INTERNATIONAL ENVIRONMENTAL SCIENCE OLYMPIAD

Battery Examination – Part 1
High School Division
Friends and Family Adult Division

Name _____

Country OR State _____

ID Number _____

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

Questions 1-10 are on ecosystems.

1. Which process in the water cycle returns water vapor from plants directly to the atmosphere?
   A. evaporation
   B. transpiration
   C. infiltration
   D. precipitation

2. What term describes the variety of species within an ecosystem?
   A. species richness
   B. genetic diversity
   C. functional diversity
   D. ecosystem services

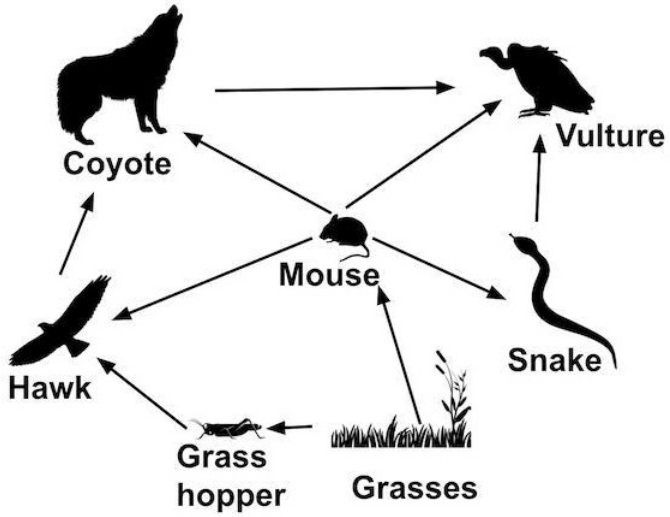
3. Which biome is most adapted to seasonal droughts and frequent fires?
   A. tropical rainforest
   B. boreal forest
   C. tundra
   D. savanna

4. Which of the following is an example of mutualism?
   A. A tick feeding on a deer
   B. A remora fish attaching to a shark for transportation
   C. A lion hunting a zebra
   D. Algae providing nutrients to a fungus in a lichen

5. Which of the following is the best example of a producer in an ecosystem?
   A. deer
   B. beetle
   C. pine tree
   D. mushroom

6. Which of the following is an abiotic factor that influences ecosystems?
   A. predation
   B. temperature
   C. decomposition
   D. competition

Use this image to answer questions 7 to 10.



7. Which of the following is a primary consumer as shown by this diagram?
   A. mouse
   B. snake
   C. coyote
   D. vulture

8. Based on this diagram, which of these would NOT result from an increase in the coyote population?
   A. a decrease in the hawk population
   B. a decrease in the mouse population
   C. a decrease in the vulture population
   D. an increase in the snake population

9. According to this diagram, which of these are a food source for hawks?
   A. coyotes
   B. snakes
   C. vultures
   D. grasshoppers

10. Assuming that 10,000 units of light energy from the sun reached the grasses in this image, how many units of that energy would be available to a hawk that consumed a mouse?
   A. 1,000 units
   B. 100 units
   C. 10 units
   D. 1 unit

Questions 11-20 are on biodiversity.

11. Which of the following species would be most at risk of extinction?
    A. a generalist species with a wide geographic range
    B. a specialist species with a very limited range
    C. a species with a high reproduction rate
    D. a species that thrives in disturbed habitats

12. Which of these best describes the term 'edge effect'?
    A. decrease in biodiversity near the center of large habitats
    B. competition between species at the edges of a food web
    C. changes in species composition after a natural disaster
    D. increased biodiversity at the boundary between two ecosystems

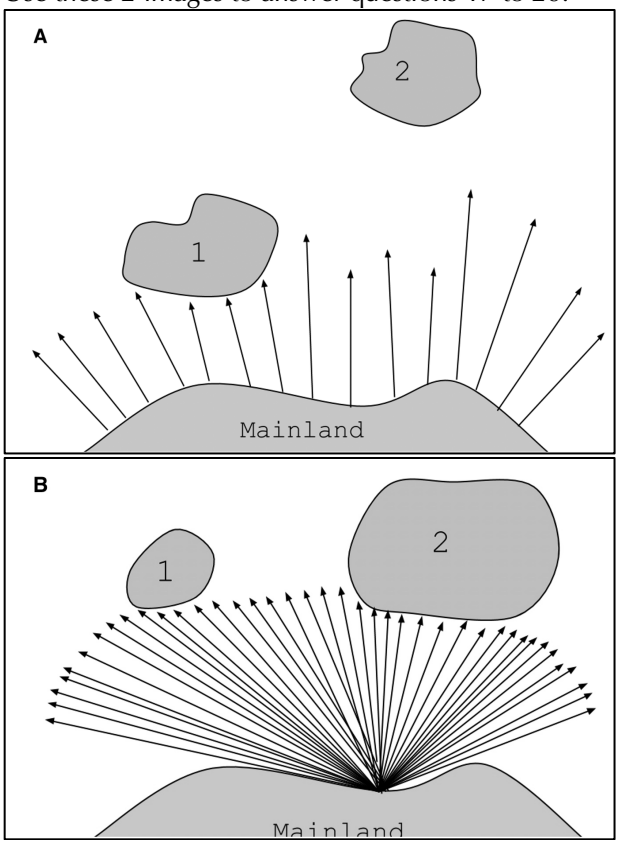
13. Why are island ecosystems particularly vulnerable to biodiversity loss?
    A. they are usually uninhabited by humans
    B. they lack predators to maintain population balance
    C. they have a high proportion of endemic species and limited space
    D. they receive less sunlight compared to mainland areas

14. How does overfishing affect marine biodiversity?
    A. it increases genetic diversity in fish populations
    B. it causes a trophic cascade, disrupting food webs
    C. it leads to habitat restoration for aquatic species
    D. it reduces species richness in freshwater ecosystems

15. Which of these best describes the 'Sixth Mass Extinction'?
    A. an extinction event caused by natural climatic shifts
    B. a prehistoric extinction event caused by volcanic eruptions
    C. the extinction of dinosaurs 65 million years ago
    D. the ongoing extinction event driven by human activities

16. Which of the following best defines biodiversity?
    A. the variety of genes, species, and ecosystems in a region
    B. the total number of species on Earth
    C. the number of organisms in a given area
    D. the diversity of ecosystems in urban areas

Use these 2 images to answer questions 17 to 20.



17. Which of the following terms describes the effects illustrated in these images?
    A. conservation biology
    B. habitat heterogeneity
    C. island biogeography
    D. serendipity

18. In image B, given that the locations are roughly the same distance from the mainland, which of these would receive a greater variety of species?
    A. 1
    B. 2
    C. they would receive roughly the same variety
    D. it is impossible to determine from this illustration

19. Which of the following would help to describe the relationship illustrated in image B?
    A. the species-area curve
    B. assembly rules
    C. metapopulation ecology
    D. distance decay

20. Which of these would have the most impact on the difference in species variety between the two islands in image A?
    A. the species-area curve
    B. assembly rules
    C. metapopulation ecology
    D. distance decay

Questions 21-30 are on populations.

21. What is the term for the number of children a woman is expected to have during her lifetime?
    A. replacement-level fertility
    B. crude birth rate
    C. total fertility rate
    D. net reproduction rate

22. What is the main reason for high birth rates in the pre-industrial stage of demographic transition?
    A. cultural and religious influences
    B. access to advanced healthcare
    C. low infant mortality rates
    D. widespread use of contraception

23. Which region of the world is likely to experience the greatest population growth by 2050?
    A. North America
    B. Europe
    C. East Asia
    D. Sub-Saharan Africa

24. Which of the following is a density-dependent factor that affects population size?
    A. droughts
    B. diseases
    C. volcanic eruptions
    D. hurricanes

25. Which of these best describes carrying capacity (K) in population ecology?
    A. the maximum number of individuals that a population can sustain indefinitely in a given environment
    B. the number of individuals added to a population during exponential growth
    C. the total number of individuals in a population at any given time
    D. the reproductive potential of a population

26. Which of the following countries is most likely to have a high dependency ratio?
    A. a country with a large elderly population
    B. a country with a balanced age structure
    C. a country with a large working-age population
    D. a country with declining birth rates

27. Logistic growth is typically associated with which of these shapes?
    A. J-shaped curve
    B. S-shaped curve
    C. Linear line
    D. Exponential rise and fall

28. If an initial population of 10,000 individuals has an annual growth rate of 5%, how large will the population be after 42 years?
    A. 15,000
    B. 20,000
    C. 40,000
    D. 80,000

29. Which of these describes the difference between exponential and logistic growth curves?
    A. exponential growth depends on birth and death rates while logistic growth does not
    B. exponential growth depends on density while logistic growth depends on carrying capacity
    C. logistic growth reflects density-dependent effects like birth rates while exponential growth is independent of density
    D. exponential growth follows a sigmoidal curve while logistic growth follows a linear function

30. The biotic potential of a population equals the reproductive potential minus which of these other factors?
    A. carrying capacity
    B. mortality
    C. natural selection
    D. population density

Questions 31-40 are on earth systems and resources.

31. What is the main cause of seasonal changes on Earth?
    A. the tilt of Earth's axis relative to its orbit around the sun
    B. variations in the distance between Earth and the sun
    C. fluctuations in solar output
    D. the influence of ocean currents on global temperatures

32. Which of the following is an example of chemical weathering?
    A. freezing and thawing of water in rock cracks
    B. acid rain dissolving limestone
    C. rockfall caused by gravity
    D. abrasion of rocks by windborne particles

33. What type of plate boundary is associated with the formation of mid-ocean ridges?
    A. convergent boundary
    B. transform boundary
    C. divergent boundary
    D. subduction zone

34. What is the primary driver of the water cycle?
    A. tectonic activity
    B. gravitational pull
    C. wind patterns
    D. solar energy

35. The Earth's magnetic field performs which of these functions?
    A. creates tectonic plate movement
    B. protects the Earth from solar wind and cosmic radiation
    C. controls ocean currents and atmospheric circulation
    D. regulates volcanic activity

36. Which soil horizon is rich in organic material and critical for plant growth?
    A. O horizon
    B. A horizon
    C. B horizon
    D. C horizon

37. Which of these is NOT true of sea and land breezes?
    A. land breezes form mostly during daytime hours
    B. they are examples of thermal circulations
    C. sea breezes can result in rain showers near shore
    D. large lakes often have smaller versions of sea breezes

38. Jet streams over the United States travel primarily in what direction?
    A. east to west
    B. west to east
    C. south to north
    D. north to south

39. Which of these soil particles is characterized by poor nutrient-holding capacity, good water filtration capacity, and good aeration?
    A. clay
    B. silt
    C. sand
    D. loam

40. On the leeward side of a mountain, one would expect to find which of these?
    A. more clouds and rain than on the windward side
    B. more clouds and less rain than on the windward side
    C. fewer clouds and less rain than on the windward side
    D. no significant difference in clouds or rain than on the windward side

Questions 41-50 are on land and water use.

41. Which of the following is an environmental benefit of drip irrigation?
    A. reduced groundwater recharge
    B. minimizing water waste through evaporation
    C. increased soil erosion
    D. enhanced pesticide distribution

42. Which of the following is a method of sustainable forestry?
    A. clear-cutting
    B. prescribed burns to reduce underbrush
    C. overgrazing by cattle in forested areas
    D. planting monocultures of fast-growing trees

43. Which of the following best describes gray water?
    A. water that is unsuitable for irrigation or reuse
    B. water from untreated storm runoff
    C. water from sinks, showers, and washing machines that can be reused
    D. water from industrial discharges

44. What is the primary environmental concern associated with concentrated animal feeding operations (CAFOs)?
    A. high greenhouse gas emissions and nutrient pollution
    B. decreased crop diversity
    C. reduced water consumption
    D. overuse of open range grazing

45. What is a key advantage of aquaculture compared to wild-capture fisheries?
    A. it eliminates all environmental impacts of seafood production
    B. it requires less water than farming
    C. it avoids the use of antibiotics or chemicals
    D. it reduces the pressure on wild fish populations

46. What is the environmental benefit of using permeable pavement in urban areas?
    A. it eliminates the need for stormwater systems
    B. it increases surface runoff
    C. it reduces the demand for construction materials
    D. it reduces flooding by allowing water infiltration into the ground

47. Which of these is the primary cause of soil erosion?
    A. chemical degradation
    B. physical degradation
    C. wind erosion
    D. water erosion

48. Given the loss of energy between trophic levels, the Second Law of Thermodynamics would support which of these as the most efficient?
    A. people eating a balanced diet from all food groups
    B. people becoming vegetarians
    C. people eating a roughly equal amount of grain and meat
    D. people eating almost entirely meat

49. Most of the Earth’s land area is which of these?
    A. forest
    B. farmland
    C. desert
    D. rangeland

50. Most of the grain that is produced in the US is used for what purpose?
   A. to feed livestock
   B. for use in processed foods
   C. for export to other countries
   D. to make alcohol for industrial use and human consumption

Questions 51-60 are on energy resources and consumption.

51. What is a key challenge of integrating wind power into the electrical grid?
   A. high greenhouse gas emissions
   B. high water usage
   C. limited availability of land
   D. fluctuations in wind speed and reliability

52. Which of the following is an example of passive solar design?
   A. orienting a building to maximize sunlight during the winter
   B. installing photovoltaic panels on a roof
   C. using natural gas to generate heat when solar is not available
   D. burning biomass for cooking

53. Which of the following fossil fuels is the cleanest burning in terms of greenhouse gas emissions?
   A. coal
   B. oil
   C. natural gas
   D. wood

54. Which of these has the lowest net energy ratio, meaning it requires significant input energy to produce usable energy?
   A. wind
   B. tar sands
   C. hydropower
   D. geothermal

55. Which of the following best describes energy efficiency?
   A. percentage of energy converted into useful work
   B. total amount of energy consumed
   C. the cost of producing energy
   D. the speed of energy production

56. What is the largest renewable energy source used for electricity generation worldwide?
   A. wind
   B. geothermal energy
   C. hydropower
   D. biomass

57. Which of these is the LEAST efficient at conversion of energy?
   A. LED lightbulb
   B. steam turbine
   C. internal combustion engine
   D. incandescent lightbulb

58. Which of these energy sources has the lowest average sustainable generating cost?
   A. coal
   B. a large hydroelectric facility
   C. nuclear
   D. solar photovoltaic

59. All of these are potential advantages of using nuclear fusion as an energy source EXCEPT which of the following?
   A. abundant fuel supply
   B. 100% efficiency
   C. no air pollution
   D. no high-level nuclear waste

60. Which of these would NOT increase future energy sustainability?
   A. removing efficiency standards for appliances and HVAC systems
   B. assessing penalties or taxes on fossil fuel use by industries
   C. policies to encourage governments to purchase renewable energy
   D. tax incentives for production of renewable energy

Questions 61-70 are on atmospheric pollution.

61. What is the primary health impact of fine particulate matter?
   A. skin irritation
   B. respiratory and cardiovascular issues
   C. neurological damage
   D. increased risk of bone fractures

62. Which of these pollutants is a precursor to acid rain formation?
   A. carbon monoxide (CO)
   B. ozone (O_3)
   C. sulfur dioxide (SO_2)
   D. methane (CH_4)

63. What is the role of catalytic converters in reducing air pollution?
   A. They increase fuel efficiency.
   B. They reduce sulfur dioxide emissions.
   C. They convert harmful emissions like CO and NO_x into less harmful gases.
   D. They prevent the release of particulate matter.

64. Which of these atmospheric conditions exacerbates smog formation?
A. high wind speeds
B. low temperatures and high humidity
C. frequent rainfall
D. temperature inversions

65. Which of these is an environmental consequence of ground-level ozone pollution?
A. damage to plant tissues and reduced crop yields
B. ozone layer depletion
C. increased biodiversity in aquatic ecosystems
D. enhanced natural photosynthesis

66. What is the main source of anthropogenic sulfur dioxide emissions?
A. automobiles
B. industrial processes and coal combustion
C. forest fires
D. agricultural practices

67. What is the role of volatile organic compounds in atmospheric pollution?
A. They directly damage the ozone layer.
B. They react with nitrogen oxides to form photochemical smog.
C. They are inert gases that do not affect the atmosphere.
D. They reduce the impact of acid rain.

68. Which of these pollutants is neurotoxic in humans?
A. mercury
B. nitrogen oxides
C. carbon dioxide
D. ozone

69. Which of these is the largest single source of air pollution worldwide?
A. factories
B. internal combustion engines
C. agriculture
D. volcanoes

70. The average American spends what percentage of their time indoors?
A. under 25%
B. between 25% and 49%
C. between 50% and 74%
D. over 75%

Questions 71-80 are on aquatic and terrestrial pollution.

71. Which of these pollutants can cause biomagnification in terrestrial predators?
A. phosphates
B. DDT
C. sulfur dioxide
D. methane

72. Which of these is a primary environmental concern with untreated sewage entering waterways?
A. introduction of pathogens and organic waste
B. increased sedimentation
C. reduction in atmospheric nitrogen levels
D. increased biodiversity in aquatic ecosystems

73. Which of these is a major contributor to terrestrial pollution in urban areas?
A. deforestation
B. intensive farming practices
C. improper disposal of electronic waste
D. desertification

74. Which of the following is a major source of microplastics in aquatic systems?
A. decomposition of organic matter
B. release of industrial waste
C. chemical runoff from agriculture
D. breakdown of larger plastic debris

75. Which of the following pollutants is most likely to bioaccumulate in aquatic food chains?
A. nitrates
B. phosphates
C. mercury
D. oxygen

76. What is the most effective way to reduce agricultural runoff pollution in aquatic systems?
A. building more dams
B. using buffer strips and riparian zones
C. draining wetlands near farmland
D. applying more chemical fertilizers

77. In developing countries, which of these would be the most likely cause of respiratory disease?
A. smoking
B. particulate matter
C. photochemical smog
D. industrial smog

78. The largest source of solid waste in the US is which of these?
A. mining
B. agriculture
C. power generation
D. household waste

79. What is the purpose of riparian buffers in controlling pollution?
A. to create habitat for aquatic species
B. to reduce nutrient runoff into water bodies
C. to eliminate thermal pollution from industrial facilities
D. to increase urban stormwater flow

80. Which of the following methods can best prevent groundwater pollution from agricultural activities?
A. sing synthetic fertilizers instead of organic ones
B. draining wetlands to absorb pollutants
C. applying pesticides and fertilizers year-round
D. practicing crop rotation and reduced tillage

Questions 81-90 are on global change.

81. What impact does melting of land-based glaciers have on the global water cycle?
A. It decreases sea levels due to water storage on land.
B. It increases sea levels by adding freshwater to oceans.
C. It reduces precipitation in coastal areas.
D. It increases groundwater recharge rates globally.

82. What is the significance of carbon sinks in mitigating climate change?
A. They release carbon dioxide into the atmosphere.
B. They prevent soil erosion and desertification.
C. They store carbon, reducing atmospheric CO_2 levels.
D. They enhance natural gas emissions.

83. Which of these ecosystems is most at risk from rising sea levels caused by climate change?
A. alpine forests
B. coral reefs
C. mangrove forests
D. desert ecosystems

84. How does ocean warming contribute to stronger hurricanes?
A. by increasing the energy available for storm formation
B. by raising sea levels, which amplifies storm surges
C. by increasing the salinity of surface waters
D. by reducing atmospheric water vapor

85. Which of the following is an example of a positive feedback loop related to climate change?
A. Increased CO_2 leads to more plant growth and reduced warming.
B. Ocean currents cool polar regions, slowing climate change.
C. Increased cloud cover reduces solar radiation reaching the Earth.
D. Melting ice decreases albedo, which causes further warming.

86. Which region of the world is experiencing the most rapid temperature increases due to global climate change?
A. equatorial regions
B. polar regions
C. mid-latitude regions
D. deserts

87. Which of the following is considered a tipping point in global climate systems?
A. increase in ozone concentration in the stratosphere
B. permanent loss of Arctic summer sea ice
C. gradual cooling of tropical oceans
D. stabilization of carbon dioxide levels

88. Which of these is true of the effect of aerosols in the atmosphere?
A. They can reflect sunlight, leading to temporary cooling.
B. They always contribute to global warming.
C. They increase greenhouse gas concentrations.
D. They increase atmospheric oxygen levels.

89. Which of the following gases has the highest global warming potential per molecule?
A. Carbon dioxide (CO_2)
B. Methane (CH_4)
C. Nitrous oxide (N_2O)
D. Chlorofluorocarbons (CFCs)

90. Which factor has the greatest influence on current global climate change?
A. volcanic eruptions
B. variations in Earth's orbit
C. human activity
D. increased solar radiation from the sun

Questions 91-100 are general questions about environmental science.

91. Which biome is characterized by nutrient-poor soil, high biodiversity, and a warm, wet climate?
A. tropical rainforest
B. temperate grassland
C. desert
D. taiga

92. What is the primary function of legumes in the nitrogen cycle?
A. decomposing organic matter
B. releasing nitrogen gas into the atmosphere
C. fixing atmospheric nitrogen into a usable form
D. facilitating nitrification

93. Which of the following processes in the carbon cycle removes carbon dioxide from the atmosphere?
A. combustion
B. photosynthesis
C. respiration
D. decomposition

94. Which of the following is most likely to increase biodiversity in an ecosystem?

A. introduction of a single dominant species
B. expansion of agricultural monocultures
C. restoration of natural habitats and corridors
D. increased use of chemical pesticides

95. What happens to population growth in a country where the replacement-level fertility rate is consistently below 2.1?

A. the population increases rapidly
B. the population stabilizes
C. the population grows due to high immigration
D. the population declines over time

96. Which of the following processes directly leads to the creation of metamorphic rock?

A. compaction of sediments
B. cooling and crystallization of magma
C. exposure to high heat and pressure
D. chemical weathering of existing rock

97. Which of the following would most likely increase groundwater recharge?

A. increasing the amount of impervious surfaces
B. deforestation of a large area
C. installation of rain gardens and permeable pavement
D. diversion of rivers for agriculture

98. What is the primary goal of bioremediation in polluted areas?

A. to increase industrial productivity
B. to neutralize pollutants using natural organisms
C. to build infrastructure to prevent pollution
D. to eliminate biodiversity in polluted sites

99. Which ecosystem service is an example of a regulating service?

A. pollination by bees
B. timber production
C. flood control provided by wetlands
D. recreational benefits

100. Which of these describes an ecosystem with high resistance?

A. returns to its original state quickly after a disturbance
B. is not easily affected by disturbances
C. has low biodiversity
D. experiences frequent changes in population sizes