

2024-2025 GullSO Invitational



Ecology TEST

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Exam Guidelines

- You have 50 minutes to complete this exam, plus an extra 5-minute grace period at the end to organize your pages for submission. You may not write anything during the grace period.
- You can take the test booklet apart (but you **MUST** put it back in order at the end).
- Point values are given for every question. If not otherwise indicated, multiple-choice questions are worth 1 point.
- Tiebreaker questions are denoted by the letters "TB".
- **Write your answers on the provided answer sheet**

ANYTHING WRITTEN IN THIS TEST PACKET WILL NOT BE GRADED

DO NOT TURN THE PAGE UNTIL INSTRUCTED

Gulliver, a California Gull, was flying down to the Southern United States to visit his girlfriend, Gullina. However, after flying over miles of unfamiliar same-looking territory, he finally admitted that he was lost and called up his friends (you) to help him out.

Where Am I?

For questions 1-7, determine whether his surroundings more accurately describe a grassland or a desert. The conditions described in each question are independent and not related to others. (1 pt each)

1. Gulliver flies over an arid, rugged terrain dotted by little shrubs. He tries to make some mental landmarks, but every bush looks the same.
 - a. Grassland
 - b. Desert
2. Gulliver lands in a valley, seeking shelter from the 30 degree (°C) heat. At night, though, temperatures drop well below freezing.
 - a. Grassland
 - b. Desert
3. Gulliver continues flying. The weather is still hot and dry, but he at least spots an oak tree to land on. Something smells like burning.
 - a. Grassland
 - b. Desert
4. Gulliver flies over an empty playa. Not a tree in sight. The soil is dry and highly saline.
 - a. Grassland
 - b. Desert
5. Gulliver stops to pick some flowers for Gullina. He grabs a bush poppy, a blue coneflower, and some chaparral yucca.
 - a. Grassland
 - b. Desert
6. Gulliver watches down below as a jackrabbit scurries into a cluster of yucca plants. A fennec fox burrows into a dry waterhole.
 - a. Grassland (Montane)
 - b. Desert
7. Gulliver has his nap rudely interrupted by the pungent smell of a big sagebrush. The soil is wetter and not as saline. He falls back asleep in a bed of cheatgrass.
 - a. Grassland (Steppe)
 - b. Grassland (Prairie)
 - c. Desert
8. Gulliver's map has led him to a desert region. Assuming he is still in the United States, which of the following is NOT a desert Gulliver could be flying through?
 - a. The Mojave Desert
 - b. The Sonoran Desert
 - c. The Patagonian Desert
 - d. The Chihuahuan Desert
9. The area Gulliver is flying through has been "desertified," a process defined primarily by an increase in soil _____.
 - a. aridity
 - b. turbidity
 - c. porosity
 - d. temperature
10. The process of desertification is very often due to human activity. Name 3 examples of human activities that can lead to desertification (3 pts)
11. Groups of animals that are geographically separated but still interact are called _____. (1 pt)
12. Define matrix quality in the context of habitat fragmentation. (2 pts)
13. How do natural and artificial forms of habitat fragmentation impact biodiversity? (2 pts)
14. When populations are isolated, is inbreeding depression more or less likely to occur? How is this harmful for species? (2 pts)

15. Based on this ecological concept, how is the distance between habitat patches related to the amount of the same species present in each of them? (1 pt)
16. Describe one way in which the effects of habitat fragmentation can improve the success of invasive species. (1 pt)
17. What is a distinctive adaptation of the fennec fox, and what purpose does it serve?
 - a. large, fur-covered ears; heat radiation
 - b. large, fur-covered ears; camouflage
 - c. pale fur color; shelter from extreme temperatures
 - d. long, thick fur; heat radiation
18. What is another desert animal adaptation that can serve the same purpose as above?
 - a. Sharper eyesight
 - b. Nocturnal Behavior
 - c. Burrows
 - d. A and B
 - e. B and C
 - f. None of the above
19. Which type of species is most negatively affected by habitat fragmentation?
 - a. Generalist species
 - b. Edge species
 - c. Specialist species
 - d. Invasive species
20. Which concept describes the importance of patch size in fragmented habitats?
 - a. Ecological succession
 - b. Island biogeography
 - c. Trophic cascades
 - d. Genetic drift

Here Comes the Sun

21. Enough solar energy reaches the earth's surface every ___ to meet the earth's energy needs for an entire year.
 - a. Minute
 - b. Hour
 - c. Week
 - d. Month
22. What is dual-use solar farming, and why is it ecologically beneficial? (2 pts)
23. Describe a strategy that can minimize habitat damage during solar panel installation. (2 pts)
24. Explain the process of obtaining energy using PV cells. (3 pts)
25. How does latitude impact irradiation? What does this mean for how solar farms are geographically distributed? (2 pts)
26. Are solar panels an example of active or passive solar energy? Define both types. (3 pts)
27. Name 3 ways a home can be designed to use solar energy without converting to solar power. (3 pts)

28. How are local temperatures impacted by solar farms? Why is this? (2 pts)
29. Are fixed tilt or adjustable arrays more efficient? Why? (2 pts)
30. What are three pros and cons of rooftop solar panels compared to solar farms? (3 pts)

Numbers Game

31. A gull colony has a carrying capacity of 1,000 individuals. If the current population is 800, what is the potential growth rate if the growth rate is 10% per year? (2 pts)
32. If a population of gulls increases by 50 individuals in a year, and the carrying capacity is 1,200, what is the population growth rate as a percentage of the current population of 1,000? (2 pts)
33. What are three density-dependent limiting factors for gull populations? (3 pts)
34. If a researcher finds that the doubling time for a gull population is 5 years, what is the approximate annual growth rate using the Rule of 70? (1 pt)
35. If a density-independent factor causes a decrease in the gull population from 1,000 to 750, what is the percentage decrease? Provide an example of such a factor. (2 pts)
36. What type of growth model would typically be seen in a gull population?
 - a. Exponential growth
 - b. Logistic growth
 - c. Linear growth
 - d. Cyclical growth
37. What typically happens to a gull population once it initially reaches carrying capacity?
 - a. Continued exponential growth
 - b. Population decline
 - c. Overshoot before stabilization
 - d. Immediate extinction
38. How does predation act as a density-dependent factor for gull populations?
 - a. Predation increases population density
 - b. Predation increases as population density increases
 - c. Predation decreases as population density increases
 - d. Predation impacts the species equally regardless of density
39. If a colony of gulls has an initial population of 500 and experiences a yearly increase of 20% due to favorable conditions, what will the population be after three years? (2 pt)
40. How can understanding these population dynamics shape conservation plans for both vulnerable gull species or species that might face harmful impacts because of the presence of some gull species? (2 pts)
41. Which of the following is the primary cause of acid rain? (select all that apply)
 - a. Carbon dioxide
 - b. Sulfur dioxide
 - c. Nitrogen oxides
 - d. Methane
 - e. Ozone
42. How are the chemicals responsible for acid rain also a part of the creation of photochemical smog? (2 pts)

43. How does acid rain negatively affect human-built structures and infrastructure? (1 pt)
44. What is biomagnification, and how does it differ from bioaccumulation? What does this have to do with acid rain? (3 pts)
45. Why are cap-and-trade systems often considered more efficient than direct regulation (such as emissions limits)? (1 pt)
46. Which of the following is a direct effect of acid rain on aquatic life?
- It increases the growth of aquatic plants
 - It reduces the availability of oxygen in water
 - It increases biodiversity in water ecosystems
 - It neutralizes acidic soils in the watershed
47. In a market-based environmental policy, such as cap-and-trade, what happens when the cost of reducing pollution is high for a company?
- The company must pay a higher tax on emissions
 - The company can purchase emission allowances from other companies
 - The company must reduce pollution further regardless of cost
 - The company is exempt from emissions reduction
48. Which economic concept best describes the idea that markets can achieve environmental goals with minimal government intervention?
- Market failure
 - Environmental externalities
 - Free market environmentalism
 - Tragedy of the commons
49. What is the primary purpose of a carbon tax?
- To encourage companies to sell more pollution allowances
 - To raise funds for environmental programs
 - To directly reduce carbon emissions by increasing the cost of pollution
 - To subsidize renewable energy investments
50. What is a key challenge associated with environmental taxes?
- They guarantee pollution reduction at a predictable level
 - They can be difficult to enforce and monitor accurately
 - They provide too much flexibility for businesses
 - They tend to disproportionately harm wealthy corporations
51. Which of the following is an example of a payment for ecosystem services (PES) scheme?
- Providing tax credits for reducing emissions
 - Paying landowners to conserve forests that absorb carbon dioxide
 - Mandating energy efficiency standards for all buildings
 - Imposing fines on companies that exceed emissions limits
52. Name one benefit of implementing a payment for ecosystem services (PES) scheme? (1 pt)
53. Describe the environmental economics principle of "externalities" and provide an example related to pollution. (2 pts)

Ducking and weaving through offshore wind

54. How does upwelling contribute to seabird feeding frenzies? (1 pt)
55. Why is wind power more effective offshore compared to onshore? (1 pt)
56. Name two ways wind turbines can be designed to reduce bird collisions? (2 pts)
57. Which type of wind turbine (HAWT or VAWT) is more commonly used in large-scale wind farms? Why? (2 pts)
58. Why is wave energy unlikely to become a major source of renewable energy in the future? (1 pt)
59. What is a pollutant that influences reproductive success called? (1 pt)
60. How can oil spills from offshore drilling affect the primary productivity of marine ecosystems?
 - a. Oil spills increase the availability of nutrients, enhancing primary productivity
 - b. Oil spills block sunlight, inhibiting photosynthesis and reducing primary productivity
 - c. Oil spills provide food for primary producers, increasing productivity
 - d. Oil spills have no effect on primary productivity in marine ecosystems
61. How does the presence of oil in marine environments impact benthic organisms?
 - a. Oil enhances nutrient availability, promoting growth of benthic communities
 - b. Oil coats organisms' bodies and reduces gas exchange, leading to suffocation and death
 - c. Oil increases sediment disturbance, improving habitat for benthic organisms
 - d. Oil has no significant effect on benthic organisms, as they are isolated from the surface layer
62. In what way can the release of toxic substances from offshore drilling influence the reproductive success of marine species?
 - a. Toxic substances enhance reproductive rates by providing chemicals that cause mutations
 - b. Contaminants can interfere with hormone regulation, leading to reproductive failure or abnormalities
 - c. Oil and other toxins improve the success of marine species by eliminating predators
 - d. Toxic substances have no effect on reproductive success, as marine species are adapted to harsh environments
63. How can the noise generated by offshore drilling activities affect marine mammals?
 - a. The noise carries their communications farther
 - b. Marine animals do not have very good hearing
 - c. The noise increases food availability by attracting marine mammals and their prey to drilling sites
 - d. It can disrupt their navigation