reservoirs associated with hydroelectric power?
- A. disruption to aquatic ecosystems upriver and downriver of reservoirs
- B. release of excessive amounts of methane in tropical areas due to decay of biological material
- C. poor reliability of using reservoirs as a water source for local populations
- D. loss of significant amounts of water from reservoirs due to evaporation

60. Which of the following produces more TWh of hydroelectric power than any other nation?
- A. China
- B. Canada
- C. Norway
- D. Russia

Questions 61-70 are on atmospheric pollution.

61. Which of these is the largest anthropogenic source of greenhouse gas emissions?
- A. transportation
- B. agriculture
- C. fossil fuel combustion for energy
- D. deforestation

62. Which of the following does the ozone layer primarily absorb?
- A. gamma rays
- B. infrared radiation
- C. ultraviolet radiation
- D. visible light

63. What is the purpose of scrubbers in industrial facilities?
- A. to improve energy efficiency
- B. to remove harmful pollutants like sulfur dioxide from emissions
- C. to monitor air quality
- D. to reduce water usage during manufacturing

64. Decomposition of organic matter in wetlands leads to the emission of which of these pollutants?
- A. methane
- B. lead
- C. nitrous oxide
- D. ozone

65. Which of these best describes how carbon monoxide affect humans?
- A. it causes skin irritation
- B. it binds with hemoglobin, reducing oxygen transport in the blood
- C. it disrupts the digestive system
- D. it leads to increased risk of infection and disease transmission

66. Which of these best describes a 'secondary pollutant'?
- A. pollutants that are less harmful to humans
- B. pollutants emitted only by industrial activities
- C. pollutants that originate from natural sources
- D. pollutants that form in the atmosphere from chemical reactions

67. What is the primary drawback of biofuels like ethanol?
- A. reduced greenhouse gas emissions
- B. competition with food production and high water usage
- C. inability to use existing infrastructure
- D. high production costs compared to fossil fuels

68. What is the efficiency range of most coal-fired power plants?
- A. 10–20%
- B. 25–30%
- C. 35–45%
- D. 50–60%

69. Which of these is the largest environmental concern with the use of nuclear energy?
- A. long-term storage of radioactive waste
- B. dependence on fossil fuels
- C. high greenhouse gas emissions
- D. inability to provide consistent energy output

70. Which nation is the largest consumer of energy per capita?
A. Mexico
B. the United States
C. India
D. China

Questions 71-80 are on aquatic and terrestrial pollution.

71. Which of the following is an example of point-source pollution?
A. agricultural runoff
B. urban stormwater runoff
C. acid deposition from the atmosphere
D. leakage from an oil pipeline

72. What is the primary effect of thermal pollution on aquatic ecosystems?
A. decreased levels of dissolved oxygen
B. increased levels of heavy metals
C. reduced pH levels
D. accumulation of microplastics

73. Which of these is a leading cause of eutrophication in aquatic ecosystems?
A. acid rain
B. excess nutrients from runoff
C. heavy metal pollution
D. oil spills

74. Which of the following is a major terrestrial source of marine debris?
A. overfishing
B. waste from cruise ships
C. improperly managed solid waste on land
D. thermal pollution from power plants

75. Which of these aquatic ecosystems is most vulnerable to sediment pollution?
A. open ocean
B. coral reefs
C. deep-sea hydrothermal vents
D. coastal estuaries

76. Which of the following is an environmental effect of persistent organic pollutants?
A. They degrade quickly in the environment.
B. They bioaccumulate in animal tissues and persist for long periods.
C. They neutralize heavy metals in aquatic systems.
D. They improve the fertility of agricultural soils.

77. Which of these is NOT considered to be a teratogen?
A. ethanol
B. tap water
C. radiation
D. benzene

78. Which of these water sources is most likely to be contaminated with radon?
A. public water systems that use surface water
B. public water systems that use groundwater
C. private wells
D. public water that has been purified with ozone

79. Which of these is the largest category of solid waste in the US?
A. metal
B. plastic
C. yard waste
D. paper

80. Which of these groups is likely to be least susceptible to the effects of air pollution?
A. an adult in their 40s
B. an adult in their 80s
C. a teenager
D. a newborn

Questions 81-90 are on global change.

81. Which of the following climate changes is most likely to increase the frequency of wildfires?
A. increased rainfall and higher humidity
B. rising temperatures and prolonged droughts
C. decreased wind activity and cooler temperatures
D. increased snowfall during winter months

82. What is a major environmental consequence of warmer ocean temperatures?
A. increased carbon sequestration in the deep ocean
B. increased occurrence of marine dead zones
C. decreased coral bleaching events
D. improved habitat for cold-water fish species

83. Which of these occurs as permafrost thaws in polar regions?
A. It releases carbon dioxide and methane into the atmosphere.
B. It increases soil water retention.
C. It decreases atmospheric carbon dioxide levels.
D. It enhances the albedo effect.

84. What is the primary goal of the Paris Agreement?
A. eliminating plastic pollution in oceans
B. phasing out ozone-depleting substances
C. limiting global temperature rise to below 2°C above pre-industrial levels
D. restoring ecosystems damaged by climate change

85. How does ocean warming affect marine biodiversity?
A. It increases dissolved oxygen levels.
B. It improves coral reef health.
C. It increases nutrient availability for fish.
D. It causes species migration and habitat loss.

86. Which of the following is most responsible for ozone depletion?
A. carbon dioxide (CO_2)
B. nitrous oxide (N_2O)
C. chlorofluorocarbons (CFCs)
D. methane (CH_4)

87. Which of these pollutants primarily leads to acid deposition on a global scale?
A. carbon monoxide (CO)
B. sulfur dioxide (SO_2)
C. chlorofluorocarbons (CFCs)
D. methane (CH_4)

88. What is the term for species that are particularly vulnerable to climate change due to narrow ecological niches?
A. specialist species
B. invasive species
C. generalist species
D. keystone species

89. What is the primary environmental effect of permafrost thawing in Arctic regions?
A. decreased biodiversity
B. release of methane and carbon dioxide
C. reduction in sea surface temperatures
D. increased soil fertility

90. What is the primary impact of El Niño events on global weather patterns?
A. warmer-than-average sea surface temperatures in the Pacific Ocean
B. increased ozone formation in the stratosphere
C. increased glacial ice accumulation in polar regions
D. reduced ocean salinity worldwide

Questions 91-100 are general questions about environmental science.

91. What type of succession occurs after a volcanic eruption forms a new island?
A. primary succession
B. secondary succession
C. terrestrial succession
D. climax succession

92. Which of the following ecosystems has the largest standing biomass?
A. open ocean
B. tropical rainforest
C. desert
D. boreal forest

93. Which type of ecological interaction benefits one species while having no effect on the other?
A. mutualism
B. parasitism
C. competition
D. commensalism

94. What is the best example of a cultural ecosystem service provided by biodiversity?
A. climate regulation by forests
B. ecotourism in tropical rainforests
C. pollination of crops by bees
D. nutrient cycling in wetlands

95. A population pyramid with a narrow base and a wide top indicates which of these?
A. rapid population growth
B. stable population
C. declining population
D. population with high fertility rates

96. What is the primary cause of plate tectonics?
A. gravity acting on ocean basins
B. earth's rotation
C. convection currents in the mantle
D. the Coriolis effect

97. What is the primary purpose of integrated pest management?
A. to eliminate the use of chemical pesticides
B. to minimize environmental damage while controlling pests
C. to increase reliance on biological control methods exclusively
D. to reduce crop yields for sustainability

98. Which of the following is a major cause of ocean acidification?
A. acid rain deposition in the ocean
B. excessive sulfur dioxide emissions
C. absorption of carbon dioxide from the atmosphere
D. runoff of chemical fertilizers

99. Which statement about energy transfer in ecosystems is correct?
A. All energy at each trophic level is transferred to the next level.
B. Decomposers receive no energy from trophic levels above them.
C. Most energy at each trophic level is lost as heat.
D. Energy flow in ecosystems is cyclical.

100. What is the main role of detritivores in an ecosystem?
A. breaking down dead organic material
B. consuming plant material
C. producing oxygen
D. fixing nitrogen in the soil