PRACTICE TEST 1

ENVIRONMENTAL SCIENCE
Section I: Multiple-Choice Questions
Time: 1 hour and 30 minutes
Number of Questions: 100

Part A

Directions: Each set of choices below, labeled A through E, will refer to a question or statement directly following the lettered choices. The questions or statements may also refer to a diagram or graph. Each lettered answer may be used more than once, only once, or not at all. Choose the one lettered choice you feel best answers the question or statement above.

Questions 1–4 refer to the map below.

1. This country has the second largest population on earth.
2. Orangutans are endangered here due to the destruction of their habitat.
3. This country has undergone the most complete demographic transition.
4. The first national park system was established in this country.

Questions 5–8 refer to the numbers listed below.

(A) 1
(B) 10
(C) 100
(D) 1,000
(E) 1,000,000

5. The minimum number of half-lives that must pass before radioactive waste is reduced by a factor of 1,000.
6. The concentration in ppb of a 1 ppm solution.
7. The approximate number of Fahrenheit degrees the earth has warmed in the past 100 years.
8. The factor by which rainfall with a pH of 4.6 is more acidic than rainfall with a pH of 5.6.

GO ON TO NEXT PAGE

Questions 9–12 refer to the national parks listed below.

(A) Everglades National Park
(B) Yellowstone National Park
(C) Grand Canyon National Park
(D) Yosemite National Park
(E) Great Smoky Mountains National Park

9. The most visited U.S. National Park, also known for the Appalachian Trail and the mist that hangs over its mountains and valleys.

10. Burmese pythons are an invasive species whose population is growing rapidly in this park.

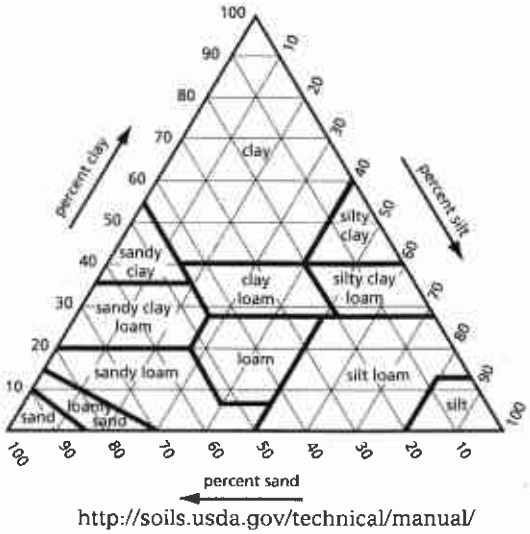
11. The proposed site of a dam that was famously blocked by the Sierra Club in the 1960s.

12. Gray wolves were reintroduced to this park in 1995.

Part B

Directions: Five answer choices, lettered A through E, will follow each one of the following questions or incomplete statements below. The questions or statements may refer to a graph, diagram, or table. Choose the one answer that best fits each question or completes the statement.

13. A diet deficient in this nutrient may lead to goiter.
(A) iodine
(B) iron
(C) protein
(D) vitamin D
(E) vitamin A



http://soils.usda.gov/technical/manual/print_version/chapter3.html

14. It is determined that a soil sample is composed of 27% silt, 45% clay, and 28% sand. According to the soil triangle, which of the following is the soil texture of the soil?
(A) Silty clay loam
(B) Silt loam
(C) Clay
(D) Sandy loam
(E) Loamy sand

15. A disadvantage of liquefied natural gas is that it
(A) must be stored and transported at high temperatures
(B) produces more carbon dioxide than most other fossil fuels
(C) cannot be used in conventional power plants
(D) must be stored and transported at high pressure
(E) is less efficient than most other fossil fuels

16. Which of the following has the lowest average net primary productivity?
(A) Swamps
(B) Savanna
(C) Tropical forest
(D) Tundra
(E) Coniferous forest

17. Ranges of active volcanoes are often abundant near
(A) convergent plate boundaries
(B) coastal estuaries
(C) divergent plate boundaries
(D) sub-bituminous coal deposits
(E) transform faults

18. The largest proven reserves of oil are located in
(A) the North Sea
(B) the Gulf of Mexico
(C) South America
(D) the Middle East
(E) Alaska

19. The pH of precipitation in the United States is highest in the
(A) southwest and lowest in the northwest
(B) southeast and lowest in the northeast
(C) southeast and lowest in the northwest
(D) southwest and lowest in the northeast
(E) northeast and lowest in the southwest

20. The active ingredient in most solar cells is
(A) iron
(B) silicon
(C) aluminum
(D) platinum
(E) oxygen

21. To most effectively capture solar energy in the United States, solar panels should be placed so that they face
(A) northwest
(B) north
(C) northeast
(D) west
(E) south

22. Bycatch refers to which of the following?
(A) a filtering method for removing particulates from coal smoke
(B) near-shore trawling for shellfish
(C) organisms that are unintentionally caught while fishing
(D) the harvesting of fish in Arctic seas
(E) the harvesting of fish in tropical seas

23. Which of the following is least vulnerable to biomagnification?
(A) Bald eagle
(B) Human
(C) Bottlenose dolphin
(D) Moose
(E) Bluefin tuna

24. The population of a country is 6 million in 2010 and growing at a rate of 1.4% each year. If the rate of population growth remains constant, the population will reach 24 million in
(A) 2045
(B) 2050
(C) 2060
(D) 2080
(E) 3010

25. Of the following, the factor that is most directly responsible for the growth of the human population in the past 100 years is
(A) increased numbers of women working outside the home
(B) improved birth control methods
(C) improved medical care and sanitation
(D) increased urbanization
(E) increased immigration

26. In the troposphere, oxygen is found primarily as ____, while nitrogen is found primarily as ____.
(A) O_3; N_2
(B) O_2; NO_2
(C) O; NO_2
(D) O_2; NH_3
(E) O_2; N_2

GO ON TO NEXT PAGE

27. Which of the following is used to determine soil texture?
(A) The water content
(B) The decomposition rate of organic material
(C) The relative proportions of different particle sizes
(D) The mineral composition
(E) The dominant type of humus

28. Which of the following is true of oligotrophic lakes?
(A) They have high nutrient levels and low productivity.
(B) They have low nutrient levels and low productivity.
(C) They have high nutrient levels and high productivity.
(D) They have low nutrient levels and high productivity.
(E) They have unpredictable nutrient levels and productivity.

29. Which of the following is true of estuaries?
(A) The temperature and salinity change little during the day.
(B) The temperature remains fairly constant during the day, but the salinity varies.
(C) The temperature varies during the day, but the salinity remains fairly constant.
(D) The temperature and salinity vary during the day.
(E) The temperature remains fairly constant and they have no measurable salinity.

30. Which of the following is true of modern intensive farming practices?
(A) They result in little or no change in species diversity.
(B) They result in a sharp increase followed by a slow, steady decrease in species diversity.
(C) They result in an increase in species diversity.
(D) They result in a decrease in species diversity.
(E) They result in unpredictable changes in species diversity.

31. Consider the following food chain:

Switch grass → Grasshopper → Western fence lizard → Red-tailed hawk

If each species feeds exclusively on this food chain, which of the following is most likely required to support a 1-kg hawk?
(A) 10,000 kg of grass
(B) 100 kg of grasshoppers
(C) 1 kg of lizards
(D) 1,000 kg of lizards
(E) 100 kg of grass

32. Which of the following is a density-independent population control factor?
(A) Predation
(B) Disease
(C) Habitat destruction
(D) Parasitism
(E) Competition

33. Primary succession occurs before secondary succession to
(A) establish soil in the area
(B) introduce early successional plants and animals
(C) decompose fire-damaged vegetation
(D) increase nutrient levels in the soil
(E) provide moisture for the soil

34. Which of the following practices is most damaging to species of coral?
(A) Pelagic whaling
(B) Long-line fishing
(C) Purse-seine fishing
(D) Deep-sea aquaculture cages
(E) Bottom trawling

35. Which of the following possesses the highest energy content?
(A) Anthracite coal
(B) Lignite
(C) Bituminous coal
(D) Biomass
(E) Peat

36. The treaty that cut emissions of ozone-depleting compounds was signed in
(A) Kyoto, Japan
(B) Stockholm, Sweden
(C) Montreal, Canada
(D) Kona, Hawaii
(E) Rio de Janeiro, Brazil

37. Which of the following is true about the Antarctic ozone "hole"?
(A) It is about the same area all year and it rotates clockwise around the South Pole.
(B) It is about the same area all year and it rotates counterclockwise around the South Pole.
(C) It appears and disappears without warning and with no discernible pattern.
(D) It is at its peak area during the Antarctic spring.
(E) It is at its peak area during the Antarctic winter.

38. Of the following, the factors that best explain why the earth has seasons are
(A) the tilt of the earth's axis and the rotation of the earth around its axis
(B) the distance of the earth from the sun and the rotation of the earth around its axis
(C) the tilt of the earth's axis and the distance of the earth from the sun
(D) the orbit of the earth around the sun and the rotation of the earth around its axis
(E) the tilt of the earth's axis and the orbit of the earth around the sun

39. The thawing of permafrost will most likely result in
(A) additional water vapor in the atmosphere
(B) less water vapor in the atmosphere
(C) additional nitrogen oxides in the atmosphere
(D) additional sulfur oxides in the atmosphere
(E) additional methane in the atmosphere

40. Which of the following is a significant indoor air pollutant?
(A) Sulfur dioxide
(B) Formaldehyde
(C) Dieldrin
(D) Malathion
(E) Dioxin

41. Which of the following is NOT identified by the EPA as one of its six criteria air pollutants?
(A) Particulate matter
(B) PANs
(C) Lead
(D) Ozone
(E) Carbon monoxide

42. The air temperature increases with altitude, due to the destruction of ozone by ultraviolet light in the
(A) stratosphere
(B) lithosphere
(C) aethenosphere
(D) troposphere
(E) mesosphere

43. Which of the following is the most likely to lead to acid rain?
(A) The release of carbon dioxide from a coal-fired power plant
(B) The release of carbon monoxide from automobiles
(C) The release of sulfur dioxide from a coal-fired power plant
(D) The release of methane from a cattle feedlot
(E) The release of particulates from a coal-fired power plant

44. A company pollutes a river, rationalizing that they will release a small quantity of pollutants that will quickly be diluted and have little effect on the water quality of the river. This best illustrates a
(A) synergistic interaction
(B) negative feedback
(C) positive feedback
(D) tragedy of the commons
(E) carcinogenic effect

GO ON TO NEXT PAGE

45. Which of the following is NOT a mechanism that is employed by plants to defend themselves against predators?
(A) Foul-smelling chemicals
(B) Clumping
(C) Thorns
(D) Toxic chemicals
(E) Thick bark

46. This law enables corporations to acquire large tracts of public land at far below market prices.
(A) the Endangered Species Act
(B) the General Mining Law
(C) the Lacey Act
(D) the Clean Air Act
(E) the Surface Mining Control and Reclamation Act

47. Which of the following is the natural source of ozone in the stratosphere?
(A) Photochemical reactions
(B) Combustion of fossil fuels
(C) Volcanic eruptions
(D) The spontaneous decay of diatomic oxygen
(E) Solar winds

48. The phosphorus and nitrogen concentration found in groundwater most likely would be greatest beneath
(A) undisturbed forest land
(B) an animal feedlot
(C) a coal-fired power plant
(D) an automobile salvage facility
(E) a petroleum refinery

49. Mountaintop removal is associated with which of the following?
(A) Geothermal energy
(B) Rice cultivation
(C) Coal mining
(D) Irrigation
(E) Hog farming

50. The _____ is an endangered species; the _____ is an invasive species; and the _____ is an extinct species.
(A) passenger pigeon; American alligator; dodo
(B) giant panda; Zebra mussel; California condor
(C) whooping crane; Africanized honeybee; passenger pigeon
(D) African black rhinoceros; dodo; Africanized honeybee
(E) giraffe; gypsy moth; blue whale

51. Catalytic converters remove which of the following from automobile exhaust?
I. Carbon monoxide
II. Carbon dioxide
III. Nitrogen dioxide

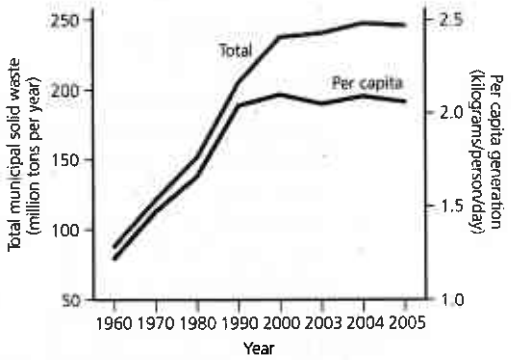
(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

52. A 2,000-watt electric space heater was used for 3 hours and 30 minutes. How much energy did the heater use?
(A) 2,000 W
(B) 7,000 kWh
(C) 7 kWh
(D) 2 kW
(E) 6,500 kWh

53. A Dobson unit measures the concentration of which of the following substances?
(A) CFCs
(B) Phosphorus
(C) UV-B radiation
(D) Ozone
(E) Carbon dioxide

54. Which of the following species is the best suited to be a successful invasive species?
(A) Giant panda
(B) Clownfish
(C) Emperor penguin
(D) American cockroach
(E) Adonis blue butterfly

Questions 55–57 refer to total and per capita U.S. production of municipal solid waste as shown in the graph below.



55. Use the graph to determine the total quantity of solid waste the average person in the United States generated during the 2005 calendar year. The amount is nearest
(A) 2 kg
(B) 200 kg
(C) 350 kg
(D) 750 kg
(E) 2,000 kg

56. The percent changes in total solid waste during the time periods 1980–1990 and 2000–2005 is nearest
(A) 1000% and 0%
(B) 3% and 25%
(C) 50% and 5%
(D) 30% and 2%
(E) 100% and 0%

57. Which of the following best explains the trend in solid waste production between 1980 and 2005?
(A) Additional consumption leading to more waste production
(B) Increased awareness of air pollution problems associated with incineration that led to more waste being diverted to landfills
(C) Increased recycling including curbside pickup of mixed recyclables
(D) Additional export of solid waste to developing countries
(E) Decreased consumption resulting in less production of consumables

58. Which of the following occurs during an ENSO event?
(A) The north to south Arctic winds reverse directions.
(B) Upwelling of warm nutrient-rich water in the South Pacific.
(C) The east to west Pacific trade winds strengthen.
(D) The east to west Pacific trade winds reverse directions.
(E) Upwelling of cold nutrient-rich water off the west coast of South America.

59. As glacial ice melts, it exposes soil that absorbs more energy than ice, which causes it to get warmer, which melts more ice, exposing more soil, and so on. This is an example of
(A) a tragedy of the commons
(B) a point source of pollution
(C) a negative feedback loop
(D) a positive feedback loop
(E) secondary succession

60. Well water is often contaminated with which naturally occurring element?
(A) Mercury
(B) MTBE
(C) Lead
(D) Arsenic
(E) DDT

GO ON TO NEXT PAGE

61. Which of the following is true of the production of ammonium nitrate fertilizer?
(A) It artificially completes the assimilation step of the nitrogen cycle and requires large inputs of fossil fuels.
(B) It artificially completes the denitrification step of the nitrogen cycle and requires large input of fossil fuels.
(C) It artificially completes the denitrification step of the nitrogen cycle and requires small inputs of fossil fuels.
(D) It artificially completes the fixation step of the nitrogen cycle and requires small inputs of fossil fuels.
(E) It artificially completes the fixation step of the nitrogen cycle and requires large inputs of fossil fuels.

62. Which of the following is an example of a brownfield?
(A) The silted floodplains following a flood
(B) An abandoned oil refinery
(C) Abandoned farmland
(D) The remains after a devastating forest fire
(E) Recently harvested farmland

63. Which of the following is most likely to increase mutations in oceanic phytoplankton populations?
(A) An increase in stratospheric ozone concentrations
(B) A decrease in stratospheric ozone concentrations
(C) An increase in tropospheric ozone concentrations
(D) A decrease in tropospheric ozone concentrations
(E) Atmospheric ozone concentrations do not affect oceanic phytoplankton populations

64. Which of the following is necessary to calculate the net primary productivity of an ecosystem?
(A) The amount of energy produced by photosynthesis and lost by plant respiration per unit area per unit time
(B) The amount of energy produced by photosynthesis and gained by heterotrophs per unit area per unit time
(C) The amount of energy gained by heterotrophs and lost by heterotrophic respiration per unit area per unit time
(D) The amount of energy gained by heterotrophs and lost by plant respiration per unit area per unit time
(E) The amount of energy lost by plant respiration and lost by heterotrophic respiration per unit area per unit time

65. Consider the following population data, and determine the values of X, Y, and Z.

Country	Crude Birth Rate	Crude Death Rate	Population Growth Rate
Country A	45	26	X%
Country B	12	Y	0.3%
Country C	Z	11	1.1%

(A) X = 19; Y = 11.7; Z = 12.1
(B) X = 19; Y = 9; Z = 22
(C) X = 9.5; Y = 5.85; Z = 6.05
(D) X = 1.9; Y = 9; Z = 22
(E) X = 1.9; Y = 12.3; Z = 12.1

66. Which of the following removes nitrogen from the atmosphere?
(A) Fertilizer production
(B) Decomposition
(C) Forest fires
(D) Denitrification
(E) Burning coal

67. Which of the following areas would most likely have the highest biodiversity?
(A) A low altitude area near the equator
(B) A low altitude area at a polar latitude
(C) A high altitude area at a temperate latitude
(D) A high altitude area near the equator
(E) A high altitude area at a polar latitude

68. The size and isolation of an island will have the greatest effect on its
(A) elevation
(B) average temperature
(C) climate
(D) species diversity
(E) albedo

69. Consider the following: a red-billed oxpecker picks ticks off a black rhinoceros. The relationships between i) the oxpecker and the ticks; ii) the oxpecker and the rhinoceros; and iii) the ticks and the rhinoceros are best described as
(A) i) parasitism; ii) competition; and iii) commensalism
(B) i) predation; ii) mutualism; and iii) commensalism
(C) i) predation; ii) mutualism; and iii) parasitism
(D) i) commensalism; ii) parasitism; and iii) parasitism
(E) i) competition; ii) commensalism; and iii) parasitism

70. Which of the following would lead to a species' adapting quickly to environmental change?
(A) A role as a keystone species
(B) Short generational time periods
(C) A long life expectancy
(D) Bearing few offspring
(E) Reproducing late in life

71. Which of the following infectious diseases is not directly transmitted from human to human?
(A) Influenza
(B) Tuberculosis
(C) Measles
(D) Malaria
(E) HIV/AIDS

72. Which of the following is true of a 60-watt incandescent light bulb with an efficiency of 5%?
(A) It produces about 5 joules of light and 55 joules of heat per hour.
(B) It produces about 3 joules of light and 57 joules of heat per hour.
(C) It produces about 3 joules of light and 57 joules of heat per second.
(D) It produces about 5 joules of light and 55 joules of heat per minute.
(E) It produces about 3 joules of light and 57 joules of heat per minute.

73. To feed the world's population an adequate diet, the total number of calories needed per day is nearest
(A) 7 billion
(B) 21 billion
(C) 700 billion
(D) 14 trillion
(E) 70 trillion

74. In a river, which of the following will most likely occur downstream as a result of the effluent discharge of a primary sewage treatment facility?
(A) An increase in the dissolved oxygen concentration of the river's water
(B) An increase in the biological oxygen demand of the river's water
(C) A decrease in the turbidity of the river's water
(D) A decrease in the pH of the river's water
(E) No change in the quality of the river's water

GO ON TO NEXT PAGE

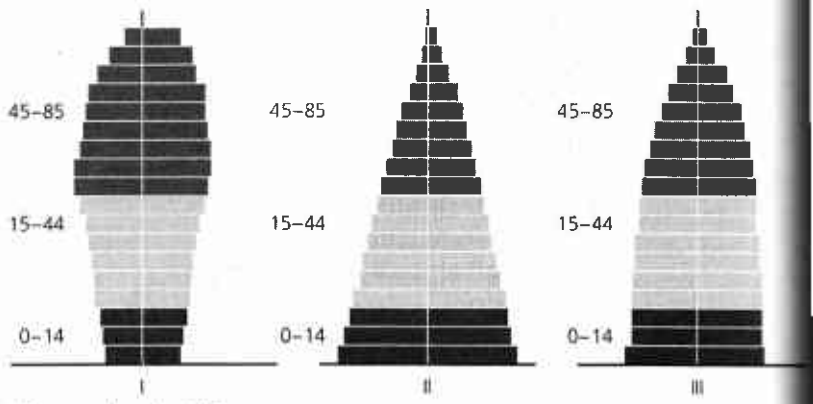
75. If the relative humidity is 30%, the air temperature is 60°F, and the air temperature rises to 90°F without any additional moisture entering the atmosphere, which of the following is most likely?
(A) The relative humidity will remain at 30%.
(B) The relative humidity will increase and rain is unlikely.
(C) The relative humidity will decrease and rain is unlikely.
(D) The relative humidity will increase and it may rain.
(E) The relative humidity will decrease and it may rain.

76. Replacement-level fertility in a developed nation is likely to be nearest
(A) 1.4
(B) 2.1
(C) 2.5
(D) 2.9
(E) 3.5

77. Which of the following is removed by scrubbers installed in smokestacks?
(A) Sulfur dioxide
(B) Carbon dioxide
(C) Lead
(D) Carbon monoxide
(E) Mercury

78. Which of the following is NOT an ecosystem service?
(A) Pollination
(B) Ozone depletion
(C) Water purification
(D) Nitrogen fixation
(E) Soil formation

79. The LD-50s of five chemicals are listed below. Which is the most toxic?
(A) 5 mg/kg body weight
(B) 500 mg/kg body weight
(C) 5 g/kg body weight
(D) 50 g/kg body weight
(E) 500 g/kg body weight



© Cengage Learning 2015

80. Arrange in order from fastest to slowest the population growth rate of the countries represented by the age-structure diagrams above.
(A) I, II, III
(B) I, III, II
(C) II, I, III
(D) II, III, I
(E) III, II, I

Questions 81–83 refer to the situation described below.

The citizens of Fremont notice that one area of Lake Fremont has fewer fish than other areas. The decreased fish population is near a power plant where lake water at 65°F is pumped out of the lake to cool equipment, and returned at 75°F. An experiment was conducted in which water from the lake was collected along with fish and divided equally into several large experimental aquariums. Each aquarium was maintained at a different temperature between 67°F and 76°F. The mortality rate of the fish population in each aquarium was monitored for several weeks. The fish were found to survive at the highest rate in the aquarium with 67°F water and at the lowest rate in the 76°F water.

81. The dependent variable in the experiment was
(A) the water temperature
(B) the species of fish
(C) the mortality rate of the fish
(D) the lake water
(E) the latitude of Lake Fremont

82. The independent variable in the experiment was
(A) the water temperature
(B) the species of fish
(C) the mortality rate of the fish
(D) the lake water
(E) the latitude of Lake Fremont

83. Of those listed below, the most plausible explanation for the experimental results is
(A) the biological oxygen demand in the water
(B) the dissolved oxygen concentration in the water
(C) pollutants washed off from the power plant equipment
(D) air pollutants mixing with lake water
(E) the pH of the water

84. A city with a population of 300,000 uses 8 million Btu of energy each day. The yearly per capita energy consumption in the city is nearest
(A) 10 thousand Btu
(B) 1 million Btu
(C) 10 million Btu
(D) 1 billion Btu
(E) 10 billion Btu

85. Which of the following has the greatest permeability?
(A) Silt
(B) Sand
(C) Humus
(D) Loam
(E) Clay

86. Which of the following is a major cause of cultural eutrophication?
(A) Global warming
(B) Pesticide runoff
(C) Organic waste
(D) Burning coal
(E) Fertilizer runoff

87. In general, what percentage of energy is transferred from one trophic level to the next?
(A) 0.1%
(B) 1%
(C) 3%
(D) 5%
(E) 10%

88. The worst nuclear accident in history occurred in which of the following locations?
(A) Love Canal, New York
(B) Valdez, Alaska
(C) Minamata, Japan
(D) Three Mile Island, Pennsylvania
(E) Chernobyl, Ukraine

89. Which of the following is most similar to overfishing?
(A) Mountaintop removal
(B) Malnutrition
(C) Slash-and-burn agriculture
(D) Overgrazing on public lands
(E) Water diversion

90. Which of the following species is extinct because of overhunting?
(A) Bald eagle
(B) Blue whale
(C) Passenger pigeon
(D) Whooping crane
(E) Orangutan

91. The most common form of renewable energy used by citizens of developing countries is
(A) solar
(B) coal
(C) wind
(D) biomass
(E) geothermal

92. Which of the following biomes is best suited for modern intensive agriculture?
(A) Chaparral
(B) Temperate grassland
(C) Deciduous forest
(D) Tundra
(E) Coniferous forest

GO ON TO NEXT PAGE

93. Which of the following occurs at an oil refinery?
(A) Crude oil is separated into its components using their densities.
(B) Crude oil is filtered to remove impurities and the filtrate is converted to gasoline.
(C) Crude oil is burned to produce gasoline.
(D) Crude oil is separated into its components using their boiling points.
(E) Crude oil is separated into its components using their water solubility.

94. Which of the following decreases the amount of carbon dioxide in the troposphere?
(A) Combustion
(B) Decomposition
(C) Respiration
(D) Photosynthesis
(E) Volcanic eruptions

95. Which of the following countries relies on geothermal energy to provide a large portion of its energy?
(A) Iceland
(B) India
(C) Canada
(D) Spain
(E) Ireland

96. Rachel Carson is to DDT as
(A) Leopold and Muir are to carbon dioxide
(B) Pinchot is to water
(C) Roland and Molina are to CFCs
(D) Hardin is to fisheries
(E) Carter is to OPEC

97. Which of the following is/are used to disinfect municipal water supplies?
I. Fluorine
II. Ozone
III. Chlorine

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) II and III only

98. If the population of the United States grows by 1% next year, the number of people who will be added to the population is nearest
(A) 500 thousand
(B) 1 million
(C) 2 million
(D) 3 million
(E) 5 million

99. Which of the following is a feature of no-till agriculture?
(A) Pesticides are allowed to naturally degrade after being applied.
(B) No crop rotation takes place.
(C) No artificial pesticides are used.
(D) Trees are planted around fields to reduce wind erosion.
(E) The land is not plowed.

100. The diversion of water from rivers that flow into a lake that has no outlet to the sea will increase the
(A) volume of water in the lake
(B) available bird habitat around the lake
(C) recreational value of the lake
(D) water quality of the lake
(E) salinity of the lake

Section II: Free-Response Questions
Time: 1 Hour and 30 Minutes
Number of Questions: 4

Section II of the AP Environmental Science Exam counts for 40% of the total test grade. You will have four essay questions, each involving several parts. Calculators may not be used on the free-response section.

1. Read the following excerpt from a press release from the U.S. Environmental Protection Agency, and answer the questions that follow.

U.S. EPA PROPOSES PLAN TO ADDRESS CONTAMINATED FISH

SAN FRANCISCO – The U.S. Environmental Protection Agency today proposed a three-prong strategy to prevent people from consuming fish containing high levels of DDT and PCBs found in contaminated ocean sediments off the Palos Verdes peninsula.

"This is the largest DDT contamination site in the country," said EPA's regional Superfund division director. "The first step to protect public health is to make sure people aren't eating white croaker contaminated with dangerous levels of DDT."

The EPA plan recommends three short-term actions: increasing enforcement of the commercial fishing ban and recreational catch limit for white croaker along the Palos Verdes coast, educating people about fish consumption advisories, and monitoring contaminant levels in commercially sold fish to evaluate the effectiveness of enforcement measures.

For the past several years, the EPA has been investigating the 100 tons of DDT and 10 tons of PCBs that remain in ocean sediments on the Palos Verdes shelf. In ocean waters there, DDT concentrations have been recently measured at levels nearly 100 times greater than the California Ocean Plan objectives for the protection of human health.

In addition to the proposed plan released today, the EPA is continuing to evaluate capping a portion of the ocean floor with a layer of clean sediment. The cap would isolate the contaminants, reducing the amount of DDT and PCBs that flow from the deposit into ocean waters. The EPA will conduct a pilot-capping project later this year to help the agency refine cost estimates and determine the most effective cap placement methods.

http://osemite.epa.gov/opa/admpress.nsf/905a0f1800315fd385257359003d4808/b1cb7c1dd65de2fd852570d8005e13a6!OpenDocument

(a) Identify ONE use for DDT and ONE use for PCBs.
(b) Identify a specific species that is not identified in the press release that has been affected by the use of DDT and discuss how DDT affected the population of that species.
(c) The solution to the DDT/PCB problem off the Palos Verdes Peninsula has been to wait for the chemicals to break down into less harmful chemical by-products. Write an argument in support of this solution and write an argument opposed to this solution.

Another problem off the Palos Verdes Peninsula is elevated mercury levels in fish.

(d) Explain why mercury levels are higher in bigger, older fish than they are in smaller, younger fish or fish lower on the food chain.

GO ON TO NEXT PAGE

2. The population of Fremont is 150,000 and the average daily per capita production of wastewater is 50 gallons. The city is planning to build a new wastewater treatment facility that incorporates primary, secondary, and tertiary treatment. During rainstorms, the peak inflow from runoff increases the volume of water that will flow into the plant by a factor of four.

   (a) Calculate the total volume of wastewater that is generated daily by the citizens of Fremont.
   (b) Calculate the minimum volume of wastewater that the new treatment facility must be capable of processing daily if it is built to handle all of the influent during peak periods.
   (c) Explain how the city could treat all of the wastewater with a wastewater treatment plant less than half the size calculated above.
   (d) Identify two pollutants that are removed during tertiary treatment, and discuss the environmental consequences of not removing one of those two pollutants.
   (e) Currently, the wastewater treatment plant in Fremont only performs primary treatment, and it does so with insufficient capacity to treat inflows at peak volumes. Identify TWO infectious diseases that spread as a result of insufficient sewage treatment.

3. Although coral reefs occupy less than one-quarter of one percent of the world's oceans, they provide numerous ecosystem services. Currently, human activities are resulting in the destruction of coral reefs at an alarming rate. Some scientists believe that because of their extreme sensitivity to environmental change, coral reefs may serve as an early warning of more future damage to the life zones of the world's oceans.

   (a) Describe the climatic and water conditions that are best suited for coral reef formation and identify a specific geographic region of the world's oceans where coral reefs can be found.
   (b) Identify and describe THREE ecosystem services that coral reefs provide.
   (c) Describe TWO human activities that contribute to the degradation and destruction of coral reefs, and explain how each activity contributes to the loss of coral reefs.
   (d) Discuss ONE action that could be taken to reduce the destruction of coral reefs.

4. Once out of favor, nuclear energy is now being touted as a replacement for coal and a way of slowing global warming. As a result, for the first time in many years, the construction of new nuclear power plants is being proposed in the United States.

   (a) Nuclear power fell out of public favor following two incidents at nuclear power plants. Identify the location of both of those incidents and for one of the incidents, briefly describe what happened.
   (b) Describe the negative effects that the cooling of nuclear power plants has on the environment.
   (c) New, advanced nuclear reactors are touted as safer than older reactors. Identify and describe ONE of the technological advances employed in these second-generation nuclear reactors.
   (d) Discuss the assertion that nuclear energy is a feasible way of slowing global warming.
   (e) Describe ONE currently used disposal method for nuclear fuel in the United States.

ANSWERS FOR MULTIPLE-CHOICE QUESTIONS

Using the table below, score your test. You will find explanations of the answers on the following pages.

1. D	21. E	41. B	61. E	81. C
2. E	22. A	42. A	62. B	82. A
3. A	23. D	43. C	63. B	83. B
4. A	24. E	44. D	64. A	84. A
5. B	25. C	45. B	65. D	85. B
6. D	26. E	46. B	66. A	86. E
7. A	27. C	47. A	67. A	87. E
8. B	28. B	48. B	68. D	88. E
9. E	29. D	49. C	69. C	89. D
10. A	30. D	50. C	70. B	90. C
11. C	31. B	51. D	71. D	91. D
12. B	32. C	52. C	72. C	92. B
13. A	33. A	53. D	73. D	93. D
14. C	34. E	54. D	74. B	94. D
15. D	35. A	55. D	75. C	95. A
16. D	36. C	56. D	76. B	96. C
17. A	37. D	57. C	77. A	97. E
18. D	38. E	58. D	78. B	98. D
19. D	39. E	59. D	79. A	99. E
20. B	40. B	60. D	80. D	100. E

1. **ANSWER: D.** India has the second largest population in the world with over 1.1 billion people. The population of India is growing at a faster rate than that of China with the world's largest population at 1.3 billion. By 2025, India will be close to overtaking China with the world's largest population (*Living in the Environment,* 17th ed., page 127 / 18th ed., page 136).

2. ANSWER: E. Orangutans are native in Indonesia where they are endangered due to habitat loss, which is largely the result of deforestation to clear land for palm oil plantations (*Living in the Environment,* 17th ed., page 195 / 18th ed., pages 194–195).

3. ANSWER: A. The United States is the most developed country that is marked on the map. As the most developed country, the United States would have undergone the most complete demographic transition (*Living in the Environment,* 17th ed., pages 139–141 / 18th ed., pages 134–135).

4. ANSWER: A. The National Park System in the United States was the first such system in the world (*Living in the Environment,* 17th ed., page 236 / 18th ed., page 233).

5. ANSWER: B. The half-life of a radioactive substance is the time it takes to reduce the amount of the substance by one half; after 10 half-lives, the amount of the radioactive substance is reduced by a factor of 1028 (2, 4, 8, 16, 32, 64, 128, 256, 512, 1028) (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

6. ANSWER: D. 1 ppm (part per million) is equivalent to 1,000 ppb (parts per billion) (*Living in the Environment,* 17th ed., page G11 / 18th ed., page G14).

7. ANSWER: A. The average global surface temperature increased by about 1.3°F (0.74°C) between 1906 and 2005 (*Living in the Environment,* 17th ed., page 497 / 18th ed., page 507).

8. ANSWER: B. pH is a logarithmic scale, and a pH difference of one corresponds to a hydrogen ion concentration change of 10 to the first power (10^1) or 10. A pH difference of two would be a 100-fold change in acidity (10^2) (*Living in the Environment,* 17th ed., pages S12–S13 / 18th ed., pages S13–S14).

9. ANSWER: E. Great Smoky Mountains National Park is the most visited U.S. National Park. The Great Smoky Mountains were named for the blue mist that sits over the mountains and valleys like smoke. The Appalachian Trail passes through Great Smoky Mountains National Park (*Living in the Environment,* 17th ed., page 236 / 18th ed., page 233).

10. ANSWER: A. Everglades National Park became a popular location for releasing unwanted pets, including Burmese pythons (*Living in the Environment,* 17th ed., page 202 / 18th ed., pages 200–201).

11. ANSWER: C. Grand Canyon National Park was the proposed site of a dam that was successfully blocked by the Sierra Club, in part by employing the controversial advertisement in the *New York Times* entitled, "Would You Flood the Sistine Chapel so Tourists Could Get Closer to the Ceiling?" (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

12. ANSWER: B. Gray wolves were reintroduced into Yellowstone National Park (*Living in the Environment,* 17th ed., page 238 / 18th ed., page 235).

13. ANSWER: A. Goiter is a malady that results from a deficiency of iodine in one's diet. The iodization of salt is done to prevent iodine deficiency (*Living in the Environment* 17th ed., page 280 / 18th ed., page 280).

14. ANSWER: C. Begin by extending the clay line horizontally to the right from 45% to meet the silt line coming down from 27% and the sand line coming up from

28%. They meet in the bottom of the clay region of the triangle (*Living in the Environment* 17th ed., not included / 18th ed., not included).

15. ANSWER: D. Liquefied natural gas must be kept at low temperature and high pressure while it is transported. This requires much energy, which reduces the net energy yield for liquefied natural gas (*Living in the Environment,* 17th ed., page 380 / 18th ed., page 382).

16. ANSWER: D. Tundra has the lowest net primary productivity of the options listed. Only desert biomes have a lower net primary productivity than tundra (*Living in the Environment,* 17th ed., page 66 / 18th ed., page 62).

17. ANSWER: A. Most volcanoes form on continental plates at convergent plate boundaries where oceanic plates collide and move under continental plates (*Living in the Environment,* 17th ed., page 348 / 18th ed., page 351).

18. ANSWER: D. The largest proven reserves of crude oil are in the Middle East (*Living in the Environment,* 17th ed., page 375 / 18th ed., page 378).

19. ANSWER: D. The pH of precipitation in the United States is highest (least acidic) in the west and lowest (most acidic) in the east. The pH does not change significantly from north to south (*Living in the Environment,* 17th ed., pages 477–478 / 18th ed., pages 485–486).

20. ANSWER: B. Silicon is the semiconducting element whose properties allow an electric current to result from its absorption of light energy (*Living in the Environment,* 17th ed., pages 412–413 / 18th ed., page 417).

21. ANSWER: E. In the Northern Hemisphere, the sun passes through the southern sky all year, making the southern side of a building the sunny side all year (*Living in the Environment,* 17th ed., page 149 / 18th ed., page 146).

22. ANSWER: C. Species that are caught inadvertently during fishing are referred to as bycatch. These species are often killed in the process of being caught and may include protected species such as turtles and dolphins (*Living in the Environment,* 17th ed., page 259 / 18th ed., page 254).

23. ANSWER: D. Biomagnification most severely affects species that occupy high trophic levels, like apex predators. Moose are herbivores that occupy the second trophic level. All of the other species listed are carnivores (*Living in the Environment,* 17th ed., page 203 / 18th ed., page 202).

24. ANSWER: E. Using the rule of 70, the doubling time of the population is 70/1.4 = 50 years. It will double twice to reach 24 million from 6 million; therefore, the year will be 2010 + (50 × 2) = 3010 (*Living in the Environment,* 17th ed., page G14 / 18th ed., page G17).

25. ANSWER: C. Improved medical care and sanitation have allowed the life expectancy of the world's population to rise, resulting in an increase in population even as birthrates fall. The other options either work to decrease population size or have little effect on population size (*Living in the Environment,* 17th ed., page 133 / 18th ed., page 129).

26. ANSWER: E. Both oxygen and nitrogen are found in the troposphere primarily as diatomic molecules (*Living in the Environment,* 17th ed., pages 59, 71 / 18th ed., pages 56, 66–67).

27. ANSWER: C. Soil texture is determined based on the relative proportions by weight of sand, silt, and clay (*Living in the Environment*, 17th ed., not included / 18th ed., not included).

28. ANSWER: B. Oligotrophic lakes are characterized by low nutrient levels and low productivity. They typically have little plant or algae growth and high dissolved oxygen levels (*Living in the Environment*, 17th ed., page 181 / 18th ed., page 179).

29. ANSWER: D. An estuary is a coastal wetland at the mouth of a river where freshwater mixes with saltwater. It is characterized by daily changes in water temperature and salinity that cycles with the tides (*Living in the Environment*, 17th ed., pages 173–175 / 18th ed., pages 171–172).

30. ANSWER: D. Modern farming practices employ monocultures, which reduce the species diversity of the area. They also require large inputs of artificial fertilizers, pesticides, irrigation water, and fossil fuels (*Living in the Environment*, 17th ed., page 281 / 18th ed., page 281).

31. ANSWER: B. In a typical food web 10% of the energy that is transferred to each successive trophic level is converted to body mass. The remaining energy is converted to waste heat. In this example, the 1-kg hawk would require 10 kg of lizards, 100 kg of grasshoppers, and 1,000 kg of grass (*Living in the Environment*, 17th ed., pages 64–65 / 18th ed., pages 60–61).

32. ANSWER: C. Habitat destruction, whether by humans or a flood, volcano, tsunami, or other natural events, will affect population growth regardless of population density. The effectiveness of the other factors to control population size is dependent on the density of the population (*Living in the Environment*, 17th ed., page 117 / 18th ed., page 113).

33. ANSWER: A. Primary succession establishes soil in an area prior to secondary succession, which will establish an ecological community in the area (*Living in the Environment*, 17th ed., page 119 / 18th ed., page 109).

34. ANSWER: E. Bottom trawlers drag chainmail nets over the seafloor to collect bottom-dwelling shellfish, crustaceans, and mollusks. When dragged over coral reefs, trawler nets will severely damage or destroy the reef (*Living in the Environment*, 17th ed., page 252 / 18th ed., page 249).

35. ANSWER: A. Anthracite coal is the oldest of the ranks of coal and the most dense, both by weight and energy content (*Living in the Environment*, 17th ed., page 382 / 18th ed., page 386).

36. ANSWER: C. The Montreal Protocol was signed in Montreal, Canada. The treaty restricts the production and use of ozone depleting chemicals such as CFCs, halons, and methyl bromide (*Living in the Environment*, 17th ed., page 523 / 18th ed., page 500).

37. ANSWER: D. The Antarctic ozone hole varies in size throughout the year, making its first appearance and reaching its largest area during the spring (October) in Antarctica. It rotates counterclockwise around the South Pole, but it varies in area (*Living in the Environment*, 17th ed., page 521 / 18th ed., pages 497–498).

38. ANSWER: E. The tilt of the earth and its rotation around the sun are the two factors that determine the earth's seasons (*Living in the Environment*, 17th ed., page 148–150 / 18th ed., pages 145–147).

39. ANSWER: E. The thawing of permafrost will release methane and carbon dioxide into the troposphere. This could lead to additional heating, which would melt more permafrost and release more methane, which would increase warming, and so on. This is an example of positive feedback (*Living in the Environment,* 17th ed., page 497 / 18th ed., page 512).

40. ANSWER: B. Formaldehyde is a common chemical found in building materials and products used indoors (*Living in the Environment,* 17th ed., pages 482–483 / 18th ed., pages 489–490).

41. ANSWER: B. The six criteria air pollutants are ozone, lead, nitrogen dioxide, particulate matter, sulfur dioxide, and carbon monoxide (*Living in the Environment,* 17th ed., page 485 / 18th ed., page 493).

42. ANSWER: A. The reaction between ozone and ultraviolet light occurs in the stratosphere and generates heat; as a result, the temperature in the stratosphere increases with increasing altitude (*Living in the Environment,* 17th ed., page 467 / 18th ed., page 475).

43. ANSWER: C. Sulfur dioxide, along with nitrogen oxides, is the precursor to acid rain (*Living in the Environment,* 17th ed., page 470 / 18th ed., page 478).

44. ANSWER: D. This is an example of a tragedy of the commons. In this case the commons is the river. The company's perceived small impact on a large resource, like the proverbial herdsman placing additional animals onto a publicly-owned pasture, is the tragedy (*Living in the Environment,* 17th ed., page 15 / 18th ed., page 12).

45. ANSWER: B. Clumping will likely have the opposite effect of making the plant more vulnerable to predators. All of the other options are adaptations that make plants less vulnerable to predators (*Living in the Environment,* 17th ed., pages 107–108 / 18th ed., pages 104–106).

46. ANSWER: B. The General Mining Law of 1872 still allows corporations to acquire land at prices that are far below market value (*Living in the Environment,* 17th ed., pages 362–363 / 18th ed., not included).

47. ANSWER: A. Ozone forms in the stratosphere during photochemical reactions when ultraviolet light breaks the bonds between the atoms of a diatomic oxygen molecule and the oxygen atoms react with another oxygen molecule, forming ozone (*Living in the Environment,* 17th ed., pages 467–468 / 18th ed., pages 475–476).

48. ANSWER: B. Phosphorus and nitrogen run off in large quantities of animal wastes from feedlots, after which they can enter groundwater (*Living in the Environment,* 17th ed., pages 536–537 / 18th ed., pages 550–552).

49. ANSWER: C. Mountaintop removal is a type of surface (strip) mining in which heavy equipment removes mountaintops to expose coal seams for removal by more equipment (*Living in the Environment,* 17th ed., page 357 / 18th ed., page 358).

50. ANSWER: C. The whooping crane is an endangered species, the Africanized honeybee is an invasive species, and the passenger pigeon is an extinct species (*Living in the Environment,* 17th ed., pages 193, 194, 200 / 18th ed., pages 192, 193, 199).

51. **ANSWER: D.** Catalytic converters remove carbon monoxide from exhaust by oxidizing it to carbon dioxide, and nitrogen oxides by reducing them to nitrogen and oxygen (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

52. **ANSWER: C.** Power is defined as energy use per unit time. To calculate the energy used, multiply power and time to get: 2 kW × 3.5 hours = 7 kWh (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

53. **ANSWER: D.** A Dobson unit (DU) is the unit used for the measurement of ozone concentration. One DU is equivalent to a column of ozone 0.01 mm thick at a temperature of 0°C and 1 atmosphere pressure (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

54. **ANSWER: D.** Successful invasive species are generalists with a wide range of tolerance limits. In this case the American cockroach is an outstanding candidate (*Living in the Environment,* 17th ed., pages 198–200 / 18th ed., pages 197–199).

55. **ANSWER: D.** The per capita generation according to the graph is slightly greater than 2.0 kg/person/day; therefore in one year, a person generates slightly more than approximately 2.0 kg/person/day × 365 days/year = 730 kg/person/year. The nearest answer is 750 kg (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

56. **ANSWER: D.** The change from 1980 to 1990 is from approximately 150 million to 200 million tons; the percent change is (200 − 150)/150 × 100 = 33%. From 2000 to 2005 the change is from approximately 230 million to 235 million tons (you may get something slightly different, but you should recognize a slight increase between 2000 and 2005); the percent change is (235 − 230)/230 = 2%. The nearest answer is 30% and 2% (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

57. **ANSWER: C.** The trend is a decrease in the amount of solid waste produced per capita. A corresponding increase in recycling has also occurred during that time (*Living in the Environment,* 17th ed., page 561 / 18th ed., not included).

58. **ANSWER: D.** During an El Niño Southern Oscillation, the east to west Pacific trade winds reverse directions (*Living in the Environment,* 17th ed., pages S26–S28 / 18th ed., pages S19–S21).

59. **ANSWER: D.** In the system described, the original disturbance, melting glacial ice, results in a series of changes to the system that eventually results in additional melting of ice. This is an example of positive feedback (*Living in the Environment,* 17th ed., page 49 / 18th ed., page 44).

60. **ANSWER: D.** Arsenic is commonly found in groundwater due to naturally occurring arsenic deposits in soils and rocks (*Living in the Environment,* 17th ed., pages 540–541 / 18th ed., pages 555–556).

61. **ANSWER: E.** Ammonium nitrate is an inorganic fertilizer that is produced by taking atmospheric nitrogen and fixing it by inputting large quantities of fossil fuels (*Living in the Environment,* 17th ed., page 72 / 18th ed., page 68).

62. **ANSWER: B.** A brownfield is an abandoned industrial site such as a factory, gas station, power plant, steel mill, etc. (*Living in the Environment,* 17th ed., page 579 / 18th ed., page 596).

63. **ANSWER: B.** A decrease in stratospheric ozone concentrations will lead to an increase in UV radiation capable of ionizing cellular DNA in oceanic phytoplankton, leading to mutations (*Living in the Environment,* 17th ed., page 523 / 18th ed., page 500).

64. **ANSWER: A.** The net primary productivity of an ecosystem is a measure of the amount of energy converted to biomass that is produced less the amount of energy lost by respiration per unit area per unit time in the ecosystem (*Living in the Environment,* 17th ed., page 65 / 18th ed., page 61).

65. **ANSWER: D.** The percentage growth rate of a population in the table is the difference between the birth rates and the death rates. To determine the growth rates as a percentage (per 100) from the crude rates (per 1000) divide by 10, or move the decimal one place to the left (*Living in the Environment,* 17th ed., page 130 / 18th ed., page 126).

66. **ANSWER: A.** Fertilizer production removes nitrogen from the atmosphere and artificially fixes it to produce nitrogen-based fertilizers. All of the other options add nitrogen or have no effect on the amount of nitrogen in the atmosphere (*Living in the Environment,* 17th ed., page 72 / 18th ed., page 67).

67. **ANSWER: A.** The highest biodiversity on earth can be found near the equator (at low latitudes) and at low elevations (*Living in the Environment,* 17th ed., page 94 / 18th ed., page 90).

68. **ANSWER: D.** The theory of island biogeography predicts that small, isolated islands will have the lowest species diversity as well as the highest extinction rates and lowest immigration rates, and that large nearby islands will have the highest species diversity as well as the lowest extinction rates and highest immigration rates (*Living in the Environment,* 17th ed., page 94 / 18th ed., not included).

69. **ANSWER: C.** The oxpecker preys on the ticks. The oxpecker and the rhinoceros both benefit from each other. The ticks are parasites on the rhinoceros (*Living in the Environment,* 17th ed., pages 110–111 / 18th ed., pages 107–108).

70. **ANSWER: B.** Species that adapt quickly to environmental change are those with characteristics typical of r-strategists, including short generational time periods (*Living in the Environment,* 17th ed., page 117 / 18th ed., page 113).

71. **ANSWER: D.** Malaria is a tropical disease caused by a parasite that is spread by the bite of the female *Anopheles* mosquito (*Living in the Environment,* 17th ed., pages 443–445 / 18th ed., pages 449–452).

72. **ANSWER: C.** The efficiency of 5% means that 5% of 60 watts, or 3 watts, of light will be created—the remaining 57 watts will be waste heat. A watt is a joule per second; therefore the bulb produces about 3 joules of light and 57 joules of heat per second (*Living in the Environment,* 17th ed., pages 398–399 / 18th ed., page 403).

73. **ANSWER: D.** To live an active, healthy life, people need on average about 2,200 calories each day. With nearly 7 billion people needing 2,200 calories, approximately 14 trillion calories are needed (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

74. **ANSWER: B.** The discharge from primary sewage treatment is classified as organic waste, and its decomposition will result in a decrease in the dissolved oxygen concentration and an increase in the biological oxygen demand in the

river downstream from the discharge (*Living in the Environment,* 17th ed., pages 533–534 / 18th ed., page 549).

75. **ANSWER: C.** The relative humidity is the percentage of water content in the air, where 100% humidity is the condition when the air is saturated with moisture. The amount of water that can be present in the atmosphere increases as the temperature increases; therefore, as the temperature rises the relative humidity will decrease when the amount of water in the atmosphere remains constant. The chance of rain increases as the relative humidity approaches 100% (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

76. **ANSWER: B.** The replacement-level fertility is the average number of children a couple must bear to replace themselves in the population. In most developed countries the replacement-level fertility is slightly higher than 2.0 (*Living in the Environment,* 17th ed., page 130 / 18th ed., page 126).

77. **ANSWER: A.** Scrubbers spray mists of calcium carbonate or calcium oxide solutions into the smoke created by burning coal to remove sulfur dioxide (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

78. **ANSWER: B.** Ozone depletion is an environmental problem. All of the other options are ecosystem services (*Living in the Environment,* 17th ed., page 521 / 18th ed., page 521).

79. **ANSWER: A.** The LD-50 with the smallest dose per unit of body weight is the most toxic (*Living in the Environment,* 17th ed., page 453 / 18th ed., pages 460–461).

80. **ANSWER: D.** The fastest growing population is II (the broadest base) followed by III, and then I (the narrowest base) (*Living in the Environment,* 17th ed., pages 135–136 / 18th ed., pages 131–132).

81. **ANSWER: C.** The dependent variable is the variable that is measured during the experiment. In this case the dependent variable is the mortality rate of the fish (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

82. **ANSWER: A.** The independent variable is the variable that is manipulated by the experimenter. In this case, the independent variable is the water temperature (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

83. **ANSWER: B.** The dissolved oxygen levels in water decrease as the water temperature increases, and fish are very sensitive to dissolved oxygen levels (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

84. **ANSWER: A.** Per capita means per person; therefore: $(8 \times 10^6$ Btu/day $\times$ 3.65 $\times$ 10^2 days/year)/3 $\times$ 10^5 people = 9,733 Btu/person, which is closest to 10 thousand Btu (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

85. **ANSWER: B.** Sand, the largest particle size listed, has the greatest permeability (*Living in the Environment,* 17th ed., not included / 18th ed., not included).

86. **ANSWER: E.** Cultural eutrophication is caused by the nitrogen and phosphorus fertilizers in agricultural runoff (*Living in the Environment,* 17th ed., pages 536–537 / 18th ed., pages 550–552).

87. **ANSWER: E.** Approximately 10% of the energy at one trophic level is transferred to the next with the remaining 90% lost as waste heat (*Living in the Environment,* 17th ed., pages 63–64 / 18th ed., pages 59–61).

88. **ANSWER: E.** The worst nuclear accident in history occurred in Chernobyl, Ukraine, in the former Soviet Union (*Living in the Environment,* 17th ed., page 389 / 18th ed., page 393).

89. **ANSWER: D.** Overfishing and overgrazing on public lands are both examples of tragedies of the commons (*Living in the Environment,* 17th ed., page 15 / 18th ed., page 12).

90. **ANSWER: C.** The passenger pigeon became extinct when it was hunted for food in the 19th century (*Living in the Environment,* 17th ed., pages 194–195 / 18th ed., page 192).

91. **ANSWER: D.** Biomass is the most commonly used form of renewable energy in developing countries (*Living in the Environment,* 17th ed., page 419 / 18th ed., page 424).

92. **ANSWER: B.** Temperate grasslands have deep, fertile soils that are well suited for growing crops. Unfortunately, when the native grasses are removed along with their tangled root network, the topsoil becomes vulnerable to severe wind erosion (*Living in the Environment,* 17th ed., pages 157–158 / 18th ed., pages 153–154).

93. **ANSWER: D.** Oil refineries make use of a process called fractional distillation to separate crude oil into its components based on their boiling points (*Living in the Environment,* 17th ed., page 375 / 18th ed., page 377).

94. **ANSWER: D.** Photosynthesis converts carbon dioxide and water into sugar and oxygen. All the other options increase the amount of carbon dioxide in the atmosphere (*Living in the Environment,* 17th ed., page 59 / 18th ed., page 55).

95. **ANSWER: A.** Iceland lies on the mid-Atlantic Ridge, an area that is ideally situated to tap heat that lies near the surface of the earth (*Living in the Environment,* 17th ed., page 425 / 18th ed., pages 428–429).

96. **ANSWER: C.** Rachel Carson's book, *Silent Spring,* raised public awareness about the environmental hazards of the pesticide DDT in much the same way as the publication of the research of F. Sherwood Rowland and Mario Molina raised public awareness about the role CFCs play in the depletion of stratospheric ozone (*Living in the Environment,* 17th ed., pages 298, 522 / 18th ed., pages 297, 498).

97. **ANSWER: E.** Ozone and chlorine are used to disinfect water supplies (*Living in the Environment,* 17th ed., page 551 / 18th ed., page 566).

98. **ANSWER: D.** The U.S. population is slightly more than 300 million people. One percent of 300 million is 3 million (*Living in the Environment,* 17th ed., page 127 / 18th ed., page 126).

99. **ANSWER: E.** Tilling refers to plowing the soil; no-till refers to not plowing the soil (*Living in the Environment,* 17th ed., page 306 / 18th ed., page 305).

100. **ANSWER: E.** The diversion of water from lakes or inland seas with no outlet to the sea will result in an increase in salinity of the lake's water. Examples include the Aral Sea in the former Soviet Union and Mono Lake in California (*Living in the Environment,* 17th ed., pages 332–333 / 18th ed., pages 332–333).

SCORING GUIDELINES FOR FREE-RESPONSE QUESTIONS

1. (a) Identify ONE use for DDT and ONE use for PCBs.

2 points can be earned—1 point for a correct use for DDT and 1 point for a correct use for PCBs

DDT—Used as pesticide, especially in developing countries, for control of the *Anopheles* mosquito, carrier of the microbe that causes malaria.

PCBs—used as electrical insulators, lubricants, hydraulic fluid, and as an ingredient in paints, fire retardants, adhesives, preservatives, and pesticides.

(b) Identify a specific species that is not identified in the press release that has been affected by the use of DDT and discuss how DDT affected the population of that species.

3 points can be earned—1 point for correctly identifying a species and 2 points for the discussion (1 point for correctly describing how biomagnification concentrates DDT and PCBs in higher trophic levels and 1 point for the effect that led to the demise)

Species—bald eagle, brown pelican, cormorant, peregrine falcon, osprey, songbirds (must identify a specific species for example, a robin, jay, wren or dove).

Biomagnification—DDT is not easily broken down so it persists in the environment. Moreover, it is fat soluble so it accumulates in the liver and other fatty tissues of prey species. This leads to increased concentrations in higher trophic levels.

Effects—Decreased fecundity or reproductive success as a result of the fragility of eggshells; low sperm counts; crossed or otherwise deformed beaks; feminization of males; small penises; or the presence of both male and female sex organs in individuals.

(c) The solution to the DDT/PCB problem off the Palos Verdes Peninsula has been to wait for the chemicals to break down into less harmful chemical by-products. Write an argument in support of this solution and write an argument opposed to this solution.

4 points can be earned—2 points for each argument

In support of waiting for the chemicals to break down:

1 point for each correct supporting statement—2 points maximum

Trying to remove the deposit will disturb the chemicals, re-releasing them into the water.
It is not possible to clean up the entire deposit.
Disturbing the seafloor will damage ecosystems.
Cleanup is expensive and money should be used elsewhere.

In opposition to waiting for the chemicals to break down:

1 point for each correct supporting statement—2 points maximum
The chemicals will continue to enter food chains for hundreds of years.
Humans have a moral responsibility to cleanup hazardous materials.
People will continue to get sick or die from seafood contamination.

(d) Explain why mercury levels are higher in bigger, older fish than they are in smaller, younger fish or fish lower in the food chain.

2 points can be earned—1 point explaining how biomagnification leads to high concentrations in large fish and 1 point for explaining how bioaccumulation leads to higher concentrations in older fish

Mercury biomagnifies and its concentration is highest in the highest trophic levels. The fish that occupy the highest trophic levels are large fish.
Mercury bioaccumulates and its concentration increases as an organism ages. The oldest fish will have the highest mercury concentrations.

2. (a) Calculate the total volume of wastewater that is generated daily by the citizens of Fremont.

2 points can be earned—1 point for a correct setup and 1 point for the correct answer with units

$$5\times10^{1}\,\frac{\text{gallons}}{\text{person-day}}\times1.5\times10^{5}\text{ people}=7.5\times10^{6}\,\frac{\text{gallons}}{\text{day}}$$

(The unit for time – day – is not required since the question asked for the daily volume.)

(b) Calculate the minimum volume of wastewater that the new treatment facility must be capable of processing daily if it is built to handle all of the influent during peak periods.

1 point can be earned for the correct answer with units

$$7.5\times10^{6}\,\frac{\text{gallons}}{\text{day}}\times4=3\times10^{7}\,\frac{\text{gallons}}{\text{day}}$$

(The unit for time – day – is not required since the question asked for the daily volume.)

(c) Explain how the city could treat all of the wastewater with a wastewater treatment plant less than half the size calculated above.

1 point can be earned for a correct explanation
Install a separate system for the runoff to allow it to be diverted past the treatment plant.
(Reducing residential output alone is not acceptable since even if all residential sewage is stopped, the peak volume will still be 75% of the current amount)

(d) Identify two pollutants that are removed during tertiary treatment, and discuss the environmental consequences of not removing one of those two pollutants.

4 points can be earned—1 point for each correctly identified pollutant
Pollutants removed by tertiary treatment: nitrogen or phosphorus

Consequence	Environmental effect
Increased algal blooms	Increased fish mortality
Increased plant growth	Disruption of food chains
Eutrophication	Inability of native species to compete in hypoxic conditions
Decreased dissolved oxygen	Reduced biodiversity and poorer health of aquatic life

(e) Currently, the wastewater treatment plant in Fremont only performs primary treatment, and it does so with insufficient capacity to treat inflows at peak volumes. Identify TWO infectious diseases that spread as a result of insufficient sewage treatment.

2 points can be earned—1 point for each correct infectious disease
Infectious diseases – Cholera; giardiasis; hepatitis; typhoid; cryptosporidiosis

3. (a) Describe the climatic and water conditions that are best suited for coral reef formation and identify a specific geographic region of the world's oceans where coral reefs can be found.

3 points can be earned—1 point for a correct description of climatic conditions, 1 point for a correct description of water conditions, and 1 point for a correct geographic region
Climatic conditions – warm; hot; reliable sunlight; intense sunlight
Water conditions – warm; clear; nutrient-rich; shallow
Geographic regions – shallow tropical and sub-tropical seas – e.g., Florida Keys, Mexico and Central American coasts, Hawaii, Australia

(b) Identify and describe THREE ecosystem services that coral reefs provide.

3 points can be earned—1 point for each correct description of an ecosystem service

Ecosystem Service	Description
Food production	Maintain habitats and nurseries for fisheries that provide food
Storm Protection	Shelter the coastline from the direct impact of severe storms
Carbon storage	Remove carbon from the atmosphere and provide long-term storage on the seafloor

Ecosystem Service	Description
Pharmaceuticals	Natural products extracted from marine organisms are used in pharmaceuticals that improve human health
Recreation	Resorts attract tourists who participate in snorkeling, scuba diving, and other activities associated with coral reefs that improve the local economy
Climate regulation	Removal of carbon dioxide from the atmosphere decreases greenhouse gases, which reduces the effects of global climate change
Job creation	Fishing and recreation provide jobs, reducing poverty and the associated environmental impact

(c) Describe TWO human activities that contribute to the degradation and destruction of coral reefs, and explain how each activity contributes to the loss of coral reefs.

2 points can be earned—1 point for each correct human activity

Human Activity	Contribution to Coral Loss
Bottom Trawling	Destruction of coral reef habitat by dragging trawling net across the seafloor
Overfishing	Loss of species diversity, disruption of food chains (elimination of predator/prey species)
Construction, development, or deforestation along the coast	Sediment pollution from runoff, reducing visibility; sunlight penetration, killing plant life below the surface and bleaching coral
Agriculture along the coast	Sediment pollution from runoff, reducing visibility; sunlight penetration, killing plant life below the surface and bleaching coral
Fertilizer/nutrient runoff	Algae blooms that block sunlight, reducing visibility and killing plant life below the surface
Pesticide runoff	The poisoning of sea life
Introduction of invasive species (for example, from the ballast tanks, bilge pumps, and bait tanks of vessels from distant ports)	Introduced species out-compete native species for resources, causing extinction

Human Activity	Contribution to Coral Loss
Burning of fossil fuels	Global warming resulting in warmer seas, causing coral bleaching Increase in CO_2 concentrations acidify ocean water which can cause corals to dissolve

(d) Discuss ONE action that could be taken to reduce the destruction of coral reefs.

2 points can be earned—1 point for a correct action that can be taken and 1 point for discussing how the action would reduce the destruction of coral reefs

Action	Means of Reduction
Stop eating seafood caught using fishing methods that damage reefs	Less demand for fish leading to less destructive fishing practices
Stop buying products made from raw materials harvested from coral reefs	Less demand for products leading to less harvesting of resources from coral reefs
Stop supporting businesses that encourage activities that result in sediment pollution in areas that have coral reefs	Pressure on businesses will lead to less sediment production and pollution
Visit areas with coral reefs and participate in the associated recreational activities that support the local economy	Provides capital and incentive to maintain healthy coral reefs
Reduce fossil fuel use	Reduces CO_2 concentrations in the oceans reducing the threat of acidic waters dissolving coral or warming oceans bleaching coral

4. (a) Nuclear power fell out of public favor following two incidents at nuclear power plants. Identify the location of both of those incidents and for one of the incidents, briefly describe what happened.

3 points can be earned—1 point for each correct incident and 1 point for a correct description of one of the incidents

Chernobyl—Meltdown of a nuclear reactor that occurred in Ukraine in 1987. Released massive quantity of radioactive gas that will increase cancer rates for millions of Europeans.

Three Mile Island—Loss of coolant accident that led to the release of radioactive gas in a nuclear power plant in Pennsylvania in 1979. A more serious accident was narrowly avoided.

(b) Describe the negative effects that the cooling of nuclear power plants has on the environment.

2 points can be earned—1 point for describing thermal pollution and 1 point for making the connection to lower levels of dissolved oxygen

The cooling of nuclear power plants leads to thermal pollution.

When cooling water is drawn out of rivers, lakes and oceans, and returned at elevated temperatures, the dissolved oxygen levels can fall outside the tolerance limits of some aquatic species. This can lead to a loss of species diversity.

(c) New, advanced nuclear reactors are touted as safer than older reactors. Identify and describe ONE of the technological advances employed in these second-generation nuclear reactors.

2 points can be earned—1 point for a correct new reactor and 1 point for a correct description

Advanced light water reactors or high-temperature, gas-cooled reactors—cooled by gas rather than water, increasing safety.

Pebble bed modular reactor—uses fuel pellets that are more manageable rather than rods. Also, cooled by gas rather than water, increasing safety.

Modular designs lead to smaller reactors that are inherently safer.

(d) Discuss the assertion that nuclear energy is a feasible way of slowing global warming.

2 points can be earned—1 point for each correct statement in the discussion

The production of nuclear power emits less carbon dioxide than burning coal.

The production of nuclear power still emits some carbon dioxide during mining, processing, transportation and disposal of the fuel.

Nuclear power is a nonrenewable resource and will need to be replaced in the future.

There is no long-term storage facility for spent nuclear fuel and onsite storage may prove more hazardous than global warming.

A nuclear meltdown may be more hazardous than the threat of global warming.

(e) Describe ONE currently used disposal method for spent nuclear fuel in the United States.

1 point can be earned for a correct description of current practice for the storage of spent nuclear fuel

It is stored on the site of the nuclear power plant in water-filled pools and dry casks above and below ground outside the containment shell of the reactor.

CALCULATING YOUR SCORE

This scoring worksheet is based on the 2008 AP Environmental Science released exam. While the AP grade conversion chart is NOT the same for each testing year, it gives you an approximate breakdown.

SECTION I: MULTIPLE CHOICE

_____ × 0.90 = _____

Number Correct (out of 100) — Weighted Section I Score

SECTION II: FREE RESPONSE

Document-Based Question _____ (Score out of 10) × 1.50 = _____ (*Do not round*)

Data-Set Question _____ (Score out of 10) × 1.50 = _____ (*Do not round*)

Synthesis & Evaluation Question _____ (Score out of 10) × 1.50 = _____ (*Do not round*)

Synthesis & Evaluation Question _____ (Score out of 10) × 1.50 = _____ (*Do not round*)

Sum = _____ (Weighted Section II Score)

COMPOSITE SCORE

_____ (Weighted Section I Score) + _____ (Weighted Section II Score) = _____ (Composite Score)

AP GRADE CONVERSION CHART

Composite Score Range	AP Grade
107–150	5
87–106	4
75–86	3
62–74	2
0–61	1