Chapter 3 Review Answers

Student Textbook pages 110–111

Answers to Understanding Concept Questions

1. Sample answer: Five abiotic factors in an ecosystem could include any five of the following: average annual rainfall, seasonal temperature variation, soil moisture, topography, altitude, latitude, solar radiation, concentration of atmospheric gases (such as carbon dioxide levels), dissolved oxygen concentration, and prevailing winds.

Five biotic factors in an ecosystem could include any five of the following: producers, consumers (including herbivores, carnivores, omnivores), decomposers, predator-prey relationships, the numbers of organisms, biological interactions (individuals, populations, communities, ecosystems), and biological rhythms (including nocturnal behaviour, seasonal behaviour of plants, mating seasons).

2. Particular organisms live within habitats for which they are adapted. These organisms occupy a particular niche within the habitat, which includes living requirements, as well as the organism's relative trophic activities (such as

predator-prey relationships, feeding activities, and daily behaviours).

3. Parasitism is an interaction in which one organism (the parasite) derives its nourishment from another organism (the host), which is harmed in some way. In parasitism, the host is not always permanently harmed or entirely consumed. In this example, the leech (parasite) feeds on and harms the fish (host). The leech does not entirely consume the fish (host).

4. A community of populations, together with the abiotic factors that surround and affect it, is called an ecosystem. An ecosystem includes all the non-living parts of the environment in a particular area and all the living organisms, as well as the interactions among them. A biome is a particular mix of plants, animals, and other organisms that are adapted to living under certain environmental conditions. Biomes consist of large ecosystems or groups of ecosystems. Ecosystems and biomes are similar in that they both have specific abiotic factors and biotic communities.

5. The physical structure of a coral reef provides a variety of habitats and niches for its inhabitants. Corals (animals) are responsible for building the framework of the reef. The primary component of the reef is limestone. Because the coral is closer to the ocean's surface than the ocean bed, organisms that need more light, such as plants, can grow on the reef. Some fish feed on these plants. Other fish feed on the plant-eating fish.

6. The tree swallow and little brown bat both have similar habitats, however their niches differ. Although they breed in similar habitats and both catch insects while in flight, the two species feed at different times of the day, on different insects, and live in different locations.

7. Ecosystem change can be sudden or gradual. Sudden changes in ecosystems may be brought on by natural events such as flooding, tornadoes, fire, volcanic activity, or tsunamis, or can be brought on by human activities such as deforestation, habitat fragmentation, oil spills, etc. These ecosystem changes will be followed by a natural process of gradual ecosystem recovery, where ongoing changes in the microclimate of an area will result in changes in the flora and fauna over time. Over time, however, any ecosystem will succumb to change as a result of succession, as the organisms living there create conditions favourable for other organisms. For example, after a forest fire, a succession of grasses, shrubs, and quick-growing, sun-loving trees create conditions for slower-growing, shade-loving trees.

8. Plants in a forest compete for sunlight, soil nutrients, soil moisture, and sufficient space to grow.

9. A single-celled, eukaryotic autotroph would be grouped in the kingdom Protista.

10. Resources that can be used to find the scientific name of a species include using a specific dichotomous key, the Internet, science resource books, the library, and the zoo.

11. Two species with similar niches will compete with one another if they feed on the same organisms, live in similar locations, and interact with similar organisms. If they require the same limiting resources, they will be in competition with each other for these resources. Introduced species can cause the decline of native populations because introduced species can out-compete other species for limited resources (food, space, light, moisture), and it is unlikely that the introduced species will have a natural predator to control its population.

12. In order to have an understanding of geochemical processes that occur in various environments, one must have an understanding of chemistry, meteorology, and geology. To understand the influence that these abiotic factors have on biotic relationships, one must have a good understanding of microbiology, zoology, biology, and population and community ecology. All of these disciplines are interconnected when ecologists try to synthesize ecosystem models and gain an understanding of biosphere processes.

13. The three domains used in this text are Bacteria, Archaea, and Eukarya. Students' answers must include an organism from each one. Representative organisms found in the domain Bacteria include heterotrophic bacteria and cyanobacteria. Representative organisms found in the Archaea include chemosynthetic, unicellular organisms. Representative organisms found in the Eukarya can be any plant, animal, protist, or fungi.

14. (a) The following factors control the size of a population:

- *interspecific competition* is competition between two or more populations. Two species with similar niches may compete with each other for food, water, or other resources found in the habitat. The result of competition is a reduction in the growth rate of both populations. In some cases, one species will eventually out-compete the other and the "losing" species will disappear.
- *intraspecific competition*—this type of competition occurs when members of the same population compete with each other for a limited resource. Members of a population may not only compete for food. They may compete for other resources including water, sunlight, soil nutrients, shelter, mates, breeding sites. Regardless of the resource, the result of the competition is always the same—a reduction in the population's growth rate.
- *predation* is a biotic interaction that involves the consumption of one organism by another. In this type of interaction, the consumer organism is referred to as a predator and the consumed organism is called the prey. If the population of predators increases, the result will be a reduction in the population of prey. The prey population size will likely increase if the population of predators decreases.

- *parasitism* is an interaction in which one organism (the parasite) derives its nourishment from another organism (the host), which is harmed in some way. Parasitism is similar to predation because one organism benefits from the interaction and the other organism does not. In parasitism, however, the host is not always permanently harmed or entirely consumed. An increase in the density of the host population makes it possible for the parasites to increase in number. The increased number of parasites decreases the host's ability to survive or reproduce and may lead to a decrease in the density of the host population.

(b) The abiotic components of an ecosystem limit the distribution and size of the populations that live there. Plants, for example, have an optimum set of abiotic requirements including soil type, moisture and humidity levels, and temperature range. Their population is controlled by these factors. The population of animal populations may decrease in times of severe drought, if there is a drastic temperature change, or a widespread natural disaster occurs.

Answers to Applying Concepts Questions

15. (a) The two most closely related individuals in this table are the dog and the coyote. Both animals belong to the genus *Canis*.

(b) The praying mantis is least closely related to the other five animals. The praying mantis belongs to the Phylum Arthropoda while all of the other organisms belong to the Phylum Chordata.

(c) Sample answer: the house cat. Binomial nomenclature is a two-name system. The first name of an organism identifies its genus. The second name of an organism identifies its species. The binomial name for the house cat is *Felix* (genus) *domesticus* (species).

(d) The genus of a wolf is *Canis*—it is related to dog and coyote. The genus of the lion is *Felix*—it is closely related to the house cat.

(e) Animals in the Order Carnivora are meat-eating consumers. All of the animals listed in this category are primarily meat eaters, although most eat plant material at different times.

(f) From closest related to farthest removed: dog, coyote, cat, skunk, bat, praying mantis. The dog and coyote are separated at the species level (and therefore most closely related); the cat, dog, coyote, and skunk are separated at the family level (order = carnivores); the cat, skunk, coyote, dog, and bat are from the same class (mammals); the praying mantis is separated from the others as it belongs to a different phylum (the arthropods).

16. (a) Sample answer: this multicellular, heterotrophic organism is from kingdom Animalia. Students may also select the kingdom Fungi. Rationale for this decision: Since the organism was discovered on a field trip, it is likely that the organism is large enough to be viewed with the naked eye (therefore this rules out Protista). Since the organism is multicellular, Archaebacteria and Eubacteria would both be ruled out. Since the organism does not have chloroplasts, plants are ruled out.

(b) Students should cite the other choice, i.e., Animalia if they chose Fungi and vice versa.

17. Student diagrams will show two scenes: one mowed area and one left to grow wild. The area left to grow wild will include a variety of grasses, plants (weeds), and small shrubs, which should provide food and habitat for a greater variety of insects and other animals.

The first paragraph should focus on the abiotic factors, including the amount of moisture, nutrients, and light available to the plants in both areas. Their answers may note that a manicured lawn requires regular watering and fertilizing in order to sustain plant growth. The natural area has plants specifically adapted to the abiotic conditions in that area and would not require watering or fertilizing (they may recall the biogeochemical cycles mentioned in previous science courses).

In the second paragraph, students should note that the variety of habitats and ecological niches, and thus the variety, or biodiversity, of species, can vary widely in different areas depending on the specific abiotic and biotic components. In this example, the wild area will have a greater diversity of plant species. The diversity of species results in a diversity of habitats and niches as well.

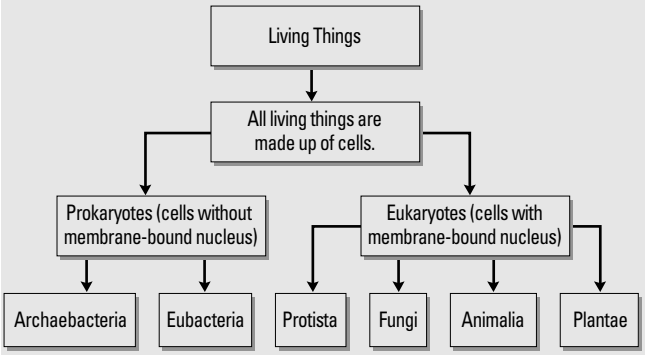
18. (a) Scientists use the binomial system, called binomial nomenclature. To make it universal, scientists agreed to use a language that is spoken by no country but forms the basis of many languages—Latin. Using these two-part scientific names allows scientists from all around the world to be sure they are talking about the same species when they are communicating.

(b) Students may predict that the term "arctos" was used because the scientist that named these bears first noted them in northern regions of Europe and Asia.

(c) Natural factors that may limit the population could include food shortages, predation on young, competition, parasites, or diseases.

(d) Human activities that would limit the grizzly population would include hunting and habitat destruction/fragmentation (housing developments, golf courses, major highways, ski resorts).

19. The following is an example of a graphic organizer:



Answers to Making Connections Questions

20. Changes to ecosystems caused by the action of people include draining of wetlands, interbasin water transfer, habitat fragmentation, land use, urbanization, slash-and burn, clearcutting, and monoculturing (e.g., forests, lawns, agriculture). Effects will include habitat destruction and loss of species diversity.

21. It can be argued that everything we do in a day affects the ecosystem we live in. Student answers should give an example of a normal daily activity and one effect. Examples may include the following: use of water by brushing teeth, flushing toilet, laundry, which removes water from the river, contributing to loss of aquatic habitat; use of electricity, which comes mostly from coal generators that release $CO_2(g)$; and driving vehicles, which results in wildlife fatalities and habitat fragmentation; the release of air pollutants; heating homes, which results in heating up the atmosphere; generating waste which may or may not be biodegradable, which encroaches on habitat.

22. (a) Politically, in order for organisms to be protected, they need to be identified and classified as endangered. This is unfortunate, as scientists suggest that there are many species that have not been identified or catalogued. Typically, wildlife legislation protects large mammals that are familiar to us. Public pressure placed on governments protects them because of how we feel about them, not because of the importance of their ecological role. These feelings may be based on how an organism looks (we grow up with teddy bears, so we have an affinity for pandas), or based on what is portrayed by the media (seeing elephants poached for their ivory instils feelings of sympathy and we are likely to rally for their protection). Other organisms that may be smaller, or unheard of, or unattractive to the general public are not typically protected, even though they have just as much, if not more, ecological importance. We must protect all species and operate based on precautionary principles, especially since scientists do not have a full understanding of the important role that all organisms play in our biosphere.

(b) The use of the name "*horribilis*" is likely to instill a fear of these animals in people who have never even observed them. This fear could easily be translated into indiscriminate killing of these bears just because of their name. Students may also relate this same problem to other animals such as the Killer Whale.