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Name:_____ Class:_____ Date:_____

Chapter 1

1. Which ecological level would be of most interest to an ecologist studying adaptations?
   a. ecosystem
   b. population
   c. individual
   d. community

ANSWER: c

2. Which of the following is NOT a property used in the study of populations?
   a. density
   b. change in size
   c. composition
   d. interactions with other populations

ANSWER: d

3. Which level of ecological hierarchy includes the movement of water and air?
   a. community
   b. population
   c. ecosystem
   d. biosphere

ANSWER: d

4. A group of organisms that interbreeds in nature and produces fertile offspring is called a
   a. population.
   b. species.
   c. community.
   d. prokaryote.

ANSWER: b

5. The boundaries of communities are
   a. difficult for species to cross.
   b. flexible.
   c. clear and distinct.
   d. never overlapping.

ANSWER: b

6. Which of the following 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

ANSWER: d

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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

ANSWER: d

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.

ANSWER: b

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

ANSWER: Many species' interactions play a part in birth and death rates of populations, such as any species that relies on another for food. Understanding these relationships is often essential to understand why a population is growing or shrinking.

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

ANSWER: While species were originally defined as organisms that could interbreed and produce fertile offspring, exceptions continue to be found. For example, prokaryotic organisms can transfer DNA to each other in horizontal gene transfer. This makes it hard to have a clear difference between species, since they can easily share DNA but are varied enough that they cannot be considered one species.

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.

ANSWER: d

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.

ANSWER: c

13. In evolution by natural selection, which of the following is true?
   a. All individuals within a population are identical.

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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.

ANSWER: b

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.

ANSWER: c

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.

ANSWER: b

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

ANSWER: a

17. At what ecological level does evolution occur?
a. individual
b. population
c. ecosystem
d. community

ANSWER: b

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

ANSWER: If the individual level is not maintained in steady state, this might mean that the organism would not find enough food to meet its energy requirements, reducing its fitness. If continued across multiple individuals, the birth rate might decrease and the death rate increase, leading to the potential for the population to go out of equilibrium as well.

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?

ANSWER: To maintain a system in disequilibrium with its environment requires expenditure of energy. A

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warm-blooded animal in cold surroundings must acquire food (with its associated energy costs in locating and acquiring food) and use the metabolic energy released from that food to maintain its temperature higher than that of its surroundings.

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

ANSWER: If some insects survive the initial application, they may be resistant to the chemical as a result of their genetic makeup. The surviving insects could pass on that trait to the next generation. Over time, the insect species may evolve to be resistant to the pesticide.

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

ANSWER: Although matter cannot be destroyed, it can be transformed into forms that are not useful or that are difficult to use.

22. A pitcher plant eats insects trapped within its specialized cupped leaves, while its other leaves can photosynthesize. In which one of the following categories would pitcher plants belong?

a. autotrophs
b. heterotrophs
c. mixotrophs
d. homotrophs

ANSWER: c

23. Cyanobacteria are

a. protists.
b. producers.
c. consumers.
d. mixotrophs.

ANSWER: b

24. Organisms that use photosynthesis or chemosynthesis are

a. autotrophs.
b. consumers.
c. heterotrophs.
d. herbivores.

ANSWER: a

25. Which interaction is characterized by negative effects on the fitness of both species involved?

a. predation
b. herbivory
c. commensalism
d. competition

ANSWER: d

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26. The relationship between a burdock plant and a fox is
    a. competition.
    b. herbivory.
    c. predation.
    d. parasitism.
    e. commensalism.

ANSWER: e

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.

ANSWER: d

28. The range of biotic and abiotic conditions a species can tolerate is its
    a. community.
    b. habitat.
    c. niche.
    d. ecosystem role.

ANSWER: c

29. Which group of organisms function as decomposers?
    a. plants.
    b. animals.
    c. fungi.
    d. protists.

ANSWER: c

30. Which consumes dead organic matter?
    a. detritivore
    b. herbivore
    c. parasite
    d. predator

ANSWER: a

31. An organism that uses chemosynthesis to form organic compounds is classified as
    a. a consumer.
    b. a mixotroph.
    c. a producer.
    d. a parasitoid.

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ANSWER: c

32. What pair of species would you expect to exhibit commensalism?
    a. owls and oak trees
    b. osprey and herons
    c. coyotes and foxes
    d. algae and kelp

ANSWER: a

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.

ANSWER: c

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

ANSWER: If two species have the identical niche, they will be competing for the same resources in the same place during the same time. While both species might survive for a brief period, eventually the better competitor will outcompete the other species, leading to the elimination of the lesser competitor from the community.

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.

ANSWER: Animals obtain energy from foods they consume. This absorption is best accomplished internally, where foods can be subjected to conditions that release molecules to be taken up across large areas of absorptive structures. Most plants obtain energy from sunlight. They must expose relatively large external absorptive surfaces (typically leaves) to sunlight to obtain this energy, which makes internal absorption impractical.

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

ANSWER: The small size of most protists makes it easy for them to live inside other larger species. In symbiotic relationships the diverse nature of protists has led to specialized adaptations that can be very useful to other organisms. An example of this is the protists that live in the gut of termites and break down cellulose. In exchange, the host organism provides a relatively stable environment for the protists, reducing the energy required to survive.

37. Which type of interaction between species results in positive outcomes for both species?
    a. commensalism
    b. mutualism
    c. herbivory
    d. heterotrophism

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ANSWER: b

38. What method is used to increase experimental reliability?
    a. replication
    b. proximate hypotheses
    c. natural experiment
    d. mathematical models

ANSWER: a

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.

ANSWER: b

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.

ANSWER: b

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.

ANSWER: d

42. Most scientific investigations begin with a set of facts about nature. These facts are obtained by
    a. observation and collection of data.
    b. development of mathematical models.
    c. development of hypotheses.
    d. experimental testing of hypotheses.

ANSWER: a

43. The formulation of hypotheses is a critical step in the scientific process. In the simplest terms, what is a hypothesis?
    a. an explanation

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b. an experiment
c. an observation
d. a proven fact

ANSWER: a

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.

ANSWER: a

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

ANSWER: Since a natural experiment relies on existing conditions, it can be difficult to find enough suitable sites to gather sufficient data. The inherent variation in natural systems makes it difficult to isolate the desired variable in the less controlled environment.

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?

ANSWER: The scientist wants to vary the volatile chemicals presented to the larvae without giving the larvae other cues to the identity of the plants from which these chemicals are extracted. Since all of the pieces of paper look alike, the scientist can eliminate the possibility that the larvae use visual cues to recognize the pieces of paper moistened with extracts from plants in the carrot family. Separating the larvae from the pieces of paper ensures that the larvae cannot use their sense of taste.

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.

ANSWER: One possible question is how the owls can fly so quietly, which would mean studying the structure of the wings and feathers and how they differ from those of other birds. Another question would be why it is advantageous for the owls to fly silently; for example, what prey this allows the owl to catch that it might not be able to catch otherwise.

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

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ANSWER: c

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

ANSWER: With a narrow niche a species has a small range of conditions in which it can survive and reproduce. As humans continue to alter and destroy habitat and change ecosystems, smaller niches may be eliminated entirely, causing the species to go extinct.

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

ANSWER: Our ability to manage human impact on global systems depends on understanding the structure and function of ecosystems.

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

ANSWER: There are multiple possible answers for this. For example, one might discuss efforts made to save endangered species from extinction, like captive breeding and reintroduction.

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

a. 24
b. 144
c. 23
d. 26.5

ANSWER: a

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

a. 32
b. 2
c. 2.2
d. 35.5

ANSWER: c

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

ANSWER: c

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

ANSWER: The sample variance is larger than the variance of the mean because the smaller the sample, the less reliable the results. Thus, for a small sample, the sample variance multiplier is larger than for large

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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.

ANSWER: c

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

ANSWER: One part of the sea otter story that illustrates this is the population loss due to killer whales. The food preferences of the whales had to be understood (on the individual level), but so did the community and ecosystem interactions between lower seal and sea lion populations due to low fish populations, which drove killer whales to find new food sources.

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.

ANSWER: d

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.

ANSWER: d

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.

ANSWER: b

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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.

ANSWER: a

62. A moose, a monarch butterfly, and a wolf are all examples of
    a. autotrophs.
    b. producers.
    c. heterotrophs.
    d. detritivores.

ANSWER: c

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.

ANSWER: a

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).

ANSWER: Two competitive species would not only be found in the same habitat and likely feeding at the same time, but would also be feeding at the same trophic level and likely on the same species.

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?

ANSWER: Predation tends to be lethal to the species negatively impacted, while in herbivory the interaction is not lethal to the species negatively impacted.

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

ANSWER: Competition has a negative impact on both species' fitness. Energy is spent competing for resources that might have been allocated for reproduction (improving one's fitness by producing more offspring) if adapted (behaviorally or morphologically) to avoid competition.

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

ANSWER: Decomposers are typically fungi and bacteria and function by breaking down biological material into elements and compounds that can be reused in the system. Detritivores tend to be invertebrates that feed off of dead organic material as their food source, breaking the material down into smaller

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parts that facilitate the action of decomposers by increasing the surface area for bacteria and fungi to act.

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