1. A student studying the biosphere makes a list of biotic and abiotic characteristics of various biomes. Which characteristic is considered a biotic factor?
   A. dry, sandy, nutrient-poor soil in a desert
   B. less than 25 cm of precipitation in a desert
   C. evergreen trees present in a coniferous forest
   D. temperature range of -40 to 40°C in a grassland

2. Which example describes a mutualistic relationship between organisms?
   A. Young wasps prey on caterpillars.
   B. Crabs eat the remains of dead fish.
   C. Ants protect a tree on which they feed.
   D. Tapeworms feed on food in the intestines of cats.

3. Most of the water on Earth is located in the oceans and has a salinity of about 3.5%. Which statement best explains why rain is fresh water and has a very low salinity?
   A. When water precipitates from oceans, most of the salt remains in the oceans.
   B. When water evaporates from oceans, most of the salt remains in the oceans.
   C. When water precipitates from clouds, most of the salt remains in the clouds.
   D. When water evaporates from clouds, most of the salt remains in the clouds.

4. Why are nonnative species often considered a disturbance in an ecosystem?
   A. They increase mutations.
   B. They compete for resources.
   C. They have special growth needs.
   D. They cause increased biodiversity.
5. A population of squirrels was separated during the formation of the Grand Canyon. Over time the squirrels, separated by the canyon walls and the Colorado River, became unique species. Which mechanism most likely caused the development of the new species?

A. habitat preference
B. increased gene flow
C. geographic isolation
D. behavioral isolation

6. Which description is the best example of a population?

A. all of the red foxes in a forest
B. all of the red foxes in every forest
C. all of the organisms in a forest
D. all of the organisms in every forest
7. Which energy transfer most likely occurs between organisms in the food web?
   A. from owl to fox
   B. from rabbit to fox
   C. from sparrow to grass
   D. from mouse to grasshopper
8. In Pennsylvania, a nonnative plant called stiltgrass out-competes native plants in many forest ecosystems. Which statement best describes how the spread of stiltgrass negatively affects native herbivores?

A. Stiltgrass stops the life cycles of native herbivores.
B. Stiltgrass reduces the size of the native plant populations.
C. Stiltgrass increases the flow of energy through the ecosystem.
D. Stiltgrass attracts other nonnative plants to the forest ecosystem.

9. Strep throat is a common human illness often caused by the bacterium *Streptococcus pyogenes*. Which term best classifies the colonies of *Streptococcus pyogenes* in a person with strep throat?

A. a population
B. an organelle.
C. a community
D. an ecosystem

10. Which statement best describes a contribution that decomposers make to an ecosystem?

A. They reduce the atomic mass of carbon atoms.
B. They increase the recycling of carbon-containing molecules.
C. They reduce the total number of carbon atoms in the atmosphere.
D. They increase the total number of carbon nuclei within the atoms.

11. Which set of ecological organization levels is most likely to contain the largest variety of species?

A. multiple biomes in a biosphere
B. multiple ecosystems in a biome
C. multiple individuals in a population
D. multiple populations in a community
12. Tadpoles grown in ponds with high densities of tadpoles have lower survival and growth rates than tadpoles grown in ponds with lower densities of tadpoles. Which interaction between tadpoles grown in high-tadpole-density ponds would \textbf{most likely} cause the decreased survival and growth rates?
   A. symbiosis
   B. mutualism
   C. competition
   D. commensalism

13. Ash from a volcanic eruption decreases the amount of available solar energy for a region. Which statement describes how a decrease in available sunlight will \textbf{most likely} affect ecosystems of this region?
   A. Producer populations will decrease, causing a decrease in consumer populations.
   B. Producer populations will decrease, causing an increase in consumer populations.
   C. Decomposer populations will increase, causing a decrease in consumer populations.
   D. Decomposer populations will increase, causing an increase in consumer populations.
14. Some pistol shrimp within a population do not have eye tissue pockets. What role will natural selection most likely have in the frequency of the alleles responsible for the presence of tissue pockets in the shrimp population over time?

A. Natural selection will increase the allele frequency for tissue pockets because they are beneficial to the shrimp.
B. Natural selection will decrease the allele frequency for tissue pockets because they are beneficial to the shrimp.
C. Natural selection will not affect the allele frequency for tissue pockets because the trait is only in a few organisms.
D. Natural selection will lead to the extinction of the shrimp species over time because the tissue pockets could cause poor vision.
15. A student listed characteristics of a classroom aquarium ecosystem. Which characteristic is a biotic component of the aquarium ecosystem?

A. The water temperature is 23°C.
B. The pH of the water is usually between 6.5 and 6.8.
C. The ammonia is controlled with a filter that uses two types of bacteria.
D. The lighting is supplied by natural sunlight and a fluorescent light bulb.

16. Tadpoles grown in ponds with high densities of tadpoles have lower survival and growth rates than tadpoles grown in ponds with lower densities of tadpoles. Which interaction between tadpoles grown in high-tadpole-density ponds would most likely cause the decreased survival and growth rates?

A. symbiosis
B. mutualism
C. competition
D. commensalism
17. Which population description is most likely represented by the graph?

A. A population of birds quickly increases but then becomes stable due to limiting factors in the environment.

B. A population of mice slowly increases but then fluctuates seasonally as predators raise their young and limit prey populations.

C. A population of fish quickly increases in the spring when there is plenty of food but then decreases quickly in the fall when food is limited.

D. A population of wolves slowly increases because of limiting factors in the environment but then increases constantly when additional prey migrate into the environment.
**An Erie Ecosystem**

Presque Isle is located along the short stretch of Pennsylvania coastline on Lake Erie.

**Presque Isle and Vicinity**

Many different species of plants and animals live in the waters near Presque Isle. An environmental scientist decided to investigate the impact of human activity on the environment surrounding Presque Isle. The scientist used a net to catch several different fish species in the waters off the west shore of the isle. The scientist also took water samples and scrapings from the bottom of Lake Erie to analyze. The scientist was able to identify several different organisms. The food web shows the relationship of some of the organisms within the Presque Isle coastal ecosystem.
The scientist observed that very few amphipods were present in the water samples that were collected. The scientist thought that the reduced number of amphipods might indicate an endangered ecosystem. In a preliminary report, the scientist hypothesized that the absence of amphipods was due to pesticides being released into Lake Erie that were especially toxic to aquatic invertebrates.

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**18.** Which sequence of steps is needed for the scientist’s hypothesis about the absence of amphipods to eventually become a theory?

A. 3, 2, 4, 1, 5  
B. 4, 3, 5, 1, 2  
C. 5, 1, 4, 2, 3  
D. 5, 4, 3, 2, 1

**19.** Asian carp are an invasive species of fish. These large fish eat up to 40% of their body weight per day by feeding on phytoplankton. The carp also reproduce quickly. If these fish were to enter Lake Erie, how would the Presque Isle coastal ecosystem most likely be affected?

A. Producers in the ecosystem would grow at a faster rate, and smaller fish such as yellow perch would thrive.  
B. The invasive fish would prey on mollusks such as mussels, but native fish species would quickly eat the invasive fish.  
C. Consumers in the higher trophic levels would suffer stress, but crustaceans such as amphipods would be unaffected.  
D. Most consumers in the ecosystem would face a shortage of food, and larger fish, such as walleye, would be unable to thrive.

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<table>
<thead>
<tr>
<th><strong>Step</strong></th>
<th><strong>Action</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyze the water for the presence of different pesticides.</td>
</tr>
<tr>
<td>2</td>
<td>Communicate the data and results of the investigation to a peer-reviewed scientific journal.</td>
</tr>
<tr>
<td>3</td>
<td>Allow many other scientists to perform experiments, review the data, and agree with the hypothesis.</td>
</tr>
<tr>
<td>4</td>
<td>Draw a conclusion about any pesticides found in the water that could be causing the extinction of water fleas.</td>
</tr>
<tr>
<td>5</td>
<td>Collect additional samples from Presque Isle Bay and the waters north and east of Presque Isle.</td>
</tr>
</tbody>
</table>
Constructed Response Questions

Use the table below to complete question 1.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Food Sources</th>
<th>Predators</th>
</tr>
</thead>
<tbody>
<tr>
<td>beaver</td>
<td>tree bark, twigs, leaves, and roots; pond lilies</td>
<td>coyote, wolf, eagle, black bear</td>
</tr>
<tr>
<td>warbler birds</td>
<td>insects, earthworms, fruit</td>
<td>eagle, coyote, hawk</td>
</tr>
<tr>
<td>black bear</td>
<td>fish, insects, fruit, small mammals, eggs, carrion</td>
<td>brown bear, wolf</td>
</tr>
</tbody>
</table>

1. An ecosystem includes the organisms listed in the table.

Part A: Identify the initial source of energy for the ecosystem.

Part B: Using the table, complete a food chain that includes a producer, a primary consumer, and a secondary consumer.

Part C: The number of beavers in this ecosystem suddenly decreases. Describe the effect this may have on one other organism.

2. State officials are considering constructing a road through a forested wilderness area. This action will likely affect the forest ecosystem in various ways.

Part A. Predict how the construction of a road could negatively affect plants in the forest ecosystem.

Part B. Predict how the construction of a road could negatively affect animals in the forest ecosystem.

Part C. Describe one way that the construction of a road could have a positive effect on the forest ecosystem.
3. White-tailed deer from North America were brought to the islands of New Zealand around the year 1900. This species of deer has survived in several regions in New Zealand.

Part A: Explain why the white-tailed deer population is considered a nonnative species in New Zealand.

Part B: Describe one possible effect that a nonnative species can have on a native ecosystem and explain why this effect might occur.