

Practice Test
Multiple-Choice Portion
90 minutes

This section has 100 multiple-choice questions. NO CALCULATORS PERMITTED!

Directions: The lettered choices below refer to the numbered statements immediately following it. Select the one lettered choice that best fits each statement. Each choice may be used once, more than once, or not at all in each set.

Questions 1-3 refer to the following processes.

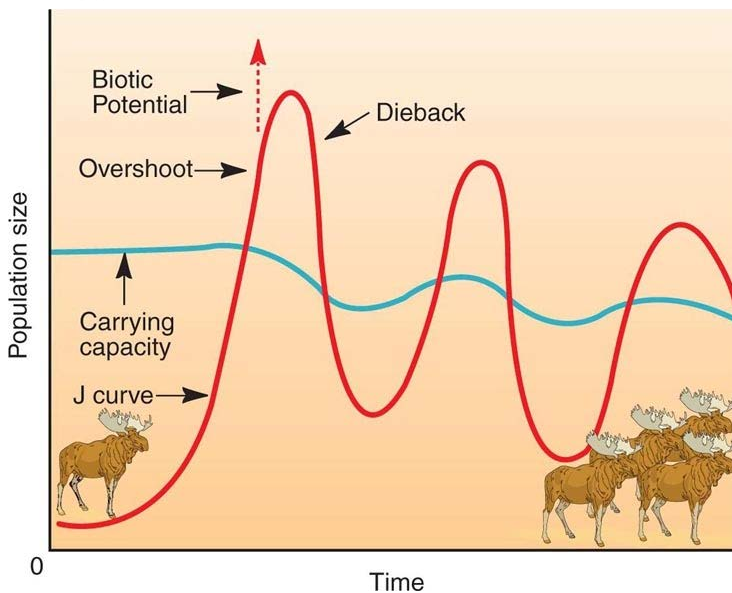
- (A) Nitrogen Fixation
- (B) Nitrification
- (C) Assimilation
- (D) Ammonification
- (E) Denitrification

1. Proteins, DNA and amino acids are made for the plant **C**
2. The process where N_2 gas is created and released to the atmosphere **E**
3. This process takes place in the roots of some plants when bacteria convert the nitrogen gas to NH_3 and NH_4^+ **A**

[In the diagram below, the letter A will replace “J Curve”, B will replace “Overshoot”, C will replace “Carrying capacity”, D will replace “Biotic Potential” and E will replace “Dieback”.]

Questions 4-6 refer to the letters in the figure below.

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4. Which letter represents the long term carrying capacity of the ecosystem? **C**
5. Which letter represents the reproductive time lag of the ecosystem? **B**

6. Which letter represents a situation in which the species has unlimited resources and will be able to reproduce at its maximum rate? **D**

Match the following energy resources with the approximate number of years we have left of them to answer questions 7-9.

- (A) 10-20 years
- (B) 40-80 years
- (C) 60-100 years
- (D) 100-150 years
- (E) 200-300 years

7. Coal **E**
8. Oil **B**
9. Natural Gas **C**

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case.

10. If a country has a population of 10,000 and experiences 500 births, 200 deaths, 30 immigrants and 30 emigrants in a year, what is the country's net annual percentage growth rate?
- (A) 1%
 - (B) 3%**
 - (C) 12%
 - (D) 15%
 - (E) 30%
11. Which of the following is NOT a primary pollutant?
- (A) Sulfur dioxide
 - (B) Carbon dioxide
 - (C) Ozone**
 - (D) Nitrogen monoxide
 - (E) Nitrogen dioxide
12. Which of the following is an example of biological pest control?
- (A) Using ladybugs to control aphids**
 - (B) Spraying herbicide on weeds in the yard
 - (C) DDT used on mosquitoes in Africa
 - (D) Aerial sprayings on cropland
 - (E) Putting a fungicide on a yard
13. An incandescent light bulb is only about 5% efficient, meaning that 95% of the energy is converted to heat. This is an example of which of the following?

- (A) 1st law of thermodynamics
- (B) 2nd law of thermodynamics
- (C) 3rd law of thermodynamics
- (D) Law of heat transfer
- (E) Law of conservation of matter

14. As organic matter is put into a body of water, decomposers obtain nutrients and begin to grow. This increases the

- (A) Dissolved oxygen
- (B) Biochemical and biological oxygen demand
- (C) Acid deposition rate
- (D) Ability of aquatic organisms to thrive
- (E) Biodiversity of the area

15. If the average American uses 25 barrels of petroleum a year, how much does the entire U.S. population consume?

- (A) 7.75 billion barrels
- (B) 167 billion barrels
- (C) 50 billion barrels
- (D) 905 million barrels
- (E) 2.8 billion barrels

16. Which of the following is an example of the tragedy of the commons?

- (A) Cutting trees on logging company land
- (B) Pollution of the atmosphere from a coal fired power plant
- (C) Soil erosion on a farmers land due to overgrazing
- (D) Acid drainage on private property from a mining operation
- (E) Overhunting on commercial ranch property

17. Which of the following is true about the replacement level fertility of a society?

- (A) The replacement level fertility is the total average number of children a couple will have depending on the country they live in.
- (B) The replacement level fertility is the number of children a couple in a developing country will have to replace the children that died in infancy.
- (C) The replacement level fertility increases as the country goes through the demographic transition.
- (D) The replacement level fertility is only indicative of the preindustrial stage of the demographic transition.
- (E) The replacement level fertility is the number of children a couple will have to have to replace themselves in the next generation.

18. Leachate is a problem associated with

- (A) Car exhaust
- (B) Sewage treatment plants
- (C) Landfills
- (D) Coal burning power plants
- (E) Nuclear power plants

19. Which of the following would be a result of urban sprawl?

- (A) Increased crop areas
- (B) Wetlands would improve
- (C) Wildlife habitats would be lost
- (D) Decreased soil erosion
- (E) Less energy use

20. Which of the following is a part of a passive solar system?

- (A) Using photovoltaic solar panels to produce electricity
- (B) Using a battery system to store the captured solar energy
- (C) Planting a deciduous tree in front of a south facing window in the Northern Hemisphere
- (D) Using a solar water heating system with a pump
- (E) Using small sun-tracking motors attached to solar panels

21. The major cause of cultural eutrophication is the addition of which chemical into a body of water?

- (A) Carbon
- (B) Mercury
- (C) Sulfur
- (D) Nitrates
- (E) Lead

22. All of the following are reasons a species might become extinct EXCEPT

- (A) Large body size
- (B) Slow reproductive rate
- (C) Generalist
- (D) K selected species
- (E) Being a top predator

23. Thermohaline Circulation of the ocean

- (A) Is caused by hot volcanic vents in the bottom of the ocean
- (B) Is causing hurricanes to increase in strength
- (C) Is causing the polar ice shelves to melt
- (D) Is being affected by increased SO_2
- (E) Is driven by the differences in ocean water temperatures and density

24. An example of a clown fish living in a sea anemone is which type of relationship?
- (A) Predator/prey
 - (B) Commensalism
 - (C) Parasitism
 - (D) Mutualism
 - (E) Amensalism
25. Which of the following reasons would most likely **not** be a reason why a woman in a poor, developing nation would want to have more children?
- (A) to ensure that she is taken care of in her old age
 - (B) to ensure at least some of her children will survive to adulthood
 - (C) to collect government benefits such as welfare and food stamps
 - (D) to meet the cultural and social expectations of her society
 - (E) to conform to the mandates of her religion
26. Where is most of the nuclear waste in the United States currently stored?
- (A) In underground abandoned salt mines
 - (B) In toxic waste landfills
 - (C) Yucca Mountain, Nevada
 - (D) At government compounds in Washington State (Hanford Site)
 - (E) Onsite at the nuclear power plant facilities
27. Which of the following countries has the largest deposits of coal?
- (A) Australia
 - (B) Denmark
 - (C) Brazil
 - (D) Canada
 - (E) China
28. Which of the following types of coal produces the most energy per gram and contains the least amount of moisture?
- (A) Peat
 - (B) Lignite
 - (C) Bituminous
 - (D) Sub-bituminous
 - (E) Anthracite
29. What makes up the largest component of municipal solid waste?
- (A) Metals
 - (B) Plastics
 - (C) Fabrics
 - (D) Glass
 - (E) Paper and cardboard

30. Invasive species are often able to take over because they can do all of the following EXCEPT
- (A) Outcompete native species
 - (B) Have multiple offspring
 - (C) Become predators of native species
 - (D) Live in a multitude of different environments
 - (E) Have trouble adapting to new environments
31. Which of the following would help decrease the effect of soil erosion?
- (A) Removing the "O" Horizon in a grassland ecosystem
 - (B) Farmers tilling their soil to increase crop yields
 - (C) Contour plowing of agricultural fields
 - (D) Clear-cutting an area to raise cattle
 - (E) Increasing the number of livestock on a ranch
32. According to the 10% rule concerning energy pyramids, to create 1000 kilograms of deer biomass you need
- (A) 100 kilograms of grass
 - (B) 10,000 kilograms of lion
 - (C) 10,000 kilograms of grass
 - (D) 900 kilograms of lion
 - (E) 9000 kilograms of grass
33. An asbestos worker who smokes is an example of
- (A) Bioaccumulation
 - (B) Synergism
 - (C) Biomagnification
 - (D) Dose response
 - (E) Toxic threshold
34. As a country goes through the demographic transition, which is the phase that shows the birth rate slowing down?
- (A) The preindustrial
 - (B) The pretransitional
 - (C) The transitional
 - (D) The industrial
 - (E) The postindustrial
35. Which Federal agency regulates the grazing of livestock on desert and semi-arid public lands?
- (A) The National Park Service
 - (B) The U.S. Fish and Wildlife Service
 - (C) The U.S. Bureau of Land Management
 - (D) The U.S. Forest Service
 - (E) The U.S. Department of Commerce

36. The fossil fuel that is used by the most people worldwide is which of the following?

- (A) Oil
- (B) Natural gas
- (C) Coal
- (D) Peat
- (E) Nuclear

37. Which of the following is an example of a point source of pollution?

- (A) Runoff from cattle ranches
- (B) Oil and grease residue from roadways
- (C) Sewage entering a river from a pipe
- (D) Eutrophication caused by fertilized agricultural fields
- (E) Sediments washing off from a forest-fire burn area

38. Stratospheric ozone depletion causes problems on Earth by

- (A) absorbing too much UV radiation
- (B) absorbing too much IR radiation
- (C) reducing the Earth's surface temperatures
- (D) allowing too much UV radiation through
- (E) reflecting heat back to space

39. 75% of the mass of all the layers of the atmosphere is found in the

- (A) Troposphere
- (B) Stratosphere
- (C) Mesosphere
- (D) Thermosphere
- (E) Exosphere

40. Geographic isolation can occur as species become physically isolated from one another. This can result in

- (A) reduced biodiversity
- (B) overpopulation
- (C) coevolution
- (D) differential reproduction
- (E) speciation

41. The law that regulates how toxic waste is picked up, transported, and disposed of is

- (A) Safe Drinking Water Act
- (B) Clean Air Act
- (C) CERCLA- Comprehensive Environmental Response, Compensation and Liability Act
- (D) ARA- Air Resource Act
- (E) RCRA- Resource Conservation and Recovery Act

42. The current population of the United States is about 310 million and is growing at the rate of 0.9%. If the US were to continue to grow at this rate for the next year, approximately how many people would be added?
- (A) 2.8×10^3
 - (B) 2.8×10^4
 - (C) 2.8×10^5
 - (D) 2.8×10^6
 - (E) 2.8×10^7
43. When we suppress forest fires the buildup of dead branches, leaves, and other organic material on the ground occurs. As a result, a large uncontrollable fire can occur causing extensive damage to natural ecosystems, as well as, homes and property. Which of the following terms correctly describes this kind of fire?
- (A) Surface fires
 - (B) Prescribed fires
 - (C) Stand fires
 - (D) Crown fires
 - (E) Old-growth fires
44. Cesium -135 has a half life of approximately 2000 years. If Cesium is considered safe after the radioactivity has dropped to 1.6% of the original level, how many half lives have occurred?
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 5
 - (E) 6
45. The biggest concern with landfills is
- (A) Air pollution
 - (B) Surface water contamination
 - (C) Ocean contamination
 - (D) Groundwater contamination
 - (E) Biodiversity loss
46. All of the following remove carbon from the Earth's atmosphere EXCEPT
- (A) Photosynthesis
 - (B) Oceans
 - (C) Algae
 - (D) Respiration from land organisms
 - (E) Forests

47. The Marianas Trench is an example of a
- (A) Convergent plate boundary
 - (B) Divergent plate boundary
 - (C) Transform plate boundary
 - (D) A fault zone
 - (E) A hot spot
48. A coal-fired power plant is approximately 30% efficient. The 70% that is converted to heat is explained by the
- (A) First law of thermodynamics
 - (B) Second law of thermodynamics
 - (C) Third law of thermodynamics
 - (D) Law of kinetic energy
 - (E) Law of conservation of mass
49. Which of the following strategies would help to ensure that we can provide food for a growing population?
- (A) Increase ethanol production in industrialized nations
 - (B) Encourage parents to have more offspring to increase available farm labor
 - (C) Increase palm oil production in poor countries
 - (D) Reduce the amount of meat consumption worldwide
 - (E) Reduce the production of nitrogen fertilizers
50. Which of the following is an example of the “Tragedy of the Commons”?
- (A) Conserving water by turning off the tap
 - (B) Carpooling to work or school
 - (C) Secondhand smoke in a public restaurant
 - (D) Deforestation on private land
 - (E) Excessive noise throughout an industrial factory
51. All of the following are advantages of hydroelectricity EXCEPT
- (A) Nondepletable resource
 - (B) Low cost
 - (C) Flood control
 - (D) Improves fish migrations
 - (E) Recreation
52. Which of the following components would NOT be considered an essential part of a modern sanitary landfill?
- (A) Perforated leachate pipes designed to remove toxic liquids
 - (B) Groundwater and leachate monitoring wells
 - (C) Chlorine disinfection tubes for viral and bacterial management
 - (D) Methane gas recovery wells
 - (E) A thick synthetic liner on the bottom and sides of the landfill

53. The biggest reason that species become extinct is
- (A) Invasive species
 - (B) Bioaccumulation
 - (C) Global climate change
 - (D) **Habitat destruction**
 - (E) Predators
54. England's latitude is similar to Russia, however England is warmer than Russia because
- (A) The Earth's tilt is more directed towards the sun from England
 - (B) England has a large desert in its interior that keeps it warm
 - (C) England's deciduous forests retain more heat than Russia's coniferous forests
 - (D) **Warm ocean currents from the equator keep England warmer**
 - (E) There is an urban heat island effect occurring in England due to its dense population
55. When cool air is trapped below an area of warm air it is called
- (A) A cold front
 - (B) A warm front
 - (C) **A temperature inversion**
 - (D) An occluded front
 - (E) A jet stream
56. As you travel toward the equator you increase both temperature and precipitation. This results in
- (A) a steady increase in soil fertility as you move toward the equator
 - (B) a decrease in the number of vertebrate species as you move towards the equator
 - (C) slower rates of organic decomposition as you move towards the equator
 - (D) **an increase in both biomass and the number of species per hectare**
 - (E) a significant increase in the albedo per hectare
57. Which of the following parts of a sewage treatment plant is designed to remove large, solid debris, such as trash?
- (A) **Bar screen**
 - (B) Settling tank
 - (C) Secondary treatment
 - (D) Disinfecting tank
 - (E) Primary clarifier
58. A species such as a top predator which plays a crucial role in the ecosystem where it lives is known as a(n)
- (A) **keystone species**
 - (B) indicator species
 - (C) critical species
 - (D) exotic species
 - (E) invasive species

59. As a country goes through the demographic transition, which is the phase that shows the population growing exponentially?
- (A) The preindustrial
 - (B) The pretransitional
 - (C) The transitional
 - (D) The industrial
 - (E) The postindustrial
60. All of the following are characteristics of genetically engineered crops EXCEPT
- (A) Resistance to disease
 - (B) High water needs
 - (C) Need less fertilizer
 - (D) Faster growing
 - (E) Higher yielding
61. What is the process of using the heat or steam to turn a turbine and generate electricity before using it for industrial purposes?
- (A) Capacity factor
 - (B) Industrial electricity
 - (C) Secondary energy
 - (D) Refraction
 - (E) Cogeneration
62. Which type of smog occurs when sunlight reacts with nitrogen oxides and volatile organic compounds in the atmosphere?
- (A) Temperature smog
 - (B) Temperature inversion
 - (C) Industrial smog
 - (D) Photochemical smog
 - (E) Acid deposition
63. Which of the following pollutants was the direct cause of stratospheric ozone depletion?
- (A) CO
 - (B) CO₂
 - (C) O₃
 - (D) CFC₃
 - (E) VOCs
64. The countries with the largest coal reserves are
- (A) China, India and Mexico
 - (B) The U.S., China, Mexico
 - (C) The U.S., China and Russia
 - (D) India, Russia and the U.S.
 - (E) Canada, the U.S. and Mexico

65. DDT was known for its ability to work its way up the food chain. This is known as
- (A) Synergism
 - (B) Bioaccumulation
 - (C) Incidence response
 - (D) **Biomagnification**
 - (E) Metabolism
66. Which of the following formulas correctly summarizes photosynthesis?
- (A) **$6 \text{ CO}_2 + 6 \text{ H}_2\text{O} + \text{solar energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2$**
 - (B) $6 \text{ H}_2\text{O} + \text{solar energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2 + 6 \text{ CO}_2$
 - (C) $\text{CH}_4 + \text{NO}_2 + \text{solar energy} \rightarrow \text{CN}_2 + \text{H}_4\text{O}$
 - (D) $\text{CH}_4 + \text{H}_4\text{O} + \text{solar energy} \rightarrow \text{CN}_2 + \text{NO}_2$
 - (E) $6 \text{ H}_2\text{O} + \text{C}_{12}\text{H}_6\text{O}_6 + \text{solar energy} \rightarrow 6 \text{ H}_2\text{O} + 6 \text{ CO}_2$
67. If a country has an annual growth rate of 5 percent, how many years will it take for the population of this country to double?
- (A) **14 years**
 - (B) 18 years
 - (C) 26 years
 - (D) 35 years
 - (E) 42 years
68. According to the Environmental Protection Agency, the most dangerous type of air pollution is particulate pollution which is fine particles entering the air from factories, coal fired power plants, and transportation vehicles. The size at which the EPA considers these particles to become dangerous to health is
- (A) 0.5 micrometers (0.5 microns)
 - (B) 1.0 micrometers (1.0 microns)
 - (C) **10 micrometers (10 microns)**
 - (D) 100 micrometers (100 microns)
 - (E) 1000 micrometers (1000 microns or 1.0 millimeter)
69. Which of the following is a benefit of aquaculture?
- (A) **It removes the commercial pressure from wild fisheries**
 - (B) Waste from the area can cause eutrophication
 - (C) Large areas of land are needed
 - (D) It allows for the easy transfer of disease between members of a fish population
 - (E) It enhances natural ocean ecosystems

70. Nuclear energy is produced when a neutron strikes a nucleus and then splits it into two or more parts. What is this process called?

- (A) Nuclear Fission
- (B) Nuclear Fusion
- (C) Nuclear Fragmentation
- (D) Fission Fragmentation
- (E) Hubbert Curve

71. Los Angeles has a problem with air pollution because

- (A) It is the largest city in the United States
- (B) Cars in Los Angeles are not as regulated as other states
- (C) The topography of the area traps pollutants along with an inversion layer
- (D) The Clean Air Act does not apply to Southern California
- (E) Los Angeles receives air pollutants from Mexico as the air currents bring it northward

72. Which of the following gases is NOT associated with an increase in temperature resulting in global climate change?

- (A) SO₂
- (B) N₂O
- (C) CFC
- (D) CO₂
- (E) CH₄

Questions 73-74 refer to the pyramid below.

**[Insert pyramid of Kenya 2010 from website:
<http://www.census.gov/ipc/www.idb/country.php>.]**

73. A country with an age distribution like that shown above, is most likely a country that

- (A) is growing slowly
- (B) has a low number of infant deaths
- (C) has a high GDP
- (D) has a rapid growth rate
- (E) is highly competitive in the world economy

74. Approximately how many people in this country are under the age of 20?

- (A) 5 million
- (B) 9 million
- (C) 16 million
- (D) 21 million
- (E) 25 million

75. The most widespread and common type of water pollution is

- (A) Thermal Pollution
- (B) Sediment Pollution
- (C) Sewage Waste Pollution
- (D) Inorganic Chemical Pollution
- (E) Radioactive Waste Pollution

76. Which of the following is an example of an r strategist?

- (A) Koala bear
- (B) Otter
- (C) Salmon
- (D) Kangaroo
- (E) Elephant

77. Which of the following is NOT true of wind energy?

- (A) It is the fastest growing source of electricity in the world
- (B) It has been linked to killing birds
- (C) There are noise and aesthetic impacts
- (D) It can be depleted
- (E) Most rely on batteries to store electricity

78. Which chemical contributes to acid deposition?

- (A) Carbon monoxide
- (B) Sulfur dioxide
- (C) Volatile organic compounds
- (D) Ozone

19. Lead

79. Soils in grasslands are generally

- (A) Shallow and nutrient poor
- (B) Shallow and nutrient rich
- (C) Deep and nutrient poor
- (D) Deep and nutrient rich
- (E) Rich in clay and iron

80. Overall carbon dioxide levels fluctuate yearly because of

- (A) More driving in summer months
- (B) More air condition use in summer months
- (C) More heat use in winter
- (D) Seasonal photosynthesis from plants
- (E) Seasonal use of coal burning power plants

81. One complaint people have with wind power is the

- (A) Noise pollution
- (B) Air pollution
- (C) Expense of construction
- (D) Water pollution
- (E) Expense to maintain the system

82. Which of the following is NOT a concern of a nuclear power plant that is operating normally?

- (A) The possibility of a nuclear accident
- (B) Carbon dioxide and air pollution emissions
- (C) Storage of highly radioactive spent fuel
- (D) Amortizing expensive construction costs and maintenance costs
- (E) Earthquakes and terrorists attacks

83. Which of the following would be considered an essential part of Integrated Waste Management?

- (A) Send waste to a landfill
- (B) Incinerate the waste
- (C) Pretreat waste before it is stored
- (D) Send nuclear waste to Yucca Mountain
- (E) Recycle aluminum and other metals

84. Which of the following countries has the worst problem with desertification?

- (A) Russia
- (B) The United States
- (C) Canada
- (D) Australia
- (E) Brazil

85. The biological step of the sewage treatment process occurs in the

- (A) Bar screen
- (B) Grit chamber
- (C) Settling tank
- (D) Aeration tank
- (E) Disinfection tank

86. Urbanization can lead to a depletion of groundwater resources because

- (A) The recharge area is covered up by impervious materials such as concrete
- (B) Less water is pumped out of the aquifer
- (C) The urban heat island effect increases evaporation
- (D) Non-native plants used in urban landscaping have higher rates of transpiration than native plants
- (E) Increased surface mass from urban structures reduces aquifer porosity

87. Which of the following is the law that is designed to make mining companies clean up and replant after mining?

- (A) Deep-well Mining Act
- (B) Surface Mining Control and Reclamation Act
- (C) The Clean Water Act
- (D) CERCLA (Superfund Act)
- (E) FIFRA

88. Cities tend to be warmer than rural areas. This is known as

- (A) Heat urbanization
- (B) Rural cooling effect
- (C) Urban Heat Island Effect
- (D) Global warming
- (E) Temperature inversions

89. Dark soil is usually indicative of soil that

- (A) Has little nutrients
- (B) Has high amounts of pesticide
- (C) Contains large amounts of humus material
- (D) Is from the tropical rainforest
- (E) Is easily eroded

90. The laws that regulate the MPG that each class of car must meet are known as

- (A) CAFÉ- Corporate Average Fuel Economy Act
- (B) Clean Air Act
- (C) CERCLA- Comprehensive Environmental Response, Compensation and Liability Act
- (D) ARA- Air Resource Act
- (E) RCRA- Resource Conservation and Recovery Act

91. Protection of our nations surface water falls under the

- (A) Safe Drinking Water Act
- (B) Clean Water Act
- (C) Marine Fisheries Act
- (D) Safe Groundwater Act
- (E) Water Policy Act

92. Which of the following is NOT a cause of atmospheric pollution?

- (A) Windmills
- (B) Factories
- (C) Car exhaust
- (D) Coal burning power plants
- (E) Using natural gas to heat homes

93. As temperatures on the planet become warmer and evaporation increases, the hydrologic cycle is affected. This will probably result in
- (A) a widespread drought situation around the globe
 - (B) a decrease in severe storm activity throughout the planet
 - (C) a more predictable and stable climate
 - (D) regions of increased precipitation and regions of increased drought
 - (E) increased salinity in the oceans waters near the poles
94. The process by which ammonia is converted to nitrite then to nitrate is
- (A) Nitrogen fixation
 - (B) Nitrification
 - (C) Ammonification
 - (D) Assimilation
 - (E) Denitrification
95. Which of the following dealt with stabilizing the size of the human population?
- (A) Montreal Protocol
 - (B) Kyoto Protocol
 - (C) The Cairo Conference
 - (D) The Earth Summit
 - (E) UN Conference on the Human Environment
96. The number one preventable cause of death in the United States is from
- (A) Tobacco use
 - (B) Car accidents
 - (C) Suicides
 - (D) Homicides
 - (E) Infectious disease
97. Which of the following could happen when natural habitats are developed for urban housing?
- (A) The natural habitats will thrive
 - (B) The number of large predators will increase
 - (C) There will be a decrease in invasive species
 - (D) Keystone species numbers will increase
 - (E) Indigenous biodiversity will decrease
98. Which of the following renewable energy sources is the most used in the world today?
- (A) Wind
 - (B) Geothermal
 - (C) Solar
 - (D) Biomass
 - (E) Hydroelectric

99. What would a scientist add to a lake that has had a problem with acid deposition?

- (A) Nitrates
- (B) Phosphates
- (C) Lime (Calcium carbonate)
- (D) Rainwater
- (E) Vinegar

100. Ozone in the troposphere is a major cause of what problem?

- (A) Respiratory illness
- (B) Lead poisoning
- (C) Cancer
- (D) Sunburn
- (E) Neurological disorders

Free Response Portion

90 minutes

The free-response section of the exam consists of 4 required questions: 1 data set question, 1 document-based question, and 2 synthesis and evaluation questions. Where calculations are required, be sure to show all work clearly. Be sure to thoroughly answer each question by using specific examples and support your answers with specific information. It is recommended that you use approximately 22 minutes to answer each of the following four essays. NO CALCULATORS PERMITTED!

1. A farmer has decided to take his cow manure and sell it to a local nursery to be made into mulch. His cows produce approximately 200 lbs of manure a week and for each 1 lb of manure he provides, the nursery will add enough wood chips to make 10 lbs of mulch. The mulch is sold in 40 lb bags.

- (a) How many bags of mulch can be made each month (assume a 4-week month) from the farmers manure?

(2 pts; 1 pt for the set up and 1 pt for the answer)

200 lbs of manure a week X 4 weeks = 800 lbs manure a month

800 lbs of manure X 10 lbs of wood chips/lb manure = 8000 lbs of mulch

8000 lbs of mulch / 40 lb bags = 200 bags of mulch

The nursery can make 200 bags of mulch using the farmers manure.

- (b) If a bag of mulch is sold for \$2 a bag, how much money will the nursery make each month?

(2pts; 1 pt for set up and 1 pt for the answer)

200 bags X \$2 a bag= \$400

- (c) If the nursery pays the farmer 50% of their price per bag, how much money will the farmer make a year?

(2pts; 1 pt for set up and 1 pt for answer)

$\$400/2 = \200 per month

$\$200 \text{ per month} \times 12 \text{ months/year} = \2400 per year

- (d) If the farmer is offered \$0.05 a lb for his manure by the local energy company to be converted into energy, how much money would the farmer make a year by selling his cow's manure to the energy company?

(2pts; 1 pt for set up and 1 pt for answer)

$200 \text{ lbs a week} \times \$0.05 \text{ per lb} = \$10 \text{ per week}$

$\$10 \text{ per week} \times 52 \text{ weeks per year} = \520 per year

- (e) List and describe TWO environmental benefits that would occur by the farmer using the manure to either make mulch or energy.

(2pts; 1 for each answer with an appropriate description)

Possible answers include:

Lessen eutrophication- the running off of nutrients into the water

Lower the dependence of the energy company on coal or nuclear fuel

Reduce the impacts caused by mining coal or uranium

Reduce soil erosion by encouraging other farmers and homeowners to use mulch

Lessen the impact of bacteria getting into the ground or surface waters

Mulch will save water by reducing evaporation

Improve the overall soil fertility by using mulch

2. Read the following article from the *Sandy Point Courier*.

The town of Sandy Point is experiencing a problem with their town lake. The lake has turned a dark shade of green and has dead fish floating on the surface. Residents are concerned about the odor coming from the lake and are worried that this could be having harmful effects upon their groundwater resources.

- (a) List and describe TWO activities that could be causing the problem in the lake.

(4pts, 2 for each activity and 2 for the proper description of that activity)

Possible answers include:

Eutrophication caused by runoff from fertilizers on yards and crops or from nearby livestock wastes. These nutrients get into the lake and cause algal blooms. In turn, bacteria feed on dying algae and use up the lake's dissolved oxygen which results in hypoxia and the death of fish resources.

The release of inorganic nutrients (nitrates, phosphates) from an industrial factory or sewage treatment plant (point sources) could also be causing the eutrophication of the lake.

Increase water temperature in the lake caused by nearby clear cutting, power plant thermal pollution, or climate change could be making it more advantageous for undesirable species such as algae to flourish. An increase in water temperature might push native species out of their range of tolerance.

- (b) Describe how the town could remediate the problem that is occurring in the lake?

(2 pts for an accurate description)

Possible answers include:

Herbicides could be applied to kill the algae.

Fish or other animals that eat algae could be put into the lake.

Mechanical equipment could be used to rake the algae out of the lake.

Air can be pumped into the lake to help restore the oxygen level.

- (c) Describe TWO things that the town should do to stop this problem from occurring in the future?

(2pts; one for each idea with a proper description)

Possible answers include:

Plants and trees could be planted along the edge of the lake to absorb some of the nutrients.

Laws could be put into place that could minimize the amount of fertilizers allowed on yards and crops or ban the use of phosphates in soap.

Collecting animal waste and turning it into compost that can be used on landscaping and other projects.

Prevent farms and livestock operations from locating too close to the lake

Prevent point sources (sewage treatment plants, factories) from releasing plant nutrients into the lake

Prevent the clear cutting of trees nearby the lake or along streams that feed into the lake

Prevent lake water from being used for the thermal cooling of power plants

- (d) Name and explain a current law that applies to bodies of water like this lake.

(2 pts; 1 for naming a law and 1 for proper explanation)

Possible answers include:

Clean Water Act- names 100 water pollutants and how much of each can be put into a body of water

Endangered Species Act- protects animals that might be living in the lake that are on the endangered species list

Safe Drinking Water Act- protects the quality of drinking water

Water Quality Act- requires states to issue water quality standards

National Environmental Policy Act (NEPA) – requires that all major actions and projects take environmental impacts into account

3. A group of students took a trip to Costa Rica to help with reforesting a section of the rainforest and helping with a sea turtle project. As the students plant the trees they discover an aggressive, invasive species, *Syzigium jambos* (Myrtaceae) growing in the area. This non-native species is displacing native species.

- (a) If the students planted 300 native trees at a cost of \$.25 per tree, determine how much money the students will need to save to cover the cost of the re-planting project.

(2 pts, 1 for the set up and one for the correct answer)

$$300 \times .25 = \$75$$

- (b) List TWO characteristics of invasive species and explain how these may have allowed *Syzygium jambos* to thrive in this tropical forest ecosystem.

(4 pts, one for each characteristic and one for each explanation, only the first two answers will be accepted)

Possible answers include:

High reproductive rate – invasive species generally produce large numbers of offspring at an early age. *Syzygium jambos* would reproduce rapidly in the tropical forests of Costa Rica because it is native to the tropical forests of Southeast Asia

Generalist species – invasive species can adapt to a wide-range of environments and are able to thrive on a variety of food sources.

Aggressive, opportunistic behavior – invasive species are able to out compete native species for needed resources. *Syzygium jambos* is successful at colonizing areas where it gets a foothold.

- (c) List and explain ONE characteristic of the Costa Rican rainforest that has allowed this invasive species to take over.

(2 pts, one for the characteristic and one for the explanation)

Possible answers include:

No predators on the invasive species

Fire is uncommon which could kill the invasive species.

The canopy doesn't allow much light to hit the floor and the invasive species may be adapted to this environment.

- (d) Invasive species are a problem all over the world. Give two examples of how an invasive species can be introduced into an area.

(2 pts, one for each example)

Possible answers include:

Brought in by humans as exotic pets

Animals escaping from captivity in areas they are not native

Carried on animals

Brought in boats which dump their ballast tanks

Brought in by the transfer of soil samples from one ecosystem to another

Fundamental changes (temperature, nutrient levels) in native ecosystems may allow non-native species to thrive

Introduced as food sources for humans

Brought in to control pest species

4. Country X is in the Preindustrial Stage of the demographic transition.

- (a) List and describe TWO living conditions that are generally associated with a developing nation in the Preindustrial Stage.

(2 pts, one for each with an appropriate description)

Possible answers include:

Poverty- many people live on or under \$1 a day

Malnutrition- People can be under nourished due to insufficient food resources

High infant death rates- many children die under the age of 2

Short life span- many people do not live to adulthood

High Fertility Rate – needed because so many children die young

- (b) If a Preindustrial Stage country is growing at the rate of 3.5% annually, calculate the number of years it will take for this country to double their population.

(2 pts, one for set up and one for correct answer).

$70/3.5 = 20$ years (Rule of 70)

- (c) The government of country X wants to slow down the growth rate of its nation. List TWO things that could be done to accomplish this goal. For each example describe how this would help to lower the growth rate.

(4 pts. One for each example and one for each explanation)

Possible answers include:

Provide family planning services – provides access to birth control methods and health care

Reduce poverty – increased wealth encourages education and health care

Provide education opportunities for girls – educated women are more likely to be aware of birth control and are more likely to use it. They will also be more likely to obtain good jobs

Provide job opportunities for women – women with jobs and professional opportunities generally have fewer children

Provide social welfare for the elderly – when couples know that there is a social safety net available when they get old, they will feel less need to have large numbers of children in an effort to assure care as they age

Mandate the maximum number of children that a couple can have – governments can use the force of law to reduce the fertility rate (e.g. China)

- (d) List and describe TWO environmental benefits that would be accomplished by lowering the population growth rate in country X.

(2pts one for each benefit and explanation)

Possible answers include:

Less habitat loss – less land is need to feed and house the population

Less deforestation – less land is needed for farming and grazing; fewer trees are needed for fuel and construction

Less energy use – less energy is needed for heating, cooking, transportation, and manufacturing

Less pollution – increased per capita wealth will mean that increased financial resources will be available to mitigate the negative impacts of most types of pollution