

# INTERNATIONAL ENVIRONMENTAL SCIENCE OLYMPIAD



## Battery Examination – Part 1 Middle School Division Friends and Family Older Siblings

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. filtration
- B. transpiration
- C. infiltration
- D. precipitation

2. What term describes the variety of species within an ecosystem?

- A. species richness
- B. genetic drift
- C. functional keystone
- 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

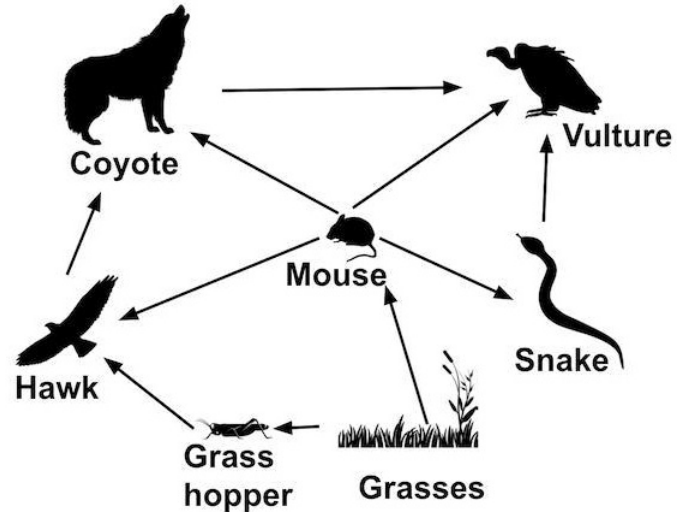
5. Which of the following is the best example of a producer in an ecosystem?

- A. deer
- B. beetle
- C. pine tree
- D. hawk

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

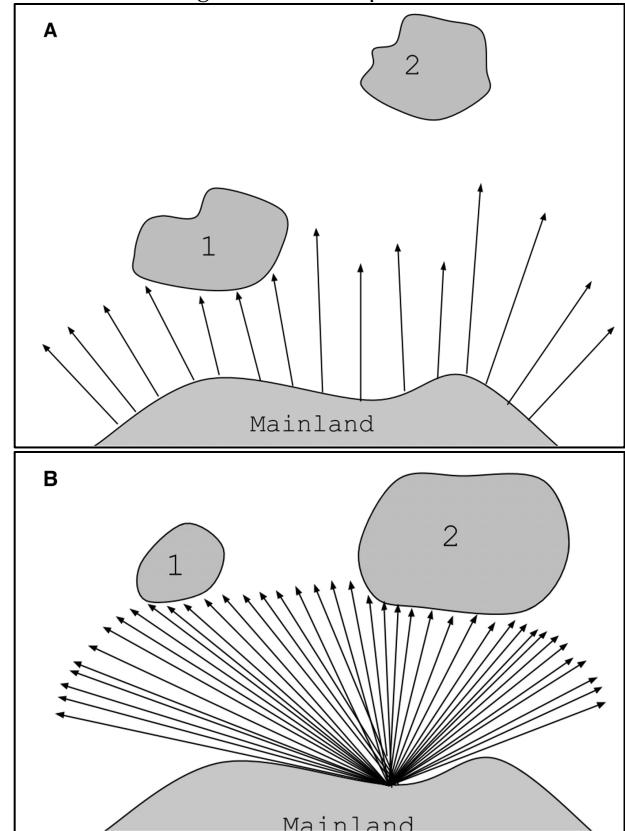
15. Which of these best describes the 'Sixth Mass Extinction'?

- 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 animals in a city or town
- C. the number of species that have gone extinct
- 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 loss
- 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 death rate
- C. total fertility rate
- D. net population growth

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<sub>3</sub>)
- C. sulfur dioxide (SO<sub>2</sub>)
- D. methane (CH<sub>4</sub>)

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<sub>x</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub>)
- B. Methane (CH<sub>4</sub>)
- C. Nitrous oxide (N<sub>2</sub>O)
- 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