

## Practice Exam 2

## Answer Sheet

Remove this sheet and use it to mark your answers for the multiple-choice section of Practice Exam 2.

## Section I

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## Section I: Multiple-Choice Questions

Time: 90 minutes

100 questions

Directions: Each of the questions or incomplete statements in this section is followed by five answer choices. Select the best answer choice and fill in the corresponding circle on the answer sheet.

- Which of the following is responsible for reducing global CFC production by half?
  - Copenhagen Protocol
  - Montreal Protocol
  - Pollution Prevention Act
  - Kyoto Protocol
  - Convention on Long-Range Transboundary Air Pollution
- The main global contributing factors to greenhouse-gas emissions are
  - Electricity production and transportation
  - Industrial processes
  - Agricultural processes
  - Agriculture and transportation
  - None of the above
- Which of the following is a way to potentially avoid a tragedy of the commons?
  - People sharing the resource work to manage the resource
  - Private ownership
  - Regulation by the government
  - All of the above
  - None of the above
- In the transitional stage of demographic transition, why does the death rate fall?
  - Movement of people into urban areas
  - Less disease on a global scale
  - More efficient and reliable food production and medical advancements
  - Fewer births
  - Fewer work-related accidents
- What is the most abundant greenhouse gas in the atmosphere?
  - Methane
  - Nitrogen dioxide
  - Water vapor
  - Carbon dioxide
  - Sulfur dioxide
- How does a nuclear meltdown occur?
  - Radiation is released when temperatures in the core of the reactor increase and the uranium fuel rods melt.
  - Radiation escapes from the core of the reactor due to the shutdown of the generator.
  - The nuclear core collapses.
  - The fission process halts instantaneously.
  - None of the above.
- As a whole, industrialized nations use \_\_\_\_\_% more energy than developing nations.
  - 10
  - 25
  - 50
  - 75
  - 100
- $$\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$$

$$2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$$

$$\text{NO}_2 \rightarrow \text{NO} + \text{O}$$

$$\text{O} + \text{O}_2 \rightarrow \text{O}_3$$

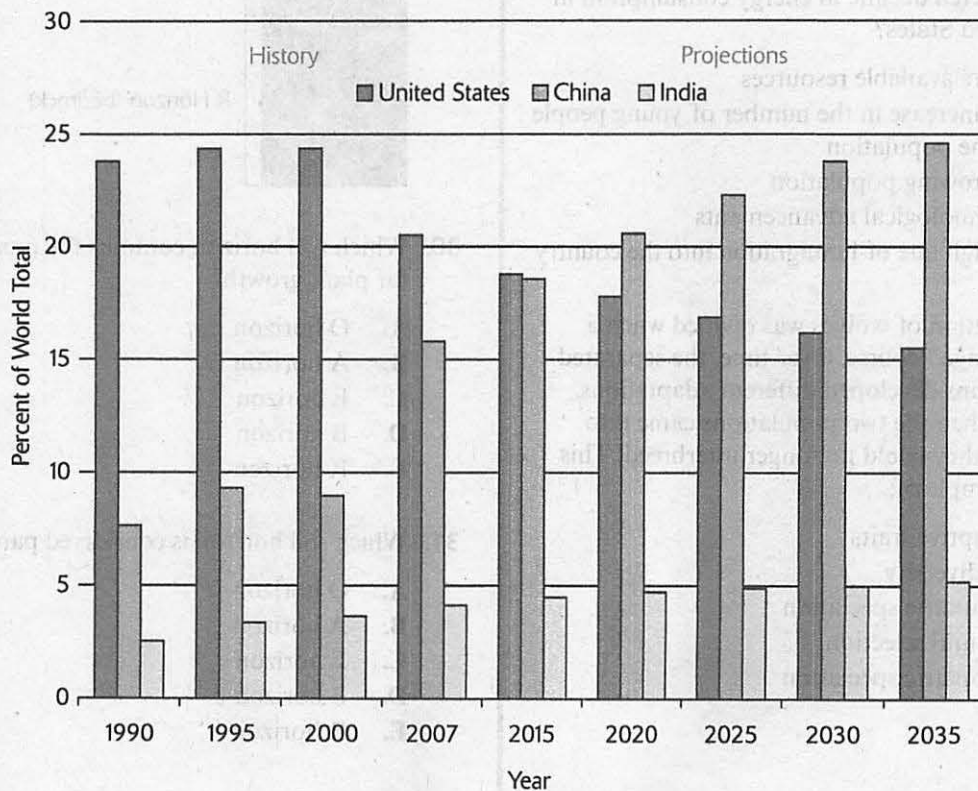
The above reactions describe the chemical process that forms:

  - Photochemical smog
  - Industrial smog
  - Acid precipitation
  - Ozone
  - Peroxyacetyl nitrate

9. Which of the following is the main advantage of breeder nuclear fission over conventional nuclear fission?
- A. Breeder nuclear fission is less expensive.
  - B. Breeder nuclear fission is a more efficient use of the fuel.
  - C. Breeder nuclear fission is safer.
  - D. Breeder nuclear fission creates less emission.
  - E. Breeder nuclear fission uses less land to build the reactor.
10. In what products are PBDEs commonly used?
- A. Fire retardants
  - B. Food preservatives
  - C. Cosmetics
  - D. Pesticides
  - E. Paint thinners
11. Which of the following biomes is comprised mainly of trees that lose their leaves in the winter?
- A. Tundra
  - B. Boreal forest
  - C. Temperate rain forest
  - D. Temperate deciduous forest
  - E. Tropical rain forest
12. Invasive species are able to survive and thrive in new environments because of all of the following EXCEPT:
- A. The ability to travel long distances
  - B. The increased risk of predation
  - C. The decreased threat of disease
  - D. The ability to outcompete native species
  - E. The abundance of food sources
- Questions 13–15 refer to the following answer choices.*
- A. Biomass
  - B. Hydrogen
  - C. Tidal
  - D. Solar
  - E. Hydropower
13. Uses electrolysis to split a water molecule into oxygen and hydrogen atoms.
14. Uses heat-absorbing material for part of its process.
15. Uses reservoirs as a storage mechanism.
16. The green revolution brought which of the following to modern society?
- A. Increased movement into urban areas
  - B. New farming techniques, new crop varieties, and increased food production
  - C. A return to traditional agriculture
  - D. New breeds of animals capable of the strenuous work on a farm
  - E. Suburban areas
17. Soil degradation is an increasing global problem. Two main reasons for this are
- A. Agriculture and deforestation
  - B. Deforestation and industrialization
  - C. Industrialization and overgrazing
  - D. Overgrazing and climate change
  - E. Climate change and agriculture
18. Which of the following types of electricity generation produces the least amount of greenhouse-gas emissions from cradle to grave?
- A. Coal
  - B. Nuclear
  - C. Natural gas
  - D. Biomass
  - E. Oil
19. The biome that is adapted to and dependent upon frequent fires is:
- A. Chaparral
  - B. Tundra
  - C. Desert
  - D. Boreal forest
  - E. Savannah
20. In an ecosystem, what represents the amount of energy available as food to heterotrophs?
- A. Gross primary production
  - B. Biomass
  - C. Net primary production
  - D. Photosynthesis
  - E. Cellular respiration

21. Which of the following is an invasive species that has had devastating effects on freshwater ecosystems, while also clogging pipes and boat engines?
- Bullfrogs
  - Blue mussels
  - Cheatgrass
  - Brown tree snakes
  - Zebra mussels
22. Species that fulfill a narrow niche and depend on specific requirements for survival are considered:
- Generalists
  - K-selected
  - Specialists
  - r-selected
  - Survivors
23. Essential to the process of natural selection and evolution are:
- Survival and adaptations
  - Adaptations and reproduction
  - Adaptations and mutations
  - Survival and reproduction
  - Adaptations and reproduction
24. In a population of anteaters, in order to reach ants far underground, each generation has successively longer tongues than the preceding generation. Which of the following types of selection does this adaptation reflect?
- Directional selection
  - Disruptive selection
  - Stabilizing selection
- I only
  - II only
  - III only
  - I and II
  - II and III

Questions 25–27 refer to the following graph.



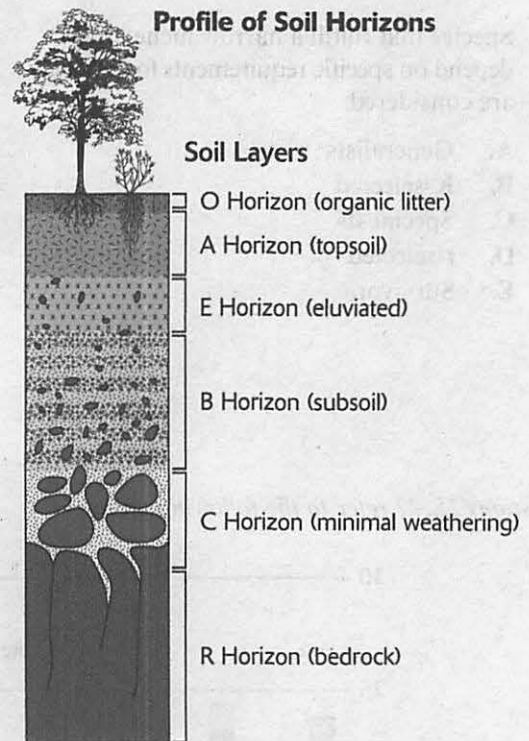
Source: U.S. Energy Information Administration



25. Which statement best explains the trend of energy consumption in India?
- Both past and projected consumption remain stable into the future.
  - Both past and projected consumption are steadily increasing.
  - Projected consumption appears to decline.
  - Though past consumption increased dramatically, consumption is projected to nearly level out in the future.
  - Both past and projected consumption increase at a rapid rate.
26. Which of the following most likely explains the projected increase in energy consumption in China?
- Fewer available resources
  - An increase in the number of elderly in the population
  - A growing population
  - Decline in technological advancements
  - A high rate of immigration into the country
27. Which of the following could potentially explain the projected decline in energy consumption in the United States?
- More available resources
  - An increase in the number of young people in the population
  - A growing population
  - Technological advancements
  - A high rate of immigration into the country
28. A population of wolves was divided when a river changed course. Over time, the separated populations developed different adaptations, so that when the two populations came into contact, they could no longer interbreed. This is an example of:
- Adaptive traits
  - Biodiversity
  - Sympatric speciation
  - Natural selection
  - Allopatric speciation

29. Which of the following nations consume the most oil?
- The United States, China, and Japan
  - Saudi Arabia, Iran, and Iraq
  - Russia, China, and India
  - The United States, Russia, and China
  - Iran, Iraq, and Russia

Questions 30–31 refer to the following diagram.



30. Which soil horizon contains the most nutrients for plant growth?
- O horizon
  - A horizon
  - E horizon
  - B horizon
  - R horizon
31. Which soil horizon is considered parent material?
- O horizon
  - A horizon
  - E horizon
  - B horizon
  - R horizon

32. Where is acid precipitation most commonly found?
- Downwind of industrial emissions
  - Upwind of industrial emissions
  - Where industrial emissions are released
  - Where excessive fertilizer and pesticides are sprayed
  - Next to nuclear power plants
33. Which of the following is the most abundant gas in the Earth's atmosphere?
- Oxygen
  - Nitrogen
  - Argon
  - Hydrogen
  - Helium
34. What is meant by the phrase *fishing down the food chain*?
- Humans have harvested the majority of the smaller fish and are now fishing for larger fish.
  - Techniques such as long-lining and drift-netting are catching fish of all sizes, so humans are depleting the entire fish population.
  - Humans are depleting larger fish stocks, leading to the harvesting of smaller and smaller fish.
  - Fishing efforts are now focusing on the benthic environment, depleting the organisms at this level.
  - Only small fish are being harvested.
35. The Hawaiian Islands were formed from which of the following processes?
- Diverging plates
  - Hot spots
  - Earthquakes
  - Plate subduction
  - Sea-level change
36. Which part of the ocean contains most of the ocean's primary productivity?
- Benthic zone
  - Abyssal zone
  - Hadal zone
  - Photic zone
  - Intertidal zone
37. The main goal of the creation of golden rice is to provide
- A more nutritious rice that contains vitamin B
  - A frost-resistant rice
  - A form of rice that contains a preservative
  - A more nutritious rice that contains vitamin A
  - Pest-resistance
38. Permit trading is used as a way to
- Provide capitalistic incentives for companies to reduce emissions
  - Create a top-down approach to emission standards
  - Enable different countries to trade
  - Enforce socialism
  - Provide incentives for companies to work cooperatively
39. All the following are important and unique properties of water EXCEPT:
- Cohesiveness
  - The ability to resist temperature change
  - The low density of ice
  - The ability to bond
  - Neutral pH
40. In which of the following ecosystems do tree roots serve as important havens for biodiversity?
- Salt marshes
  - Coral reefs
  - Mangrove forests
  - Estuaries
  - Freshwater wetlands
41. An energy source that is difficult to extract but contains a large amount of energy is:
- Natural gas
  - Methane hydrate
  - Manganese nodules
  - Anthracite
  - Hydrogen

42. In the United States, the largest component of the municipal solid waste stream is:
- A. Yard clippings
  - B. Plastics
  - C. Food remnants
  - D. Glass and wood
  - E. Paper
43. Which of the following changes most likely acted as a key step toward the dramatic and steady decline in levels of lead in human blood between the 1960s and 1990s?
- A. Decreased use of lead in water pipes
  - B. Removal of lead as a gasoline additive
  - C. Reduction in emissions containing lead
  - D. Decreased use of lead in paint
  - E. Reduction in the usage of lead in building materials
44. Which organization is responsible for the safety of workers at their jobs?
- A. Occupational Safety and Health Administration
  - B. Environmental Protection Agency
  - C. Organization of Safety and Health
  - D. Food and Drug Administration
  - E. Department of Labor

Questions 45–47 refer to the following answer choices.

- A. Toxic Substances Control Act
  - B. CERCLA
  - C. National Environmental Policy Act
  - D. Resource Conservation and Recovery Act
  - E. Clean Water Act
45. Called the “Superfund” Act, this law mandated a federal hazardous-waste cleanup program.
46. This law manages and monitors the movement of hazardous waste.
47. This law mandates the preparation of environmental impact statements (EISs).

48. Which of the following organisms has high biotic potential?
- A. Whale
  - B. Human
  - C. Elephant
  - D. Frog
  - E. Gorilla
49. A resource manager attempts to harvest as many trees as possible without depleting the overall supply. This is applying the concept of
- A. Profit margin
  - B. Maximum sustainable yield
  - C. Adaptive management
  - D. Selective management
  - E. Ecosystem-based management
50. Persistent organic pollutants (POPs) are dangerous because they
- A. Remain in the environment, bio-accumulate in organisms, and bio-magnify throughout the food chain
  - B. Are considered carcinogens
  - C. Are corrosive and toxic
  - D. Persist in the environment and contribute to an increase in greenhouse gases
  - E. Are radioactive
51. Why has Haiti experienced repeated earthquakes throughout history?
- A. The area experiences recurring volcanic eruptions.
  - B. The nation is on a fault line.
  - C. It is an island, and islands are more prone to earthquakes.
  - D. The sediment is unstable.
  - E. The island is close to the North American plate
52. Which of the following reflects why there is concern over BPA found in foods?
- A. BPA is considered a carcinogen.
  - B. BPA is considered a teratogen.
  - C. BPA is considered an endocrine disruptor.
  - D. BPA is considered a mutagen.
  - E. BPA is considered an allergen.

53. What is one difficulty when conducting a cost-benefit analysis relating to an environmental action?
- Benefits usually outweigh costs.
  - The environmental costs and benefits associated with an action cannot necessarily be quantified.
  - The benefits are usually exceptionally high with respect to costs.
  - This is not a tool that is used in the environmental field.
  - The costs and benefits of an environmental action cannot be assessed.
54. Which of the following are repercussions experienced by the regions affected by the *Deepwater Horizon* oil spill in 2010?
- Economic loss to fishermen
  - Destruction of nesting sites for bird species
  - Endocrine disruption in organisms
- I only
  - II only
  - III only
  - I and II only
  - I, II, and III

Questions 55–57 refer to the following answer choices.

- Subsidy
  - Marketable emissions permit
  - Laws and regulations
  - Lobbying
  - Green tax
55. Uses market capitalism to reduce pollution.
56. Deters environmentally destructive activities.
57. Offers incentives to act in an environmentally friendly way.
58. The disposal of waste, including hazardous waste in a landfill, is mandated and controlled by the:
- Comprehensive Response Compensation and Liability Act
  - Pollution Prevention Act
  - Superfund Amendments and Reauthorization Act
  - Toxic Substances Control Act
  - Resource Conservation and Recovery Act

59. If a population is growing at a rate of 0.7 percent annually, the population will double in how many years?
- 20
  - 50
  - 65
  - 100
  - 140
60. Negative feedback loops
- Maintain the stability of systems
  - Are closed systems
  - Are becoming more common in nature because of human impact on the environment
  - Are open systems
  - Never occur in nature
61. Which of the following best describes the process of cellular respiration?
- Oxygen, water, and solar energy are used to produce carbon dioxide and sugar.
  - Oxygen, sugar, and solar energy are used to produce carbon dioxide and water.
  - Carbon dioxide, water, and solar energy are used to produce oxygen.
  - Oxygen and sugar are used to produce carbon dioxide, water, and energy.
  - Carbon dioxide and water are used to produce oxygen, sugar, and more carbon dioxide.
62. Often an endemic species is more prone to extinction than other species because it:
- Is endangered
  - Is found only in one location on the planet
  - Lives in a disaster-prone region
  - Is an introduced species
  - Has a limited food source
63. Which of the following is often considered a pioneer species?
- Brown tree snake
  - Mosquito
  - Lichen
  - Red-tailed hawk
  - Beaver

64. If soil is comprised of large particles and, therefore, has large pore spaces, it allows water to flow through more easily and is said to have:

- A. High soil porosity
- B. Low soil porosity
- C. High soil permeability
- D. Low soil permeability
- E. Waterlogging

65. Which of the following countries has the smallest ecological footprint?

- A. Canada
- B. Mexico
- C. Chile
- D. Pakistan
- E. China

66. In a country with a pyramid-shaped age structure diagram, there is a:

- A. Growing population
- B. High rate of disease affecting the working-age population
- C. Smaller labor market, as well as more stress on social systems to support the elderly
- D. Weak military and labor market
- E. High rate of death among younger age groups

67. In a country with 75 out of 1,000 people being added to the population through births and immigration and 50 out of 1,000 people leaving the population through death and emigration, what is the growth rate of this country?

- A. 1.8 percent
- B. 2.9 percent
- C. 2.5 percent
- D. 2.1 percent
- E. 3.4 percent

68. Chronic exposure to a substance means that an organism has been exposed to:

- A. High levels over a long period of time
- B. High levels over a short period of time
- C. Low levels over a short period of time
- D. Low levels over a long period of time
- E. Moderate levels over a lifetime

69. Minerals are transported through the soil via a process called:

- A. Active transport
- B. Waterlogging
- C. Leaching
- D. Porosity
- E. Permeability

70. Highway congestion is considered an example of:

- A. An ecological footprint
- B. Sustainable use
- C. Resource management
- D. A tragedy of the commons
- E. Maximum sustainable yield

Questions 71–73 refer to the following answer choices.

- A. Parasitism
- B. Commensalism
- C. Competition
- D. Amensalism
- E. Herbivory

71. A hookworm living inside a dog's intestine.

72. A blue jay living in a tree.

73. Sea lice living on a sunfish.

74. Which of the following is an example of a detritivore?

- A. Mushroom
- B. Bacteria
- C. Squirrel
- D. Millipede
- E. Ladybug

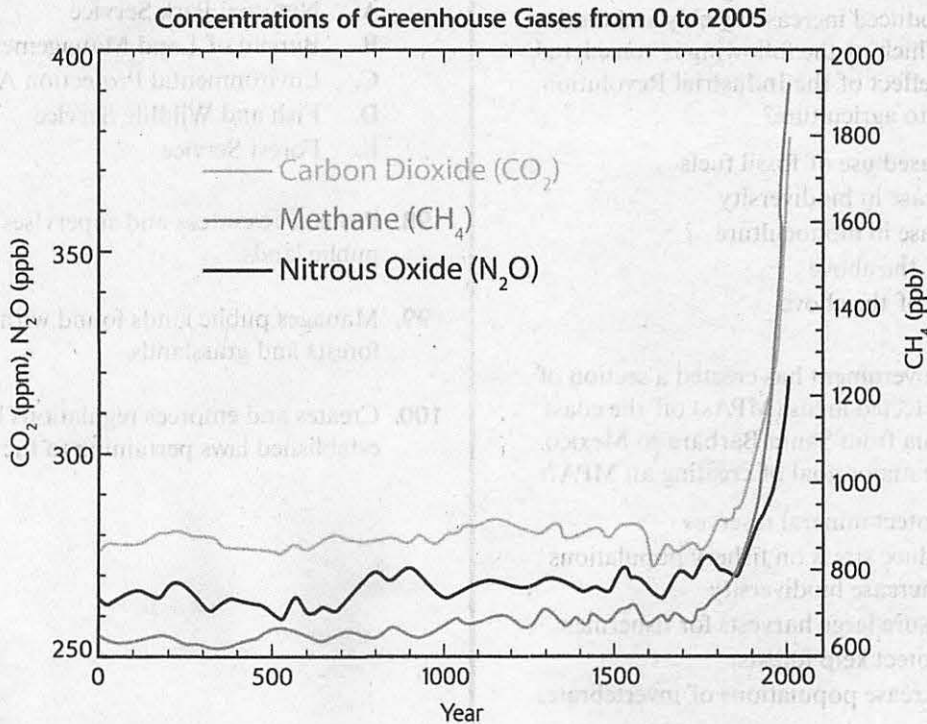
75. How can asbestos be harmful to humans?

- A. Asbestos binds to hemoglobin and blocks oxygen from binding, preventing oxygen from circulating in the blood.
- B. Asbestos acts as an endocrine disruptor.
- C. Asbestos lodges in the lining of the lungs, provoking the production of acid to destroy the invader, but over time it can potentially lead to cancer.
- D. In its gaseous form, asbestos can be inhaled and ultimately cause cancer.
- E. Asbestos can be absorbed into the blood, potentially poisoning the body.

76. In terms of matter, Earth is considered to be
- A closed system
  - An open system
  - A positive feedback loop
  - In homeostasis.
  - Unbalanced
77. Anthropogenic sources of methane include
- Methane hydrates
  - Wetlands
  - Landfills
  - Termites
  - Wildfires
78. Mercury enters the aquatic food web mainly through
- The processes of bio-accumulation and bio-magnification
  - Deposition from atmospheric sources
  - Decomposition of organisms
  - Ocean dumping
  - Fertilizer and pesticide runoff
79. During which step in the sewage treatment process are suspended solids removed?
- Pretreatment
  - Primary treatment
  - Secondary treatment
  - Tertiary treatment
  - Final treatment
80. Potential threats to biodiversity as a result of climate change include all the following EXCEPT:
- An increase in drought in some regions
  - The possibility that vegetation types could shift throughout latitudes
  - The possibility that specialized species may perish
  - The possibility that glaciers will increase in size
  - An increase in global average surface temperature
81. Which of the following is true of recombinant DNA technology?
- It is illegal under the Kyoto Protocol.
  - DNA from different species is combined.
  - There are few benefits seen from this technology.
  - It is only used for crops at this point in time.
  - It can cause mutated genes in humans.
82. In the oceans, upwellings generate areas of:
- High biotic potential
  - Low primary productivity
  - High primary productivity
  - Nutrient-poor waters
  - Strong currents
83. The process of mining can be very destructive to the environment. Which of the following best summarizes this destruction?
- Wildlife loss, toxic waste and runoff, air pollution
  - Human death, wildlife loss, acid drainage
  - Vegetation removal, acid drainage, toxic waste and runoff
  - Toxic waste, displacement of wildlife, demolition of towns
  - Earthquakes, acid drainage, vegetation removal
84. The IPAT model describes:
- The human impact on the environment through the effects of population numbers, affluence, and technological innovations
  - The human influence on the environment through the effects of pollution, affluence, and technological innovations
  - The human impact on the environment through the effects of population numbers on aquatic and terrestrial biomes
  - The International Pollution and Atmospheric Team
  - The human influence on the environment through the effects of pollution, atmosphere, and technological innovations

85. What is the important lesson modern society should learn from Easter Island?
- Unsustainable use of a resource will ultimately lead to the downfall of a civilization.
  - It is not wise to inhabit an island.
  - Lack of food can destroy a society.
  - Sustainable resource use is not necessarily important to the survival of a civilization.
  - Leaving behind relics is essential to having your civilization remembered throughout history.
86. The deterioration of soil by human actions can be considered a
- Negative feedback loop because, eventually, the system will stabilize and the soil will return to its previous state
  - Positive feedback loop because once soil becomes degraded, further consequences occur as a result
  - Negative feedback loop because once soil becomes degraded, further consequences occur as a result
  - Positive feedback loop because eventually the system will stabilize and the soil will return to its previous state
  - Both a positive feedback loop and a negative feedback loop because, at first, the system is unstable and moving toward an extreme, but eventually it balances out and becomes stable again
87. Family planning is a successful measure used to reduce population growth in many developing countries. All the following are frequent components of family planning EXCEPT
- Making contraceptives available
  - Empowering females to make decisions
  - Strengthening patriarchal households
  - Improving reproductive healthcare options
  - Education
88. Which of the following countries currently has the highest population?
- United States
  - China
  - India
  - Brazil
  - Bangladesh
89. How does soil compaction affect the use of the land?
- Compacted soils have negligible effects on land use.
  - Compacted soils help reduce the threat of invasive species taking over.
  - Although compacted soils reduce the flow of water through the soil, there is an increase in the availability of oxygen.
  - Soil compaction helps to keep the topsoil from eroding.
  - Compaction reduces space between soil particles, obstructing the flow of gases, nutrients, and water through the soil.
90. How do El Niño events cause economic loss to countries on the Pacific Coast of North America, Central America, and South America?
- Fewer upwellings bring fewer nutrients to the fisheries along the coasts, diminishing available catch for fishermen.
  - There is an increase in tropical storms, which can be destructive when they hit land.
  - Large amounts of money are spent in an effort to protect the coastlines.
  - Ocean waters are warmed, thus killing large numbers of marine organisms that cannot survive in the increased temperatures.
  - More upwellings bring large amounts of nutrients to the fisheries along the coasts, reducing available nutrients to the benthic environments.
91. Which element is consumed during decomposition in an aquatic environment, potentially leading to a hypoxic situation?
- Nitrogen
  - Phosphorous
  - Calcium
  - Carbon
  - Oxygen

Questions 92–94 refer to the following graph.



92. Which of the following is the most likely cause of the recent trend noted for all three gases?
- Increased burning of wood and biomass for fuel
  - Increasing number of livestock being raised
  - Increased combustion of fossil fuels
  - Global climate change
  - More materials being disposed of in landfills
93. What are the repercussions of this trend on the environment?
- Decreased sedimentation in benthic zones
  - Overall changes in climate patterns around the world, including more severe weather events
  - Increased growth of vegetation on a global scale
  - Growth of ice coverage over most of the Earth
  - Global cooling
94. What is one way in which CO<sub>2</sub> emissions can be reduced?
- Sequester carbon in the lithosphere.
  - Reduce the number of livestock globally.
  - Keep ocean temperatures more constant.
  - Reduce fertilizer use.
  - Use alternative, renewable sources of energy.
95. If there are an estimated 84 billion barrels of oil left in a country's reserves, and the rate of production is 4 billion barrels per year, what is the reserves-to-production ratio of oil for this country?
- 49 years
  - 33 years
  - 21 years
  - 336 years
  - 500 years



96. During the Industrial Revolution, much advancement was made in agriculture, which, in turn, produced increased yields and food security. Which of the following is considered a negative effect of the Industrial Revolution in relation to agriculture?
- A. Increased use of fossil fuels
  - B. Decrease in biodiversity
  - C. Increase in monoculture
  - D. All of the above
  - E. None of the above
97. The U.S. government has created a section of marine-protected areas (MPAs) off the coast of California from Santa Barbara to Mexico. What is the major goal of creating an MPA?
- A. To protect mineral reserves
  - B. To reduce stress on fishery populations and increase biodiversity
  - C. To ensure large harvests for fishermen
  - D. To protect kelp forests
  - E. To increase populations of invertebrates

Questions 98–100 refer to the following answer choices.

- A. National Park Service
  - B. Bureau of Land Management
  - C. Environmental Protection Agency
  - D. Fish and Wildlife Service
  - E. Forest Service
98. Protects resources and supervises use of public lands.
99. Manages public lands found within national forests and grasslands.
100. Creates and enforces regulations based on established laws pertaining to the environment.

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.



## Section II: Free-Response Questions

**Time: 90 minutes**

**4 questions**

**Directions:** Each question is equally weighted. Plan to budget your time and allow yourself approximately 20 minutes per question. Write clearly to show any calculations when computations are necessary. Calculators are not allowed. Where an explanation or discussion is required, support your answers with relevant information, facts, and/or specific examples.

*Question 1 refers to the following article from Reuters (PARS International Corp.).*

### U.S. Coral Reefs under Threat, Report Finds

Reefs in the Caribbean, in particular, are under severe assault, and coral in the U.S. Virgin Islands and off Puerto Rico had not recovered from 2005, when unusually warm waters that led to massive bleaching and disease killed up to 90 percent of the marine organisms on some reefs.

"The evidence is warning us that many of our coral reef ecosystems are imperiled and we as a community must act now," said Kacky Andrews, program manager of the Coral Reef Conservation program at the National Oceanic and Atmospheric Administration.

The new NOAA report on the state of coral reefs in the United States and Pacific territories, including Palau and Guam, was presented at a meeting of coral reef scientists in Fort Lauderdale, Florida.

It was the third such report and the second to be based on actual monitoring of reefs. The reefs were classified as excellent, good, fair, or poor based on such things as water quality, fish population, and the threats they faced.

1. Answer the following questions:
  - A. Explain two reasons why coral reefs are being threatened worldwide.
  - B. Discuss the process of coral bleaching and its impact on coral reefs.
  - C. What are two ways in which coral reefs can be protected from future destruction?
  - D. Explain the importance of protecting coral reefs.
  
2. Populations continually experience growth or decline. The human population continues to increase exponentially, with environmental and societal consequences. Following is a table representing the growth rates of a few countries.

Country	Growth Rate
Turkey	1.0
Brazil	1.2
Philippines	2.0
Kuwait	3.6

- A. Calculate the doubling time for the population of Kuwait.
- B. Calculate the natural growth rate for a country with a birth rate of 350 out of 1,000 and a death rate of 380 out of 1,000.
- C. List and explain another statistic used by demographers to predict the population growth of a country.
- D. Explain why the extinct civilization of Easter Island is considered a warning for modern society.
- E. Describe two ways in which population growth can be slowed.

3. Persistent organic pollutants (POPs) are toxic chemicals that can cause health issues in humans and wildlife.
  - A. What makes POPs so dangerous when released into the environment?
  - B. Explain two ways in which POPs are harmful to humans and wildlife.
  - C. How do POPs enter the environment? Explain POP reservoirs.
  - D. Name and describe one of the international treaties related to POPs.
  - E. Explain the purpose of DDT and issues with its use.
  
4. Coal mining is a major industry in Wyoming and provides energy for essential services throughout the country. As the third largest coal producer in the country, Wyoming's coal is either sub-bituminous or bituminous.
  - A. Identify two environmental consequences of coal combustion.
  - B. Discuss three positive economic effects of coal mining.
  - C. Explain one way in which coal is mined.
  - D. Discuss two uses for coal.
  - E. Explain two terrestrial environmental impacts of coal mining.

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.



# Answer Key

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## Section I: Multiple-Choice Questions

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

## Answer Explanations

### Section I: Multiple-Choice Questions

- B** The Montreal Protocol was a very successful international agreement to reduce CFCs, signed in 1987. It required participating nations to reduce CFC emissions by half. As a result, the ozone layer has been recuperating throughout the past two decades.
- A** The production of electricity and transportation are the two main contributors to global emissions of greenhouse gases. Fossil fuels power many electrical power plants and most forms of transportation, both of which are increasing along with the human population.
- D** A tragedy of the commons is the overexploitation of a resource due to unregulated use, and the best way to address this issue is through some form of regulation. This regulation can occur through private ownership, government regulation, or a cooperative effort of participants involved in the use of the resource.
- C** Death rates fall during the transitional stage of demographic transition due to more efficient and reliable food production and medical advancements, which reduce death due to starvation and health-related causes.
- C** Water vapor is the most abundant greenhouse gas, considered as such because of its ability to absorb reflected solar radiation that would otherwise escape into space.
- A** Radiation is released when temperatures in the core of the reactor increase and the uranium fuel rods melt. Water is usually used as a way to keep the reactor core cool in a nuclear power plant. If the coolant water is lost or leaks in some way, the core will quickly overheat, causing the melting of the metal in which the uranium fuel rods are located. This allows radiation from the uranium to escape from the core.
- E** Despite lower overall populations, industrialized nations use close to 100 percent more energy than developing nations do. This is because people in industrialized nations use relatively large amounts of energy for transportation; industry; and home heating, cooling, and lighting. Because industrialized nations have the economic ability to consume in excess, they do, and this consumption is currently not balanced by energy-saving technologies.
- A** Photochemical smog is produced when atmospheric nitrogen reacts with oxygen to produce nitric oxide, which then combines with oxygen to form nitrogen dioxide. Nitrogen dioxide absorbs light energy and splits to form nitric oxide and atomic oxygen. The oxygen atoms combine with the  $O_2$  in air to produce ozone. Then nitric oxide can remove ozone by reacting with it to form nitrogen dioxide and oxygen.
- B** Breeder nuclear reactors make more efficient use of the fuel than conventional nuclear reactors do. This is because breeder reactors make use of the isotope U-238, which is discarded as a waste product in conventional reactors.
- A** Polybrominated diphenyl ethers (PBDEs) are used as fire retardants in consumer products ranging from computers and televisions to couches, curtains, and plastics. Unfortunately, PBDEs can be released when products are created and during disposal. PBDEs may cause cancer and neurological problems.
- D** A temperate deciduous forest is mainly comprised of deciduous trees, which are trees that lose their leaves in the winter months.
- B** Invasive species thrive in a new environment because of the lack of limiting factors, including lack of predators and disease, potentially abundant food sources, and the ability to outcompete native species for resources.
- B** Hydrogen power uses electrolysis to split water molecules into their component parts of hydrogen and oxygen. Although this process makes pure hydrogen without creating any harmful or polluting by-products, overall emissions depend on the source of the electricity used for electrolysis. The chemical equation for this reaction is:  $2H_2O \rightarrow 2H_2 + O_2$ .
- D** Both passive and active solar energy use some form of heat-trapping material to capture incoming solar radiation. With passive solar energy, the heat-trapping materials—including brick, concrete, and

tile—absorb solar radiation directly. In active solar collection, solar collectors are used to capture heat from the sun. The solar panels are made of a dark metal that absorbs the heat, which is then transferred to a liquid circulating throughout an area, heating a building or water.

15. **E** Hydropower uses a dam to control water flow, generating power as water is released from the dam to power turbines.
16. **B** The Green Revolution brought new farming techniques, crop varieties, and increased food production. During this time, agricultural techniques were industrialized and the processes made more efficient. Increased yield was attained from each plot of land. Selectively breeding crops for specific traits helped to make more pest- and disease-resistant strains.
17. **A** Agriculture and deforestation are the two main contributors to soil degradation worldwide. When forests are cleared, the soil is exposed to wind and water, which can lead to erosion. Agriculture removes the protective cover of vegetation on soil, making the soil prone to erosion as well. Topsoil erosion reduces soil nutrients and its ability to retain water.
18. **B** Nuclear energy produces the least amount of greenhouse gas emissions relative to fossil fuels and biomass since combustion is not part of the nuclear process. The downside of nuclear energy, though, is the production of radioactive toxic waste.
19. **A** Chaparral ecosystems are adapted to frequent wildfires. Some vegetation found there has a protective coating to help resist fire damage, while other types of plants and trees germinate from the extreme heat of fire.
20. **C** Net primary production is the amount of energy available to heterotrophs. This represents the amount of energy from a plant available to consumers after the plant has used some energy through cellular respiration to meet its own energy needs.
21. **E** Zebra mussels were introduced to the United States through ships entering the Great Lakes. Because they had few natural limiting factors in the new environment, this invasive species proliferated. The repercussions of this invasion have been far-reaching and expensive. The zebra mussels are small, so they can get inside pipes and clog them; cling to docks, buoys, and boat engines; and damage fishing equipment.
22. **C** Specialists fill a narrow niche and have specific requirements for survival. These organisms can be affected easily by environmental changes, so they are more prone to extirpation and extinction.
23. **D** Organisms pass on their genes through reproduction. To do so, organisms must survive to reproductive age. Adaptations that allow this survival are coded in an organism's genes, so well-adapted organisms survive to reproduce and pass on these successful genes to their offspring. This is the process of natural selection.
24. **A** The development of long tongues over generations reflects directional speciation, during which one extreme of a trait is selected. This is in contrast to disruptive selection, in which extreme traits are favored in either direction (extremely short *or* extremely long tongues), or stabilizing selection in which the middle ground between two versions of a trait is reflected (a mid-length tongue).
25. **D** With India's growing population and increasing wealth, it is consuming more resources. However, the graph shows that the country's growth is predicted to slow in the future.
26. **C** An increasing population could explain why energy consumption in China is predicted to increase. More people use more energy, and China's increasing wealth leads to more per-capita energy consumption.
27. **D** The projected decrease in consumption in the United States could be attributed to improvements in technological advancements, which includes increased use of alternative forms of energy.
28. **E** Allopatric speciation occurs when a population of organisms is separated due to a geographic barrier, such as a river changing course, mountain range forming, glaciers progressing, or sea level rising. When populations are separated, each adapts to specific environmental conditions and, over time, can become so different from each other that they lose the ability to interbreed. At this point, they are considered distinct species.

29. **A** The United States, China, and Japan consume the most oil worldwide. This is due to large population (China) and high economic ability (United States and Japan).
30. **B** Considered the topsoil, the A horizon contains the most nutrients for plant growth. When the organic matter from the O horizon decomposes, the nutrients are deposited on the A horizon right below it.
31. **E** The R horizon is the location of bedrock. It is also considered to be the parent material of soil and is often the deepest part of the soil horizon.
32. **A** Acid precipitation is formed from the chemicals released into the atmosphere during combustion in industrial processes and vehicle emissions. The chemicals react in the environment to form acid precipitation. Because emissions and particulate matter can be carried long distances in the atmosphere, acid precipitation can occur far from its source.
33. **B** Nitrogen is the most abundant gas in the Earth's atmosphere, making up 78 percent of its composition. Oxygen makes up 21 percent and other gases comprise the remaining 1 percent.
34. **C** Humans are depleting stocks of large fish, leading to the harvesting of smaller and smaller fish. This is considered fishing down the food chain because the largest fish make up the top of the food chain in an ecosystem, and the smaller fish are located at the bottom.
35. **B** Hot spots occur when magma breaks through the middle of a plate, emerging and hardening on the surface. As this occurs over time, the hardened magma continues to layer and ultimately may rise above sea level. This is how the Hawaiian Islands formed.
36. **D** The photic zone is the top layer of the ocean. It receives the most solar radiation and, in turn, provides energy for most of the ocean's primary productivity.
37. **D** Vitamin A deficiency is common in malnourished populations and can lead to blindness and reduced ability to battle infection. Golden rice is a genetically modified food created with the purpose of providing people in these regions with vitamin A.
38. **A** Permit trading allows companies to buy and sell emissions permits. A certain level of emissions is established within an industry for a particular pollutant. Companies are issued a certain number of permits for these emissions. They can buy, sell, and trade these permits as long as the overall standards are met. This is considered a way to meet environmental standards through the use of capitalism.
39. **E** Only pure water has a neutral pH. The minerals and other components of naturally occurring water alter its pH slightly to become either somewhat basic or somewhat acidic.
40. **C** Mangrove forests are populated by trees that thrive in a saline environment and are partially submerged by water through much of their lives. Some roots extend upward to access oxygen from the air, and other roots extend down to act as support for the tree. This unique shape also offers protection for fish eggs and young fish.
41. **B** Methane hydrate is a solid form of methane located deep on the ocean floor. In its molecular structure, the methane hydrate is surrounded by a crystal lattice of water molecules. Methane hydrates are difficult to extract because the structure can destabilize and release methane gas, a greenhouse gas. The release of gas can also cause instability in rock and sediment structures.
42. **E** Paper is the largest part of the waste stream in the United States. Despite the fact that paper can be recycled, it is still used in many products that are not put into the recycle bin.
43. **B** Lead was an additive in gasoline but was phased out as an additive in the 1970s due to its ability to bio-accumulate in organisms and act as a neurotoxin, particularly for younger humans. As lead use was reduced, so were emissions and, ultimately, blood level concentrations in people.
44. **A** Occupational Safety and Health Administration (OSHA) is a federally run agency responsible for worker safety on the job.
45. **B** CERCLA, the Comprehensive Response Compensation and Liability Act, also called "Superfund," provides a federal means to clean up, or remediate, soil and water contaminated with hazardous waste. If

possible, parties responsible for the contamination are made to pay for cleanup. If not, the cost of cleanup comes from federal taxpayer monies.

46. **D** In an effort to reduce illegal dumping, the Resource Conservation and Recovery Act (RCRA) manages the creation, movement, and disposal of hazardous waste as well as nonhazardous solid waste.
47. **C** The National Environmental Policy Act (NEPA) mandates that the environment be taken into account prior to any development, including requiring preparation of an environmental impact statement (EIS) prior to any federal action that will or could potentially disrupt the environment.
48. **D** A frog has high biotic potential because it reproduces many young at one time. High biotic potential means that an organism has the ability to produce many offspring. Since a frog is considered to be an r-selected species, it produces many eggs at once, with some surviving into adulthood but the majority perishing at some point prior to reproductive age.
49. **B** Maximum sustainable yield requires harvesting a renewable resource for use while also maintaining the resource at adequate levels for the future—in this case, harvesting trees only at the pace at which they grow back.
50. **A** Persistent organic pollutants (POPs) remain in the environment and can bio-accumulate in organisms and potentially bio-magnify through the food chain. Substances classified as POPs do not break down easily.
51. **B** Haiti is located on a fault line between the North American and Caribbean plates. The two plates slide past each other at a transform boundary.
52. **C** BPA stands for bisphenol-A, which is a chemical used to make polycarbonate plastics and epoxy resins. Polycarbonate plastic is used to make popular containers for many foods and drinks. Its advantage is that it is lightweight, has a high resistance to heat, is tough, and has excellent electrical resistance. However, BPA is an endocrine disruptor and humans can unknowingly have daily exposure to BPA that leaches out of plastic containers into foods and beverages.
53. **B** Environmental costs and benefits are not easily quantified, because many of the pros and cons are subjective or immeasurable.
54. **D** Fishermen have suffered massive economic losses due to the oil spill. Also, the oil has accumulated on some shores, affecting the nesting sites of shore birds, potentially impacting long-term populations. To date, endocrine disruption has not been noted as a result of the oil spill. Although the dispersant used was originally thought to be a potential endocrine disruptor, no such problems have been seen.
55. **B** Permit trading allows companies to buy and sell emissions permits. A certain level of emissions is established within an industry for a particular pollutant. Companies are issued a certain number of permits for these emissions. They can buy, sell, and trade these permits as long as the overall standards are still met. This is considered a way to meet environmental standards through the use of capitalism.
56. **E** A green tax is a tool used to discourage an environmentally harmful activity. It is a tax imposed on a company for harmful actions to the environment.
57. **A** A subsidy provides a financial incentive for a company to act in an environmentally responsible manner.
58. **E** The Resource Conservation and Recovery Act (RCRA) was established in an effort to reduce illegal dumping. It manages the creation, movement, and disposal of hazardous waste as well as nonhazardous solid waste.
59. **D** To calculate the doubling time of a population, use the equation  $70 \div \text{annual growth rate}$ . Therefore, if a population is growing at a rate of 0.7 percent annually, the answer is found as follows:  $70 \div 0.7 = 100$ . This means the population will double in 100 years.
60. **A** Negative feedback loops maintain ecosystem balance. System outputs in excess of the norm turn off the mechanisms that create these outputs, realigning the system with its norms.
61. **D** In the process of cellular respiration, oxygen and sugar are used to produce carbon dioxide, water, and energy.



62. **B** An endemic species is native to only one location on the planet, which means that alterations to only one local ecosystem can make the species extinct.
63. **C** Lichens are considered a pioneer species. When a major disturbance occurs and destroys all living components of an ecosystem, one of the first species to arrive at the devastated area are lichens, which help to recolonize the area. They can do this because of their ability to be carried great distances in the air, as well as the unique mutualistic relationship between the fungi and algae that make up lichen. The fungi hold on to rocks and absorb moisture while the algae produce food via photosynthesis.
64. **C** Soil comprised of larger particles, which have larger pore spaces, allows water to flow through more easily. This means it has high soil permeability.
65. **D** Pakistan has a smaller ecological footprint than Canada, Chile, Mexico, or China because of its relatively low rates of consumption and waste.
66. **A** In a country with a pyramid-shaped age structure diagram there is a growing population. The pyramid shape represents a population with a large number of young and a progressively smaller number of people at older ages. Since the majority of the population are not yet at reproductive age, when they do reach this point, more people will have children and, therefore, the population will continue to increase.

67. **C** To find the growth rate of a population the following equation is used:

$(\text{Crude Birth Rate} + \text{Immigration}) - (\text{Crude Death Rate} + \text{Emigration}) = \text{Growth Rate per 1,000 Individuals}$

The answer is then multiplied by 100 to convert it to a percent.

In this case, the crude birth and immigration rates have already been added to equal  $\frac{75}{1,000}$ , and death and emigration have already been added to equal  $\frac{50}{1,000}$ , allowing the following calculation:

$$\frac{75}{1,000} - \frac{50}{1,000} = \frac{25}{1,000} = 0.025$$

Then convert it to a percent by multiplying by 100. The answer is 2.5 percent.

68. **D** Chronic exposure to a substance means exposure has occurred in small doses over a long period of time.
69. **C** Leaching is the process of minerals being transported down through the soil via water. As the water percolates through the soil, minerals are carried with it downward to other soil horizons. Unfortunately, pollution can be leached as well.
70. **D** Highway congestion is considered an example of a tragedy of the commons. Highways are used often and without regulation. A tragedy of the commons occurs when an unregulated resource is used unsustainably.
71. **A** A hookworm is an intestinal parasite, consuming nutrients from the host for survival. This will harm the host and may kill it.
72. **D** A blue jay living in a tree is an example of amensalism; the tree is providing habitat and shelter for the blue jay, and the tree is unaffected in this relationship.
73. **A** Sea lice living on a sunfish is a parasitic relationship. The sea lice feed off of the blood of the sunfish, harming it but not killing it, because it is beneficial for the parasite to keep its host alive.
74. **D** A millipede is considered a detritivore; physically breaking down dead organic matter through scavenging. Decomposers chemically break down dead organic matter.
75. **C** Asbestos is a fibrous mineral found in the lithosphere. People can potentially inhale small fibers of asbestos, which can lodge in the lining of the lungs, provoking the production of acid to destroy the invader. Over time, this chronic destruction can lead to cancer.
76. **A** A closed system is self-contained, without outside input. Despite minimal additions of space dust and occasional meteorites, the Earth is considered a closed system in relation to matter.

77. **C** Landfills produce methane through the anaerobic decomposition of organic matter. This methane is collected and reused for energy, burned, or released into the atmosphere.
78. **B** Mercury is added to the environment mostly as the particulate matter byproduct of combustion. As the heavy metal falls out of the air, it is deposited onto the ground and into aquatic sources. Runoff from land can transport this deposited mercury into aquatic environments.
79. **B** Primary treatment removes suspended solids in the sewage treatment process. Settling tanks are used, where solid particles sink to the bottom and are removed.
80. **D** During the planet's current climate alteration, glaciers are retreating rather than advancing due to warming temperatures. As the glaciers retreat, the species that depend on them for survival are threatened and face potential endangerment or extinction.
81. **B** Recombinant DNA technology combines DNA from different organisms, usually with the goal of producing desired traits in a new genetically modified organism (GMO).
82. **C** Upwellings in the oceans carry nutrients from the ocean bottom to the surface, creating areas of high primary productivity.
83. **C** As a result of the process of mining, the environment can be harmed in many ways, and the destruction varies depending on the type of mining employed. In general, though, mining can lead to the removal of vegetation, acid drainage, and the production of toxic waste and runoff.
84. **A** The IPAT model examines the human impact on the environment due to population, affluence, and technological innovations. Higher population means more resources consumed. Increased affluence results in the population's ability to consume more resources and, therefore, create more waste. Technological innovations can either help the environment with advancements or create new ways to pollute and deplete resources.
85. **A** The civilization on Easter Island overused its resources, using trees unsustainably. This led to the downfall of the island's civilization. If modern society is not careful, resources may be overused to the point where they cannot be replenished.
86. **B** Soil degradation is a positive feedback loop because depleted soil leads to an increasing pace of degradation.
87. **C** Family planning is an essential tool in reducing population growth and includes the availability of contraceptives, the empowerment of females in decision-making, and improved reproductive healthcare options for women. The key component in any family-planning initiative is education, providing information to women and families.
88. **B** China currently has approximately 1.3 billion people, while India has 1.1 billion, and the United States has about 300 million.
89. **D** Compaction reduces space between soil particles, obstructing the flow of gases, nutrients, and water through the soil. It also can increase the amount of water runoff and, thus, erosion. Soils can be compacted as a result of many factors, including the weight of grazing animals and the weight of heavy equipment.
90. **A** Usually upwellings from the Humboldt Current in the Pacific Ocean bring nutrient-rich cooler waters up from the ocean bottom. During El Niño periods, the surface waters are warmer and upwellings are reduced, limiting the amount of nutrients at the ocean's surface. This affects the productivity of the ocean's fisheries, which, in turn, reduces the catch for fishermen and, thus, negatively impacts their income.
91. **E** Decomposition usually requires oxygen. When extensive decomposition occurs in aquatic environments, a great deal of oxygen is consumed. This can deplete the area of oxygen, making it hypoxic.
92. **C** Carbon monoxide, methane, and nitrous oxide are all produced as a result of fossil fuel combustion. When fossil fuel use increased in the past few centuries, so did resulting emissions.
93. **B** An increase in the amount of greenhouse gases in the atmosphere increases the amount of heat in the atmosphere, potentially altering the world's weather and climate patterns. In some situations, more severe weather events can occur.

94. **E** Using alternative, renewable energy sources is one way the levels of atmospheric carbon dioxide could be reduced. The main contributor of carbon dioxide emissions is fossil fuel combustion, which shifts the lithospheric carbon into the atmosphere, increasing concentrations of the greenhouse gas, thus contributing to climate change.
95. **C** Dividing the amount of total remaining reserves (84 billion barrels) by the annual rate of production (4 billion barrels) yields a reserves-to-production ratio of 21 years.
96. **D** All the choices listed are considered negative consequences of the Industrial Revolution as it relates to agriculture. With improvements in technology and efficiencies of farming, large monocultures were created. This, in turn, reduced biodiversity in the areas. Also, the technological advancements included the use of machinery run on fossil fuels, which produce greenhouse gas emissions.
97. **B** Marine protected areas (MPAs) are created with the goal of protecting fisheries and the biodiversity of the area. Some MPAs allow harvesting of marine organisms, while others do not allow any commercial or recreational fishing. Worldwide, there are over 400 MPAs. The network of MPAs created off the coast of California from Mexico to Santa Barbara was approved in December 2010.
98. **B** The Bureau of Land Management (BLM) is responsible for protecting resources and supervising the use of public lands.
99. **E** The Forest Service manages public lands located within national forests and grasslands, with the goal of protecting the land and its resources.
100. **C** The main focus of the Environmental Protection Agency (EPA) is the protection of both human health and the environment. This is done through the creation and enforcement of regulations based on established laws pertaining to the environment.

## Section II: Free-Response Explanations

1. This question is worth a maximum of 10 points, as follows:

**A.** Explain two reasons why coral reefs are being threatened worldwide (2 points maximum):

- 1 point: Overfishing affects the biodiversity of coral reef communities, altering the food chain and causing far-reaching impacts even beyond the reef.
- 1 point: Coral bleaching is caused by an increase in water temperatures and by pollution.
- 1 point: Tourism such as boating, diving, snorkeling, and fishing can harm reefs if people touch or collect the coral, disturb sediment, or otherwise impact the reef (for example, by dropping anchors). Some tourist resorts and infrastructure have been built directly on reefs, and some empty sewage or other waste directly into water around coral reefs.
- 1 point: Pollution from manufacturing waste, sewage, agricultural chemicals, and oil extraction and refining are toxic to reefs.
- 1 point: Excess nutrients such as nitrogen and phosphorus can cause eutrophication around a coral reef, depleting the oxygen in the aquatic environment and depriving the coral of the oxygen it needs to survive.
- 1 point: Erosion caused by construction, mining, logging, and farming leads to increased sediment in rivers. This sediment ends up in the ocean, where it can inhibit sunlight from reaching corals.
- 1 point: Harmful fishing practices such as cyanide fishing, dynamite fishing, and bottom trawling.
- 1 point: The extraction of live coral from reefs, which is used as bricks, road fill, or cement. Corals are also sold as souvenirs to tourists and for export.
- 1 point: Corals are extremely sensitive to water temperature, which is warming due to global climate change.

**B.** Discuss the process of coral bleaching and its impact on coral reefs (4 points maximum):

- 2 points: Coral lives in a symbiotic relationship with zooxanthalae, an alga. The coral provides shelter and habitat for the zooxanthalae and the alga provides food for the coral through photosynthesis. Coral bleaching occurs when the zooxanthalae leave the coral, frequently as a result of excess pollution or warming water temperatures.

- 2 points: This can leave the coral devoid of nutrients and may lead to the death of the coral. The reason this is considered bleaching is because the resulting dead coral loses its color and is white.
- C. What are two ways in which coral reefs can be protected from future destruction? (2 points maximum)
- 1 point: The proper disposal of trash and waste products.
  - 1 point: Reduction in overall water and air pollution starting at the source of pollution.
  - 1 point: Consumers ceasing to purchase coral products, such as for souvenirs or to stock aquariums, which will eventually reduce harvesting.
  - 1 point: Anchor boats away from reefs.
  - 1 point: Encouraging tourists to enjoy the beauty and uniqueness of the reefs without touching or taking.
  - 1 point: Fishing in areas not located near a reef.
  - 1 point: Reduce fertilizer use and, thus, chemical runoff that can negatively impact coral reefs.
- D. Explain the importance of protecting coral reefs (2 points maximum):
- 1 point: Coral reefs provide habitat for a wide range of organisms, offering a variety of niches, food, and shelter.
  - 1 point: Coral reefs are considered areas of high primary productivity, contributing to the biodiversity of the oceans.
  - 1 point: Reefs protect the shorelines by reducing the impact of waves and storms.
  - 1 point: The reefs provide breeding grounds for organisms.
  - 1 point: Coral helps to control carbon dioxide in the oceans.
2. This question is worth a maximum of 10 points, as follows:
- A. Calculate the doubling time for the population of Kuwait (1 point maximum):
- 1 point: To calculate the doubling time of a population, use the equation  $70 \div \text{annual growth rate}$ . If Kuwait is growing at a rate of 3.6 percent annually, the answer is found as follows:  $70 \div 3.6 = 19.4$ . This means the population will double in a little over 19 years.
- B. Calculate the natural growth rate for a country with a birth rate of 350 out of 1,000 and a death rate of 380 out of 1,000 (2 points maximum):
- 1 point: Use the following equation to find the population's natural growth rate:
- $$\text{Natural Growth Rate per 1,000 Individuals} = \text{Crude Birth Rate} - \text{Crude Death Rate}$$
- The answer is then multiplied by 100 to convert it to a percent.  
For the question, calculate as follows:
- $$\frac{350}{1,000} - \frac{380}{1,000} = \frac{-30}{1,000} = -0.03$$
- Then convert it to a percent by multiplying by 100.
- 1 point: The answer is a -3 percent natural growth rate.
- C. List and explain another statistic used by demographers to predict the population growth of a country (1 point maximum):
- 1 point: Rate of natural increase reflects changes in crude birth and death rates.
  - 1 point: Infant mortality rate, which is the number of deaths of children under the age of 1 year old, per 1,000 individuals born.
  - 1 point: Replacement fertility level (the total fertility rate that is necessary to maintain a stable population).

D. Explain why the extinct civilization of Easter Island is considered a warning for modern society (4 points maximum):

- 1 point: The inhabitants of Easter Island met their demise because of their unsustainable use of the island's resources, specifically the trees.
- 1 point: Modern society has the very real potential for similar overuse, as resources can be consumed at a faster pace than they regenerate.
- 1 point: The Earth contains both finite and renewable resources. Supplies of resources such as minerals and fossil fuels will eventually run out, necessitating the development of alternatives. Resources that are considered renewable must be used sustainably in order to ensure enough for future generations.
- 1 point: If modern society does not learn from the demise of Easter Island, the planet's entire population could end up in the same situation as the island's inhabitants.

E. Describe two ways in which population growth can be slowed (2 points maximum):

- 1 point: Family planning programs.
- 1 point: Increased education about and use of contraception.
- 1 point: Shift in cultural norms (reduction in socially expected family size).
- 1 point: Female empowerment.
- 1 point: Female employment opportunities.
- 1 point: Enforced government regulations on births per family, such as China's one-child policy.

3. This question is worth a maximum of 10 points, as follows:

A. What makes POPs so dangerous when released into the environment? (2 points maximum):

- 1 point: POPs are persistent in the environment.
- 1 point: POPs bio-accumulate in tissue and bio-magnify in the food chain.
- 1 point: POPs travel long distances via the atmosphere and water.

B. Explain two ways in which POPs are harmful to humans and wildlife (2 points maximum):

- 1 point: POPs can cause diseases such as cancer.
- 1 point: POPs can create reproductive abnormalities.
- 1 point: POPs can cause neurological issues.
- 1 point: POPs can act as endocrine disruptors.
- 1 point: The immune system can be altered by POP exposure.
- 1 point: POP exposure can lead to developmental and behavioral issues.

C. How do POPs enter the environment? Explain POP reservoirs. (2 points maximum):

- 1 point: Some POPs are released during combustion, including the burning of biomass and fossil fuels.
- 1 point: Insecticides and fungicides often are released through spraying.
- 1 point: Effluent release (for example, from factories or sewage treatment plants) introduces POPs into water supplies.
- 1 point: Once in the atmosphere, POPs can be deposited onto the land and into the water.
- 1 point: POPs can enter water through runoff from the land.
- 1 point: POP reservoirs are the long-term storage of POPs in the sediment of marine or freshwater ecosystems. POPs are not very soluble, so they bond to particulate matter and are then deposited on the bottom of aquatic environments, where they can remain for long periods of time.

D. Name and describe one of the international treaties related to POPs (2 points maximum):

- 1 point: The Basel Convention.
- 1 point: The Basel Convention controls the transport of hazardous waste between nations, and particularly the transfer of waste from developed to less developed countries. It also focuses on management practices and the reduction of waste toxicity through monitoring of storage, transfer, reuse, recycling, and disposal of hazardous waste.
- 1 point: The Rotterdam Convention.

- 1 point: The Rotterdam Convention aims to protect human and ecosystem health through proper use of potentially harmful pesticides and industrial chemicals. It also promotes sharing of information and responsibility.
  - 1 point: The Stockholm Convention.
  - 1 point: The Stockholm Convention banned or set a schedule for phasing out 12 of the worst persistent organic pollutants (POPs), including DDT, eight other pesticides, PCBs, dioxins, and furans. These were called the “dirty dozen.”
- E. Explain the purpose of DDT and issues with its use (2 points maximum):
- 1 point: DDT is used as a pesticide, particularly for the eradication of mosquitoes.
  - 1 point: DDT bio-accumulates in organisms and bio-magnifies throughout the food chain.
  - 1 point: DDT was responsible for the decline of many predatory bird populations due to its thinning of eggs and resultant death of offspring.
  - 1 point: DDT is persistent in the environment, remaining for long periods of time.
  - 1 point: DDT can break down into DDE, which is also persistent and toxic.
4. This question is worth a maximum of 10 points, as follows:
- A. Identify two environmental consequences of coal combustion (2 points maximum):
- 1 point: The particulate matter of mercury emissions deposits onto land and into aquatic environments. Runoff can carry mercury from the land into the aquatic environments where it enters the food chain and biomagnifies through the food web.
  - 1 point: The combustion of coal releases sulfur into the atmosphere, where it reacts with oxygen to form sulfur dioxide, which in turn reacts to form acid precipitation and industrial smog.
  - 1 point: Soot is made up of carbon and is released as particulate matter from the incomplete combustion of coal. This is a component of industrial smog.
- B. Discuss three positive economic effects of coal mining (3 points maximum):
- 1 point: Job creation. For example, in Wyoming almost 7,000 people are employed in coal mining, and the average income for an employee is almost double that of the state’s average annual income.
  - 1 point: Taxes paid to the state and federal governments. This money is then used for programs such as education and infrastructure.
  - 1 point: Money from exports. Because the United States is the second-largest coal producer in the world, the export of this resource is important for other countries. Some countries, such as Japan and South Korea, do not have their own supply or have a very minimal supply, but they still use coal as an energy source.
  - 1 point: Commerce brought to local communities through living activities, such as home sales and rentals, food consumption, and entertainment.
  - 1 point: Decreased reliance on heavily taxed, imported fuel sources.
- C. Explain one way in which coal is mined (1 point maximum):
- 1 point: Surface mining removes the soil and rock surface over a large amount of land. This is used when deposits are located relatively close to the surface. Once the mineral deposit is completely extracted, the hole is refilled with the original soil and rock.
  - 1 point: Mountaintop removal is just as it sounds: The tops of mountains are blasted off in order to access the resource. This technique is common in the coal mines of the Appalachian Mountains.
  - 1 point: Placer mining uses water to separate the heavier minerals from lighter mud and debris. Because many deposits are formed in riverbeds, this process uses naturally running water to make the initial separation.
  - 1 point: Open pit mining involves digging up the land in order to reach the desired resource. The pits can be so large that the sides are terraced in order to allow trucks to get in and out. Open pits are usually called quarries.
  - 1 point: Subsurface mining creates shafts deep underground in order to extract resources from pockets or seams. Dynamite blasts and manual labor are used to remove rock and access the resource.

**D. Discuss two uses for coal (2 points maximum):**

- 1 point: Burning coal provides the heat source for the majority of electricity generation in the United States.
- 1 point: Coal is used in industrial and manufacturing plants for the production of products such as ceramics, paper, and chemicals.
- 1 point: Coal is used as coke in the steel industry.
- 1 point: Coal by-products are used for medicines, perfumes, wood preservatives, fungicides, linoleum, solvents, and insecticides.
- 1 point: Some indoor heating in commercial and residential buildings uses coal.

**E. Explain two terrestrial environmental impacts of coal mining (2 points maximum):**

- 1 point: Introducing oxygen and water to rock rich with sulfur allows the formation of sulfuric acid, which can run off into water sources and seep into the ground, potentially affecting wildlife.
- 1 point: Removal of vegetation and habitat on land above coal deposits can impact local wildlife.
- 1 point: Mining can cause soil erosion.
- 1 point: The runoff from mining can lead to a buildup of debris and sediment in lakes and rivers.
- 1 point: Surface mining or mountaintop removal may require deforestation.