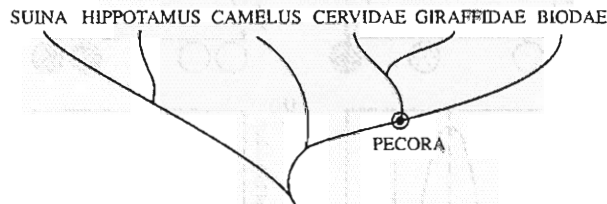


**Directions:** For each question or statement, select the one lettered choice that is the best answer and fill in the corresponding circle on the answer sheet.

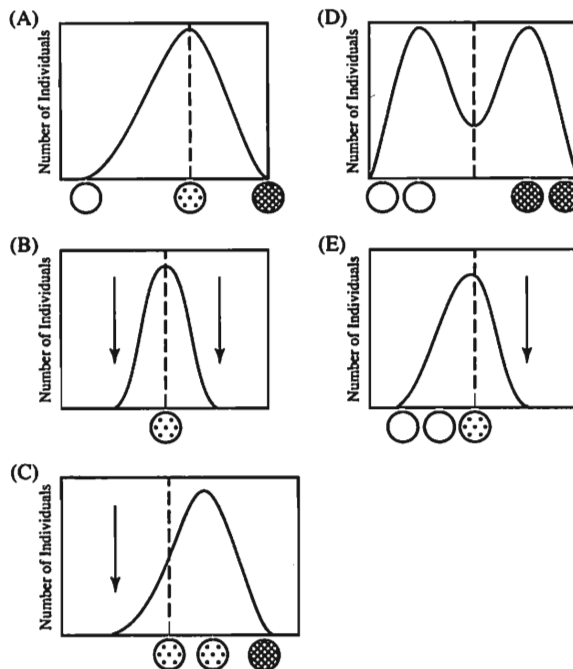
1. The diagram below represents a phylogenetic tree of the evolution of even-toed ungulates.



The most likely explanation for the branching pattern seen in the circled region is that

- (A) environmental changes caused extinction  
 (B) inbreeding led to speciation  
 (C) no speciation occurred  
 (D) speciation was influenced by environmental change  
 (E) only the best-adapted organisms survived from generation to generation
2. Two lightbulbs are for sale—a 15-watt fluorescent and a 60-watt incandescent. You know that a 15-watt fluorescent lightbulb will produce the same amount of light as a 60-watt incandescent lightbulb. If electricity costs \$0.10 per kWh and you run each lightbulb for 8,000 hours, how much money will you save in the cost of electricity by buying the fluorescent lightbulb?
- (A) \$4.00  
 (B) \$8.00  
 (C) \$12.00  
 (D) \$36.00  
 (E) \$48.00
3. Winds are primarily caused by
- (A) differences in air pressure  
 (B) the Coriolis effect  
 (C) ocean currents  
 (D) seasons  
 (E) the Earth's rotation on its axis

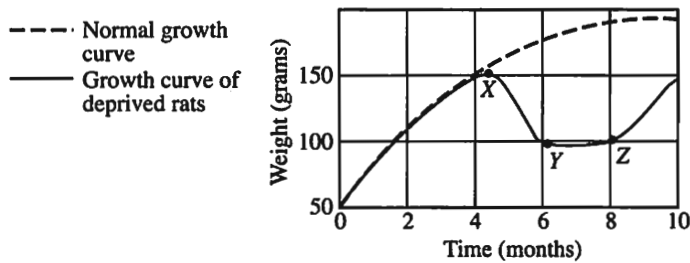
4. Below are graphs describing the fates of a hypothetical population of organisms in which there is variation in color. The arrows represent selective pressures. Which graph represents a stabilizing mode of selection?



- (A) A  
 (B) B  
 (C) C  
 (D) D  
 (E) E

5. You and a partner run an automobile salvage yard where you offer used automobile parts to customers, offering them substantial savings over buying new parts. Which of the following auto parts in your salvage yard would pose the greatest risk to stratospheric ozone depletion?
- (A) Tires, should they catch on fire.  
 (B) Oil, should it leak from the crank case and enter the groundwater.  
 (C) Air conditioners, if they should leak Freon™.  
 (D) Leaking gasoline, should it catch on fire.  
 (E) Heavy metals from batteries such as lead should it enter the food web.

6. The ecological efficiency at each trophic level of a particular ecosystem is 20%. If the green plants of the ecosystem capture 100 units of energy, about \_\_\_\_\_ units of energy will be available to support herbivores, and about \_\_\_\_\_ units of energy will be available to support primary carnivores.
- (A) 120, 140  
 (B) 120, 240  
 (C) 20, 2  
 (D) 20, 4  
 (E) 20, 1
7. An experiment with 50 newborn rats was conducted to determine the importance of two nutrients, *A* and *B*, in their diets as possible human supplements. The dashed line shows the normal growth rate of rats based on previous experiments. The solid line shows the growth rate of the 50 newborn rats, which were fed a normal diet containing nutrients *A* and *B* from birth to point *X*. At point *X*, the rats were deprived of both nutrients. At point *Y*, nutrient *A* was again added to the diet. At point *Z*, nutrient *B* was added and nutrient *A* was continued.



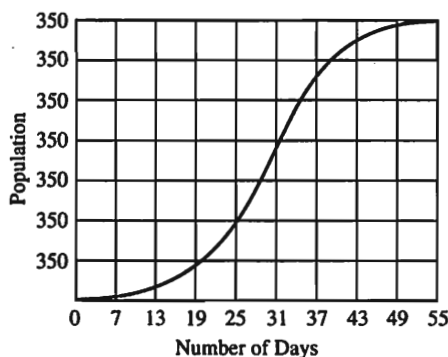
If the experiment had continued as described except that at point *Z* nutrient *B* had not been returned to the diet of the 50 rats, it is reasonable to conclude that these rats would most likely have

- (A) lived for 4 months and then died  
 (B) remained about half the size of normally developed rats  
 (C) continued to gain weight, but at a slower rate than the normal rats  
 (D) become sexually immature adults  
 (E) continuously lost weight
8. A soil test report recommends 8 pounds of 8-0-24 fertilizer per 1,000 square feet. How much phosphorus does it recommend if the area planted is equal to 10,000 square feet?
- (A) 0 pounds  
 (B) 8 pounds  
 (C) 24 pounds  
 (D) 80 pounds  
 (E) 240 pounds

9. Today, most of the world's energy comes from

- (A) natural gas, coal, and oil
- (B) oil, wood, and hydroelectric
- (C) hydroelectric, solar, and biomass
- (D) coal, oil, and nuclear
- (E) natural gas, hydroelectric, and oil

10. An AP Environmental Science class conducted an experiment to illustrate the principles of Thomas Malthus. On day 1, three male and three female fruit flies were placed in a flat-bottom flask that contained a cornmeal/banana medium. No other flies were added or removed during the course of this experiment. The students counted the number of flies in the flask each week. The graph shows the results that the class obtained after 55 days.



The rate of reproduction is equal to the rate of death on day

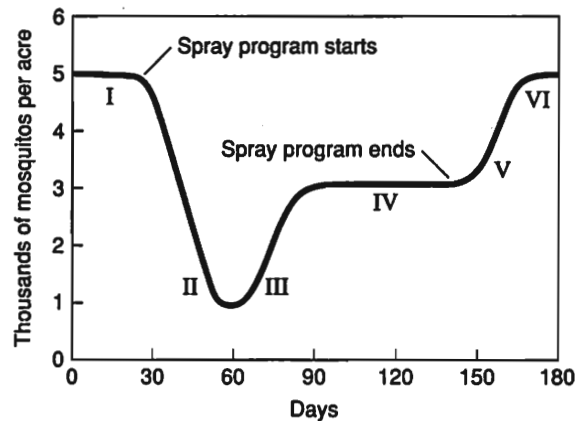
- (A) 1
- (B) 7
- (C) 25
- (D) 37
- (E) 49

11. The concept of net primary productivity

- (A) is the rate at which producers manufacture chemical energy through photosynthesis
- (B) is the rate at which producers use chemical energy through respiration
- (C) is the rate of photosynthesis plus the rate of respiration
- (D) can be thought of as the basic food source for decomposers in an ecosystem
- (E) is usually reported as the energy output of an area of producers over a given time period

12. Which of the following is NOT a unit of energy?
- (A) Joule
  - (B) Calorie
  - (C) Watt
  - (D) Kilowatt-hour
  - (E) Btu
13. Which of the following is NOT a phenomenon associated with La Niña?
- (A) Unusually cold ocean temperatures in the eastern equatorial Pacific
  - (B) Wetter-than-normal conditions across the Pacific Northwest
  - (C) Drier and warmer-than-normal conditions in the southern states
  - (D) Warmer-than-normal winter temperatures in the southeastern United States
  - (E) Substantial decrease in the number of hurricanes
14. Which of the following is NOT a possible cause/effect of increasing ocean temperatures?
- (A) A significant increase in the ocean circulation that transports warm water to the North Atlantic
  - (B) Large reductions in the Greenland and West Antarctic ice sheets
  - (C) Accelerated global warming
  - (D) Decreases in upwelling
  - (E) Releases of terrestrial carbon from permafrost regions and methane from hydrates in coastal sediments
15. In the nitrogen cycle, the bacteria that replenish the atmosphere with nitrogen gas ( $N_2$ ) are
- (A) *Rhizobium*
  - (B) nitrifying bacteria
  - (C) denitrifying bacteria
  - (D) nitrogen-fixing bacteria
  - (E) *E. coli*
16. The interface where plates move apart in opposite directions is known as a
- (A) transform plate boundary
  - (B) convergent plate boundary
  - (C) divergent plate boundary
  - (D) subduction zone
  - (E) trench

17. Which biome, found primarily in the eastern United States, central Europe, and eastern Asia, is home to some of the world's largest cities and has probably endured the impact of humans more than any other biome?
- (A) Desert  
 (B) Coniferous forest  
 (C) Temperate deciduous forest  
 (D) Grassland  
 (E) Chaparral
18. This type of economy exists when supplies and natural resources seem unlimited.
- (A) Frontier economy  
 (B) Free-market economy  
 (C) Communal resource management economy  
 (D) Command economic system  
 (E) Natural resource economy
19. A country in sub-Saharan Africa decided to spray the countryside over several months with massive amounts of DDT to rid the country of mosquitoes that were causing large numbers of citizens to contract malaria. Biologists sampled various quadrats for mosquito numbers after the spraying and the results are presented below:



Natural selection is chiefly responsible for the section of the graph labeled

- (A) I  
 (B) II  
 (C) III  
 (D) IV  
 (E) VI

20. Cars, trucks, and buses account for \_\_\_\_\_ of U.S. greenhouse gas emissions.
- (A) less than 5%
  - (B) between 10% and 20%
  - (C) between 20% and 33%
  - (D) between 35% and 75%
  - (E) more than 75%

**Questions 21–22**

Choose the appropriate era to answer the questions

- (A) Cenozoic
  - (B) Mesozoic
  - (C) Paleozoic
  - (D) Precambrian
  - (E) Archean
21. Human beings evolved.
22. Land plants appeared.
23. It takes on the order of \_\_\_\_\_ years for adaptive radiations to rebuild biological diversity after a mass extinction.
- (A) 100
  - (B) 100 thousand
  - (C) 1 million
  - (D) 10 million
  - (E) 1 billion
24. On the leeward side of a coastal mountain range, below 4,000 feet, which of the following types of trees and/or plants would be most likely to occur?
- (A) Epiphytes, lianas, bromeliads
  - (B) Mangrove, mahogany, cedar
  - (C) Prickly pear, manzanita, scrub oak
  - (D) Douglas fir, redwood
  - (E) Ferns, ivy, rhododendron

25. Succession on a sand dune would follow which order?
- (A) Grass, shrubs, beech and maple, cottonwoods, pine and black oak
  - (B) Beech and maple, pine and black oak, cottonwoods, shrubs, grass
  - (C) Grass, cottonwood, shrubs, beech and maple, pine and black oak
  - (D) Grass, shrubs, cottonwoods, pine and black oak, beech and maple
  - (E) A mixture of all species listed would occur simultaneously, stronger species replacing weaker species.
26. Certain volcanoes have a bowl-shaped crater at the summit and grow to only about a thousand feet. They are usually made of piles of lava, not ash. During the eruption, blobs of lava are blown into the air and break into small fragments that fall around the opening to the volcano. Parícutin in Mexico and the middle of Crater Lake, Oregon, are examples. These are called
- (A) cinder cones
  - (B) shield volcanoes
  - (C) composite volcanoes
  - (D) mud volcanoes
  - (E) spatter cones
27. Which of the following would NOT be considered an ecological service of a marine ecosystem?
- (A) Climate moderation
  - (B) Nutrient cycling
  - (C) CO<sub>2</sub> absorption
  - (D) Genetic resources and biodiversity
  - (E) Pharmaceuticals
28. Which continent has the highest deforestation rate?
- (A) Africa
  - (B) Asia
  - (C) Europe
  - (D) South America
  - (E) Australia/Oceania
29. Excavating and hauling soil off-site to an approved soil disposal/treatment facility would be an example of
- (A) sustainability
  - (B) remediation
  - (C) conservation
  - (D) preservation
  - (E) mitigation



30. A barnacle is a sedentary, highly modified crustacean. Barnacles live by using long, feathering appendages to sweep the surrounding water for small, free-floating organisms. The critical resource for barnacles is a place to stay. Barnacles attach to rocks, ships, shells, and whales. If a barnacle attaches itself to the shell of a scallop, the barnacle gains a place to live, and presumably, the scallop is not harmed by the presence of the barnacle. This relationship would be an example of
- (A) mutualism
  - (B) amensalism
  - (C) commensalism
  - (D) parasitism
  - (E) saprotrophism
31. In 1953, Stanley Miller, a graduate student working in the laboratory of Harold Urey, built an apparatus to demonstrate the feasibility of abiotic synthesis. Miller built an apparatus that simulated the presumed conditions of primeval Earth. The conditions included all of the following EXCEPT
- (A) a gaseous phase containing methane, ammonia, water, and hydrogen gas
  - (B) electrical energy provided by spark discharge
  - (C) ambient temperature between 0°C and 100°C
  - (D) sterile conditions (abiotic environment)
  - (E) primitive nitrifying bacteria

**Questions 32–36**

Select from the following locations.

- (A) Bhopal, India
  - (B) Chernobyl, Ukraine
  - (C) Love Canal, New York
  - (D) Minamata Bay, Japan
  - (E) Three Mile Island, Pennsylvania
32. Site of a hazardous chemical dumping ground over which homes and a school were built.
33. Site of mercury poisoning.
34. The most serious commercial nuclear accident in U.S. history.
35. Leakage of poisonous gases from a pesticide manufacturing plant.
36. Nuclear power plant accident that released 30 to 40 times the radiation of the atomic bombs dropped on Hiroshima and Nagasaki.

**Questions 37–39**

Choose the political party that matches the platform most closely.

- (A) Democratic Party
  - (B) Green Party
  - (C) Libertarian Party
  - (D) Natural Law Party
  - (E) Republican Party
37. “Encourage market-based solutions to environmental problems.”
38. “We do not have to choose between economy and environment. Invest in technology and transportation friendly to the Earth. We support grants to Amtrak and the states for improving rail routes. We believe in protecting the coasts and the Arctic National Wildlife Refuge from oil and gas drilling.”
39. “We believe in cushioning farmers from the instability unique to agriculture and enabling farmers to better pursue financial profitability. We believe that reducing global warming will help the economy. We believe in creating new jobs in energy conservation.”
40. The layer of water in a thermally stratified lake that lies below the thermocline, is noncirculating, and remains perpetually cold is called the
- (A) epilimnion
  - (B) hyperlimnion
  - (C) hypolimnion
  - (D) euphotic zone
  - (E) benthic zone
41. India’s family-planning program has yielded disappointing results for all of the following reasons EXCEPT
- (A) poor planning and bureaucratic inefficiency
  - (B) failure to employ sterilization
  - (C) extreme poverty
  - (D) a cultural preference for female children
  - (E) too little administrative and financial support

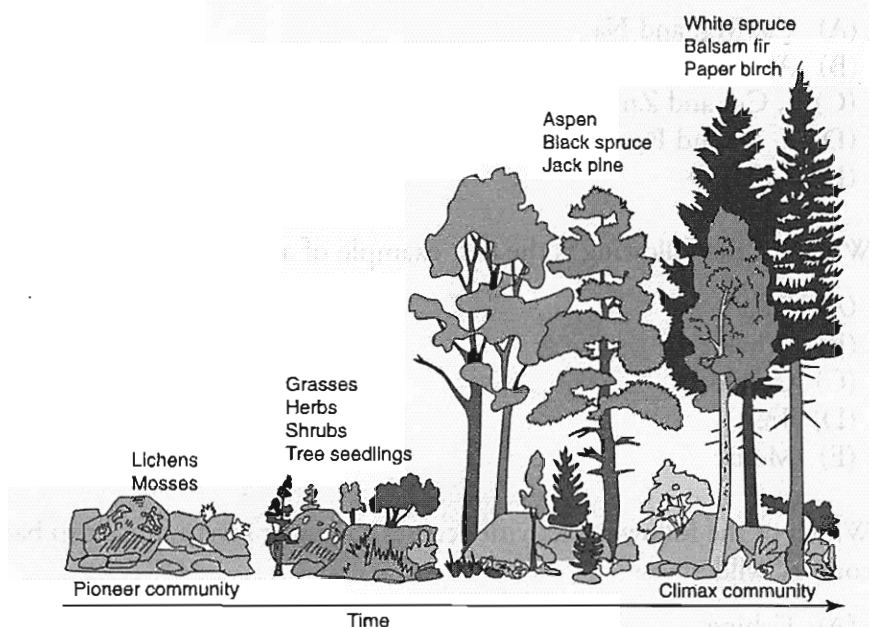
42. Issues of air and water pollution, noise, pesticides, solid waste management, radiation, and hazardous wastes would be the domain of which executive branch office?
- (A) Department of the Interior
  - (B) Department of Health and Human Services
  - (C) Council on Environmental Quality
  - (D) Environmental Protection Agency
  - (E) Office of Management and Budget
43. Which of these threats is NOT one of those that must be decreased to help the survival of the approximately 600 mountain gorillas left in the wild?
- (A) Habitat loss
  - (B) Poaching
  - (C) War
  - (D) Exotic species intrusions
  - (E) Disease
44. The largest user of freshwater worldwide is
- (A) mining
  - (B) irrigation
  - (C) industry
  - (D) home use
  - (E) production of electrical power
45. Choose the statement that is FALSE.
- (A) Domestic fruits and vegetables are less likely to have pesticide residues than imported ones.
  - (B) Cancer may not be the primary risk from chronic, long-term exposure to pesticides.
  - (C) When the EPA looks at a pesticide to decide whether to register it for use in the United States, its primary concern is to ensure that there is no significant human health or environmental risk presented by the chemical.
  - (D) The federal government does not prohibit the use of pesticides known to cause cancer.
  - (E) Washing and peeling fruits and vegetables does not remove all or most pesticide residues.

46. What happens in the market for airline travel when the price of traveling by rail decreases?
- (A) The demand curve shifts left.
  - (B) The demand curve shifts right.
  - (C) The supply curve shifts left.
  - (D) The supply curve shifts right.
  - (E) The supply curve intersects with the demand curve at the equilibrium price.
47. When taking into account only price, supply, and demand, if plotted on a graph, the supply and demand curves
- (A) are parallel lines
  - (B) are parallel lines running horizontally
  - (C) never intersect
  - (D) can run in any direction
  - (E) intersect at a point called market equilibrium
48. Wind power is a measure of the energy available in the wind, and is a function of the cube (third power) of the wind speed. For example, when wind speed is doubled, wind power increases by a factor of eight. About how much more power is produced by a typical wind turbine at 15 mph than at 12 mph?
- (A) About the same
  - (B) About 10% more
  - (C) About 25% more
  - (D) About twice as much
  - (E) About 9 times as much
49. An APES class went on a field trip into a coniferous forest. They discovered a very large section of land that had been completely logged. There were just stumps where large coniferous trees had once stood. There was also very little animal life in the area. Which method of logging had most likely been used in this section of land?
- (A) Strip cutting
  - (B) Clear cutting
  - (C) Seed-tree cutting
  - (D) Shelterwood cutting
  - (E) Selective cutting

50. You have been placed in charge of rebuilding a salmon population in a river basin that contains a hydroelectric dam. Which of the following remediation techniques would NOT be effective?
- (A) Reduce silt runoff
  - (B) Build fish ladders
  - (C) Decrease water flow from the dam
  - (D) Release juvenile salmon from hatcheries
  - (E) Use trucks and barges to transport salmon around the dam
51. Which one of the following proposals would NOT increase the sustainability of ocean fisheries management?
- (A) Establish fishing quotas based on past harvests.
  - (B) Set quotas for fisheries well below their estimated maximum sustainable yields.
  - (C) Sharply reduce fishing subsidies.
  - (D) Shift the burden of proof to the fishing industry to show that their operations are sustainable.
  - (E) Strengthen integrated coastal management programs.
52. What amount of cultivated land is used to produce over 95% of the world's food?
- (A) About 75%
  - (B) Between 50% and 75%
  - (C) About 50%
  - (D) Between 15% and 50%
  - (E) Less than 15%
53. The type of succession that begins in an area where the natural community has been disturbed, removed, or destroyed but in which the bottom soil or sediment remains is known as
- (A) allogenic
  - (B) autogenic
  - (C) primary
  - (D) secondary
  - (E) progressive
54. In general, parasites tend to
- (A) become more virulent as they live within the host
  - (B) destroy the host completely
  - (C) become deactivated as they live within the host
  - (D) be only mildly pathogenic
  - (E) require large amounts of oxygen

55. The population of a country in 1994 was 200 million. Its rate of growth was 1.2%. Assuming that the rate of growth remains unchanged and all other factors remain constant, in what year will the population of the country reach 400 million?
- (A) 2004
  - (B) 2024
  - (C) 2040
  - (D) 2054
  - (E) 2104
56. Humans having a finite capacity to manage nature would be consistent with what principle?
- (A) Precautionary principle
  - (B) Integrative principle
  - (C) Ecological design principle
  - (D) Humility principle
  - (E) Environmental justice principle
57. The circulation of air in Hadley cells results in
- (A) low pressure and rainfall at the equator
  - (B) high pressure and rainfall at the equator
  - (C) low pressure and dry conditions at about 30° north and south of the equator
  - (D) high pressure and wet conditions at about 30° north and south of the equator
  - (E) both (A) and (C)
58. All of the following are characteristics of K-strategists EXCEPT
- (A) mature slowly
  - (B) low juvenile mortality rate
  - (C) niche generalists
  - (D) Type I or II survivorship curve
  - (E) intraspecific competition due to density-dependent limiting factors
59. First levels of defensive behaviors, used by both predators and prey, to avoid detection would include all of the following EXCEPT
- (A) camouflage
  - (B) predator swamping
  - (C) countershading
  - (D) Batesian mimicry
  - (E) masquerading

Question 60 refers to the diagram below.



60. The greatest species diversity would be found in
- the pioneer community represented by the lichens and mosses.
  - the community composed primarily of grasses, herbs, shrubs, and tree seedlings.
  - the community composed primarily of aspen, black spruce, and jack pine.
  - the community composed primarily of white spruce, balsam fir, and paper birch.
  - all communities equally.
61. Which of the following is NOT an example of a chronic condition?
- Asthma
  - Measles
  - Diabetes
  - Cancer
  - Malnutrition
62. Which mobile source pollutant cannot be currently controlled by emission control technology?
- Ozone-forming hydrocarbons
  - Carbon monoxide
  - Carbon dioxide
  - Air toxics
  - Particulate matter

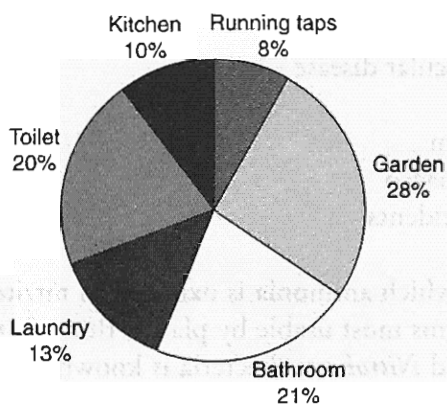
63. Which of the following are examples of trace elements necessary in the human diet?
- (A) Ca, Mg, and Na
  - (B) Al and Fe
  - (C) I, Cu, and Zn
  - (D) S, N, and P
  - (E) C, H, O
64. Which of the following is the best example of an r-selected species?
- (A) Dog
  - (B) Whale
  - (C) Condor
  - (D) Tree
  - (E) Mouse
65. Which of the following activities causes the most severe impact to back-country wilderness?
- (A) Fishing
  - (B) Hiking off trails
  - (C) Littering
  - (D) Building a fire
  - (E) Hunting
66. You are going to buy a soda. You see a vending machine that has sodas in aluminum cans, steel cans, plastic bottles, and glass bottles. Which container has the least environmental impact when recycled?
- (A) Aluminum cans
  - (B) Steel cans
  - (C) Plastic bottles
  - (D) Glass bottles
  - (E) All have the same negative environmental impact
67. The principle stating that in general, all other things being equal, the higher the price of a good, the greater the quantity of that good sellers will offer for sale over a given period of time is known as (the)
- (A) law of supply
  - (B) law of demand
  - (C) law of supply and demand
  - (D) open access
  - (E) neoclassical economics



68. You are a member of a grassroots environmental organization that has successfully lobbied your U.S. congressperson to co-sponsor a bill to create a small wildlife sanctuary for migratory birds on federal land. After your bill was introduced to the Senate, which committee would it likely be referred to for hearings?
- (A) Committee on Agriculture
  - (B) Committee on Energy and Commerce
  - (C) Committee on Resources
  - (D) Committee on Wildlife Conservation
  - (E) Committee on Preservation
69. In 1995, the population of a small island in Malaysia was 40,000. The birthrate was measured at 35 per 1,000 population per year, while the death rate was measured at 10 per 1,000 population per year. Immigration was measured at 100 per year, while emigration was measured at 50 per year. How many people would be on the island after one year?
- (A) 39,100
  - (B) 40,000
  - (C) 41,050
  - (D) 42,150
  - (E) 44,500

Question 70 refers to the diagram below.

Average Usage of Water Around the Home

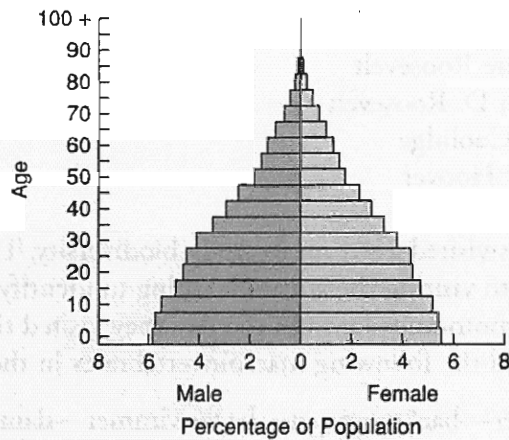


70. According to the information in the graph above, which of the following methods would be the most reasonable and effective means to decrease the amount of domestic water used?
- (A) Install flow-restrictors in faucets and shower heads
  - (B) Wash only full loads of clothes in washing machines
  - (C) Use landscaping that does not require much water combined with drip irrigation
  - (D) Check for leaking faucets
  - (E) Try to use the bathroom less often

71. To evaluate the total impact of a disease by combining premature deaths and disability into data rather than just to quantify the effects or mortality is to use a technique called (a)
- (A) risk extrapolation model
  - (B) comparative risk analysis
  - (C) epidemiology
  - (D) risk-based targeting
  - (E) disability-adjusted life year
72. Clumped spacing patterns of plants are most often associated with
- (A) pockets of resources within the population's range
  - (B) shading and competition for water and minerals
  - (C) the random distribution of seeds
  - (D) antagonistic chemicals secreted by plants that inhibit germination and growth of nearby individuals
  - (E) coincidence
73. Most of the freshwater found on Earth is in the form of
- (A) ice (glaciers, polar ice caps, etc.)
  - (B) rivers and lakes
  - (C) groundwater
  - (D) atmosphere (rain, fog, clouds, vapor, etc.)
  - (E) oceans
74. Among adults, which of the following represents the most preventable cause of death?
- (A) Cardiovascular disease
  - (B) AIDS
  - (C) Alcoholism
  - (D) Use of tobacco
  - (E) Traffic accidents
75. The process in which ammonia is oxidized to nitrite ( $\text{NO}_2^-$ ) and nitrate ( $\text{NO}_3^-$ ), the forms most usable by plants, through the action of *Nitrosomonas* and *Nitrobacter* bacteria is known as
- (A) nitrogen fixation
  - (B) nitrification
  - (C) assimilation
  - (D) ammonification
  - (E) denitrification

76. Which United States president is responsible for creating the National Park System?
- (A) Woodrow Wilson
  - (B) Theodore Roosevelt
  - (C) Franklin D. Roosevelt
  - (D) Calvin Coolidge
  - (E) Herbert Hoover
77. An APES class visited a stream to study biodiversity. The students spent the day prior to visiting the stream learning to identify macroinvertebrates by using a dichotomous key. On the day they visited the stream, one group collected the following macroinvertebrates in the following order:
- backswimmer—backswimmer—backswimmer—damselfly—damselfly—midge—mosquito larvae—mosquito larvae—mayfly—mayfly—mayfly—mayfly—damselfly—backswimmer
- What is the sequential comparison index?
- (A) 0.1
  - (B) 0.25
  - (C) 0.35
  - (D) 0.50
  - (E) 1.0
78. “We can burn coal to produce electricity to operate a refrigerator” is an example of the \_\_\_\_\_ and “If we burn coal to produce electricity to operate a refrigerator, we lose a great deal of energy in the form of heat” is an example of the \_\_\_\_\_
- (A) first law of thermodynamics, first law of thermodynamics
  - (B) second law of thermodynamics, first law of thermodynamics
  - (C) first law of thermodynamics, second law of thermodynamics
  - (D) first law of thermodynamics, third law of thermodynamics
  - (E) third law of thermodynamics, first law of thermodynamics

79. Refer to the following age-structure diagram:



The age-structure diagram above would be typical for what country?

- (A) United States
- (B) Canada
- (C) Mexico
- (D) Germany
- (E) Japan

80. The largest earthquake in the 20th century occurred

- (A) off the coast of Alaska
- (B) off the coast of Japan
- (C) off the coast of South America
- (D) off the coast of California
- (E) in Missouri

81. Butterflies and moths both feed on flowers. Butterflies feed during the day, and moths feed at night. This is an example of

- (A) r-strategy
- (B) K-strategy
- (C) resource partitioning
- (D) commensalism
- (E) mutualism

82. It costs a copper smelter \$200 to reduce its emissions by 1 ton and \$250 for an additional ton. It costs an electric utility \$100 to reduce its emissions by 1 ton and \$150 for an additional ton. What is the cheapest way of reducing total emissions by 2 tons?
- (A) Legislate that each firm must reduce emissions by two tons.
  - (B) Charge both firms \$251 for every ton they emit.
  - (C) Allow each firm to buy a permit to pollute that costs \$151.
  - (D) File an injunction to halt production until the firms reduce emissions by 2 tons.
  - (E) None of the above is correct.
83. An APES class was investigating the estimation of population size. To measure the population density of monarch butterflies occupying a particular park, 100 butterflies were captured, marked with a small dot on a wing, and then released. The next day, another 100 butterflies were captured, including the recapture of 20 marked butterflies. One would correctly estimate the population to be
- (A) 100
  - (B) 200
  - (C) 500
  - (D) 2,000
  - (E) 20,000
84. In the eastern United States, water use law is based on the legal principle of
- (A) prior appropriation
  - (B) private property rights
  - (C) common property rights
  - (D) public property rights
  - (E) riparian rights

85. Demographic transition leads to stabilizing population growth and is generally characterized as having four separate stages. Place the following stages in the proper order as they would most likely occur.
- I. Birthrates equal mortality rates, and zero population growth is achieved. Birthrates and death rates are both relatively low, and the standard of living is much higher than during the earlier periods. In some countries, birthrates may actually fall below mortality rates and result in net losses in population.
  - II. Living conditions are severe, medical care is poor or nonexistent, and the food supply is limited due to poor agricultural techniques, poor preservation, and pestilence. Birthrates are high to replace individuals lost through high mortality rates. The net result is little population growth.
  - III. Urbanization decreases the economic incentives for large families. The cost of supporting an urban family grows, and parents are more actively discouraged from having large families. Educational and work opportunities for women decrease birth rates. Obtaining food is not a major focus of the day. Leisure time is available, and retirement safety nets are in place, reducing the need for extra children to support parents. In response to these economic pressures, the birthrate starts to drop, ultimately coming close to the death rate.
  - IV. Occurs after the start of industrialization. Standards of hygiene and more modern medical techniques begin to drive the death rate down, leading to a significant upward trend in population size. Mortality rates drop as a result of advances in medical care, improved sanitation, cleaner water supplies, vaccination, and higher levels of education. The net result is a rapid increase in population.
- (A) I, II, III, IV  
(B) IV, III, II, I  
(C) I, IV, II, III  
(D) II, IV, III, I  
(E) III, I, II, IV
86. The concentration of which gas can be reduced by preventing forest depletion?
- (A) Carbon dioxide  
(B) Nitrous oxide  
(C) Oxygen  
(D) Methane  
(E) CFCs

87. Environmental lawsuits are limited in results for all of the following reasons EXCEPT
- (A) the plaintiff must be directly harmed by an action or lack thereof
  - (B) corporations may deduct their legal expenses from their federal taxes, whereas public interest lawyers cannot usually recover any fees or tax write-offs
  - (C) it is usually not difficult to prove that the defendant is liable and responsible for harmful environmental action
  - (D) the courts may take years to come to a decision and appeals may be submitted to higher courts
  - (E) bringing a suit is expensive
88. After a recent storm, an APES class took a field trip to a storm drain outlet entering the Pacific Ocean at Ballona Creek, in southern California. They carefully collected water samples and brought the samples back to the lab. Alpha group took 100.00 mL of the collected water and filtered it through a 1.2  $\mu\text{m}$  Millipore glass fiber filter. The filter was carefully transferred to a premassed stainless steel crucible and placed into a 105°C oven for 24 hours. The following is a hypothetical set of data from alpha group:

Weight of crucible + filter + residue after 24 hrs at 105°C = 100.000g

Weight of crucible + filter = 80.000g

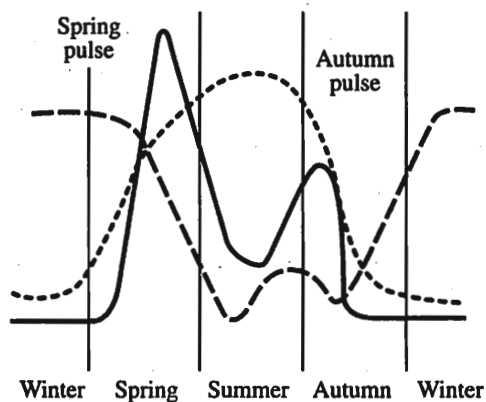
What is the total suspended solid amount measured in  $\text{mg} \cdot \text{L}^{-1}$ ?

- (A)  $(80.000/100.00) \times 100\%$
- (B)  $100.00 - 80.00$
- (C)  $\frac{(100.00 - 80.00) \times 1,000 \times 1,000}{100.00}$
- (D)  $\frac{(100.00 - 80.00) \times 1,000}{100}$
- (E)  $\frac{(100.00 + 80.00) \times 100}{1,000}$

89. Which of the following is NOT an adaptation of the barn owl that allows it to be a successful predator?
- (A) Eyes that point forward
  - (B) Excellent vision and hearing
  - (C) Long toes with curved talons
  - (D) Excellent sense of smell
  - (E) Ability to fly almost silently

### Questions 90–93

Diatoms are one-celled, microscopic plants and are distributed throughout the world in aquatic, semiaquatic, and moist habitats. They are found in the sea, estuaries, freshwater lakes, ponds, streams, and ditches. Though individual diatoms are microscopic, masses of diatoms can often be seen on stream bottoms, along the surf zones, and during plankton blooms as brownish-colored waters or films. Base your answers to questions 90–93 on the figure below, dealing with the seasonal fluctuations in the abundance of diatoms in the North Atlantic (solid black line—diatoms; dotted line—light intensity; dashed line—nitrates and phosphates):



90. Which factor probably contributes to the summer decline of diatoms?
- (A) Decreased concentration of nitrates and phosphates
  - (B) Increased concentration of nitrates and phosphates
  - (C) Increased intensity of light
  - (D) Decreased intensity of light
  - (E) Increase of temperature
91. Which is probably the principal source of nitrates and phosphates?
- (A) The water cycle
  - (B) Nitrogen fixation of lightning
  - (C) Bacterial decay
  - (D) Changes in environmental temperature
  - (E) Changes in light intensity



92. A probable reason why the autumn pulse is not as great as the spring pulse is that
- (A) diatoms undergo metamorphosis in the autumn
  - (B) temperature and light intensity decrease in the autumn
  - (C) carnivorous animals increase in the autumn
  - (D) the diatoms of the spring have used most of the proteins from the environment
  - (E) bacteria of decay increase in the autumn
93. The low level of the diatom population in winter results partially from the fact that
- (A) low temperature slows down metabolism
  - (B) photosynthesis occurs only in summer
  - (C) diatoms live in water
  - (D) diatoms migrate to warm climates during the winter
  - (E) in winter, there is a decrease in available nitrates and phosphates
94. What pulls warm Atlantic water north in the summer?
- (A) La Niña
  - (B) Convection
  - (C) El Niño
  - (D) Coriolis effect
  - (E) Gulf Stream
95. Harmful effects of increased UV radiation on Earth's surface include all of the following EXCEPT
- (A) reduction in crop production
  - (B) reduction in the growth of phytoplankton and its cumulative effect on food webs
  - (C) cooling of the stratosphere
  - (D) warming of the stratosphere
  - (E) increases in sunburns and damage to the skin
96. Which greenhouse gas has the most negative chemical properties with respect to global warming?
- (A)  $\text{CO}_2$
  - (B) CFCs
  - (C)  $\text{SF}_6$
  - (D)  $\text{N}_2\text{O}$
  - (E)  $\text{H}_2\text{O}$

97. Which of the following indoor pollutants would NOT be contributed by carpeting?
- (A) Formaldehyde
  - (B) Styrene
  - (C) Mold
  - (D) Methylene chloride
  - (E) Mites
98. A woman reading a book of poems turned a page, causing a tiny air current to slip out the open window, nudging a passing breeze. That breeze in turn nudged another breeze and eventually was the cause of a tornado in the next state. This series of conceptual events is referred to as
- (A) the Gaia hypothesis
  - (B) the butterfly effect
  - (C) chaos
  - (D) law of common cause
  - (E) natural sequencing
99. All of the following are correct statements about the regulation of populations EXCEPT
- (A) a logistic equation reflects the effect of density-dependent factors, which can ultimately stabilize a population around the carrying capacity
  - (B) density-independent factors have a greater effect as a population's density increases
  - (C) high densities in a population may cause physiological changes that inhibit reproduction
  - (D) because of the overlapping nature of population-regulating factors, it is often difficult to determine their cause-and-effect relationships precisely
  - (E) the occurrence of population cycles in some populations may be the result of crowding or lag times in the response to density-dependent factors
100. Which of the following energy sources has the lowest quality?
- (A) High-velocity water flow
  - (B) Fuelwood
  - (C) Food
  - (D) Dispersed geothermal energy
  - (E) Saudi Arabian oil deposits