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Name: _____ Date: _____

1. Which ecological level would be of most interest to an ecologist studying adaptations?

A) ecosystem
B) population
C) individual
D) community
E) biosphere

2. Which of the following is NOT a property used in the study of populations?

A) density
B) change in size
C) composition
D) historical origin of population

3. Which level of ecological hierarchy includes the movement of water and air?

A) community
B) population
C) ecosystem
D) biosphere

4. A group of organisms that interbreeds in nature and produces fertile offspring is called a

A) population.
B) species.
C) community.
D) prokaryote.

5. The boundaries of communities are

A) difficult for species to cross.
B) flexible.
C) clear and distinct.
D) never overlapping.

6. Which is the correct hierarchy of ecological systems, from smallest to largest?

A) ecosystem, biosphere, community, population, individual
B) individual, community, population, ecosystem, biosphere
C) individual, population, ecosystem, biosphere, community
D) individual, population, community, ecosystem, biosphere
E) biosphere, community, ecosystem, population, individual

7. Which of the following systems is composed of assemblages of organisms together with their physical and chemical environments?

A) organism
B) population
C) community
D) ecosystem
E) biosphere

8. An ecologist who studies populations would most likely be interested in

A) adaptations that help individual organisms live in their environment.
B) births and deaths of individuals belonging to a particular species in a particular place.
C) the number and relative abundance of species living in a particular place.
D) physical and chemical transformations of energy and materials in the soil, atmosphere, and water.
E) transport of energy and materials at the global scale.

9. Explain how studying a community can provide insight into population changes.

10. Explain how the definition of *species* has become more complicated. Give an example.

11. The first law of thermodynamics states that

A) life requires energy to be continually added to Earth.
B) matter cannot be created or destroyed.
C) when energy changes form, some energy is lost.
D) energy cannot be created or destroyed, but only change form.

12. In a dynamic steady state

A) there are no inputs or outputs to the system.
B) the second law of thermodynamics does not apply.
C) there is no net change in the system.
D) the system will continue to grow.

13. In evolution by natural selection, which of the following is true?
A) All individuals within a population are identical.
B) Some individuals have a higher fitness because of their traits.
C) Offspring inherit every trait from both parents.
D) The fitness of an individual refers to the strength of the individual.

14. How can species interactions increase the rate at which species evolve?
A) Interactions reduce the effects of natural selection.
B) Interactions increase the fitness of all individuals.
C) Interactions make certain traits more useful.
D) Interactions reduce the genetic variety in individuals.

15. A phenotype is
A) the traits an individual can pass on to its offspring.
B) the expression of an individual's traits.
C) the genes an individual possesses.
D) a trait caused by interaction with another species.

16. To maintain a dynamic steady state in a community, which two factors must balance?
A) new species arrivals and current species extinctions
B) immigration and emigration
C) births and deaths
D) food consumed and energy expended

17. At what ecological level does evolution occur?
A) individual
B) population
C) ecosystem
D) community
E) biosphere

18. How might one hierarchical level that is not in steady state affect the hierarchical level above it?

19. Many warm-blooded organisms must maintain a constant temperature that is commonly warmer than their surroundings. What is the cost associated with maintaining the dynamic steady state, and how is this cost met?

20. How might the use of pesticides to control insects that feed on wheat affect how the insects evolve?

21. The law of conservation of matter states that matter cannot be destroyed. Why, then, are we concerned about the depletion of resources?

22. Eukaryotic organisms are distinguished by their
A) inability to photosynthesize.
B) chloroplasts.
C) mitochondria.
D) single-cell structure.

23. Blue-green algae are
A) protists.
B) bacteria.
C) plants.
D) fungi.

24. Organisms that use photosynthesis or chemosynthesis are
A) autotrophs.
B) consumers.
C) heterotrophs.
D) herbivores.

25. Which interaction is characterized by negative effects on the fitness of both species involved?
A) predation
B) herbivory
C) commensalism
D) competition

26. The relationship between a burdock plant and a fox is
A) competition.
B) herbivory.
C) predation.
D) parasitism.
E) commensalism.

27. A mixotroph is an organism that
A) consumes dead organic matter.
B) can be both a parasite and a predator.
C) survives only because of a symbiotic relationship.
D) can use multiple methods to obtain energy.

28. The range of biotic and abiotic conditions a species can tolerate is its
A) community.
B) habitat.
C) niche.
D) ecosystem role.

29. Hyphae are structures found in
A) plants.
B) animals.
C) fungi.
D) protists.

30. Which consumes dead organic matter?
A) detritivore
B) herbivore
C) parasite
D) predator
E) parasitoid

31. Which evolved first?
A) plants
B) fungi
C) protists
D) bacteria

32. What pair of species would you expect to be commensalistic?
A) owls and oak trees
B) osprey and herons
C) coyotes and foxes
D) algae and kelp

33. There are many examples in nature of cooperation among organisms, such as the bacteria that inhabit the root nodules of leguminous plants. Partnerships between organisms that live in close association are called

A) networks.
B) communities.
C) symbioses.
D) ecosystems.

34. Why are two species unable to share exactly the same niche?

35. Plants and animals exchange energy and materials with their physical environments. These exchanges occur across surfaces. In animals, surfaces tend to be internal, while in plants, surfaces tend to be external. Discuss the principal reason for this important difference.

36. Why are protists suited for symbiotic relationships with other species?

37. An ultimate hypothesis

A) explains how an organism has adapted its physiology.
B) addresses an organism's response to the environment.
C) has been tested and revised.
D) is a prediction about how an organism might adapt in the future.

38. What method is used to increase experimental reliability?

A) replication
B) proximate hypotheses
C) natural experiment
D) mathematical models

39. An experimental control is a(n)

A) experiment performed on randomly selected samples.
B) manipulation without the factor of interest.
C) manipulation using natural conditions.
D) sample size that is large enough to accurately reflect the variance.

40. Which is the best action if an experiment does not support a hypothesis?
A) Create a mathematical model.
B) Revise the hypothesis.
C) Test the hypothesis again.
D) Publish your results.

41. Ecologists using global carbon-balance models were overestimating the rate of increase of atmospheric carbon dioxide. This discovery led these ecologists to
A) discard their models.
B) switch to modeling other phenomena.
C) conclude that increase in atmospheric carbon dioxide is not a serious environmental problem.
D) search for evidence of other carbon dioxide sinks in the global cycle of carbon.

42. Most scientific investigations begin with a set of facts about nature. These facts are obtained by
A) observation and description.
B) development of mathematical models.
C) development of hypotheses.
D) experimental testing of hypotheses.

43. The formulation of hypotheses is a critical step in the scientific process. In the simplest terms, what is a hypothesis?
A) an explanation
B) an experiment
C) an observation
D) a proven fact

44. Because it is difficult to experiment on large ecological systems, researchers often replicate the essential features of a system in smaller, simplified laboratory or field settings known as
A) microcosms.
B) approximate systems.
C) natural treatments.
D) experimental units.

45. Explain the potential difficulties of using a natural experiment to test a hypothesis.

46. A scientist hypothesizes that the larvae of a particular species of swallowtail butterfly uses olfaction (the sense of smell) to locate their preferred host plants in the carrot family. To test the hypothesis, the scientist uses extracts from various plants—including some from the carrot family—to moisten small pieces of paper arranged randomly under a wire screen. Swallowtail larvae are released on the wire screen but cannot come into direct physical contact with the pieces of paper. What is the advantage of this experiment compared to simply presenting the larvae with a choice among various plants?

47. Scientists ask questions about how the natural world works. These can usually be classified as how questions or why questions. A scientist observes that an owl species can fly silently. Give an example of a how and a why question that the scientist might study and what the differences would be.

48. If you wanted to understand the impact of an introduced species on existing species in an area, what ecological level should you examine?

A) population
B) individual
C) community
D) biosphere

49. Explain why a species with a very limited niche is particularly susceptible to human influences.

50. Explain the role of ecology in efforts to reduce the damage humans do to the environment.

51. Describe one specific successful solution to an environmental problem caused by human activity.

52. What is the mean of these data: 22, 19, 34, 24, 27, 20?

A) 24
B) 144
C) 23
D) 26.5

53. If the number of fruits on 10 strawberry plants is sampled and $E[\chi]$ is found to be 6 and $E[\chi^2]$ is 38, what is the sample variance?

A) 32
B) 2
C) 2.2
D) 35.5
E) 6.3

54. Which would be the most informative about the reliability of data gathered in an experiment?

A) low mean
B) high mean
C) low variance
D) high variance

55. Explain why the sample variance is larger than the variance of the mean, especially for small samples.

56. Fishermen living along the North Pacific Rim felt threatened by increased populations of sea otters because sea otters consume commercially valuable abalone, sea urchins, and spiny lobster. What beneficial aspect of sea otter ecology did these fishermen ignore?

A) Sea otters are consumed by killer whales, which would otherwise eat commercially valuable fish.
B) Sea otters catch and eat trash fish, allowing stocks of commercially valuable fish to increase.
C) Sea otters catch and eat sea urchins, thereby protecting kelps, which in turn shelter populations of larval fish.
D) Sea otters have been used in medical research to develop vaccines that protect domestic cats from a variety of diseases.

57. Use the example of the California sea otter to explain why ecologists must study multiple hierarchical levels to understand most environmental problems.

58. To better understand what happens in an aquatic system (freshwater lake) when exposed to acid deposition (acid rain), an ecologist would likely look at the lake from the

A) species level.
B) community level.
C) population level
D) ecosystem level.

59. An ecologist who studies the meadow vole (*Microtus pennsylvanicus*) in both Michigan and New York State would be looking necessarily at individuals of the same

A) community.
B) population.
C) ecosystem.
D) species.

60. An organism that does not itself consume its prey but rather its offspring does is termed a

A) parasite.
B) parasitoid.
C) detritivore.
D) decomposer.

61. Natural selection tends to result in individuals of a species that

A) produce the most offspring.
B) are the largest in size.
C) are the fastest.
D) are the strongest.

62. A moose, a monarch butterfly, and a wolf are all examples of

A) autotrophs.
B) producers.
C) heterotrophs.
D) detritivores.

63. All things being equal, one would expect to find _____ species diversity in a stream with a uniform substrate (i.e., bottom bedrock) as compared to a stream with a heterogeneous substrate (i.e., bottom composed of sand, pebbles, stones, cobble, boulders).

A) less
B) more
C) the same
D) There is no way to determine.

64. Explain why two competitive species would have greater similarity in their respective niche than two species in which one is a predator and the other the prey (of that predator).

65. The interactions known as herbivory and predation are considered to both result in a +/- outcome between the two species involved in each of the interactions (one species benefits; the other species is harmed). How are these two interactions different?

66. Explain, in terms of fitness, why a species should have, as a result of natural selection, adapted to avoid competition.

67. Explain the difference between organisms identified as decomposers and those identified as detritivores.

Answer Key

1. C
2. D
3. D
4. B
5. B
6. D
7. D
8. B
9.
10.
11. D
12. C
13. B
14. C
15. B
16. A
17. B
18.
19.
20.
21.
22. C
23. B
24. A
25. D
26. E
27. D
28. C
29. C
30. A
31. D
32. A
33. C
34.
35.
36.
37. B
38. A
39. B
40. B
41. D
42. A
43. A
44. A

45.
46.
47.
48. C
49.
50.
51.
52. A
53. C
54. C
55.
56. C
57.
58. D
59. B
60. B
61. A
62. C
63. A
64.
65.
66.
67.