Science Olympiad Questions  
Middle School, Division B

True or False:

1. A population of organisms always stays the same size.
2. Only a limited number of organisms can live in a habitat.
3. An ecosystem that is a meadow today will definitely turn into a forest within a hundred years.
4. The only organisms that take part in succession are plants.
5. There are equal numbers of each tree species in every forest.
6. If all the oak trees in a forest died, the whole ecosystem could be affected.

Short answer:

7. Which plants would grow faster, two beans planted in separate pots or two beans planted in the same pot? Why?
8. In many parts of Michigan, the climax community is a beech-maple forest. Use the diagram below to answer the following questions. The numbers in parentheses represent 5 ecosystem stages.

![Diagram of ecosystem stages]

a. What biome is represented in stage (1)? In stage (5)?
b. How many years does it take for woody plants to colonize the area?
c. After 300 years, will the area remain in stage (5) forever? What changes might occur?
d. What is the process that is represented in this diagram called?
9. Last fall scientists reported that fish populations in oceans around the world are quickly declining as a result of overfishing. The graph below shows the percent of fish populations that have collapsed since 1950. A fish population is considered “collapsed” if the current population size is less than 10% of what it once was, so that there aren’t enough fish left for fishermen to find. Use the graph to answer the following questions.

![Graph showing percent of fish populations that have collapsed since 1950.]

a. What percent of fish populations have collapsed as of the most recent year shown? What percent of fish populations remain?
b. If fish population collapse continues as it has been, by about what year will there be no fish populations left?
c. List two things that people can do to slow down the rate of fish population loss.
d. List two effects that the decline of fish populations could have on the rest of the ocean ecosystem.

10. Sometimes scientists want to find out how many of one species of animal are living in a certain place.
   a. Describe how you would determine the number of squirrels that live in a forest.
   b. Would this be an exact number or an estimate?
   c. List three factors that limit the size of the squirrel population in the forest.

11. Scientists are able to measure the productivity of the ocean plankton by looking at infrared photos taken from satellites in space. They have noticed that areas of the ocean
that are closer to towns that produce iron ore seem to show higher levels of photosynthesis. Some scientists say that this is due to greater inputs of iron in the runoff into the ocean. However, other scientists argue that these higher levels of photosynthesis are due to generally high levels of nutrients coming from these towns, not the iron. How would you design an experiment to test these two arguments?

12a. Construct a food web made up of the organisms given below. Please show the transfer of energy by drawing arrows pointing towards those organisms doing the consuming.

Herring: eat zooplankton
Algae: use photosynthesis to create energy
Mussels: eat zooplankton
Krill: eat phytoplankton
Cod: eat herring
Killer Whales: eat cod and herring
Bacteria: break down dead plant and animal material

12b. Use words from the following list to describe what role these organisms play in this community. Word list: producers, directors, primary consumers, secondary consumers, tertiary consumers, decomposers, instigators. Some terms may be used more than once. Some terms may not be used.

Herring are:
Algae are:
Krill are:
Cod are:
Bacteria are:

12c. Predict what would happen to the organisms in your food web if the most of the algae died because of pollution by humans:

12d. Which group of organisms in your food web would you expect to have the largest total number of organisms present in this community?
   a) Algae
   b) Krill
   c) cod
   d) killer whales
   e) It is impossible to tell
12e. Which group of organisms in your food web would you expect to have the smallest total number of organisms present in this community?
   a) algae
   b) krill
   c) cod
   d) killer whales
   e) It is impossible to tell

13. Organisms that live in temperate deciduous forests must survive cold winters.
   a) Give an example of an adaptation that forest trees have to help them survive cold winters
   b) Give an example of an adaptation that forest animals have to help them survive cold winters

14. The sea horse lives in the ocean and has a tube-like body which looks like the things it lives near, so the sea horse blends in to its surroundings. Why might the seahorse have this adaptation?

15. The sea anemone has tentacles that will painfully sting anything they touch. Why might the sea anemone have this adaptation?

16. Whales have a thick layer of blubber underneath their skin.
   a) Why might a whale have this adaptation?
   b) Name another adaptation that whales have to help them survive their life in the ocean and explain why this adaptation is beneficial:

17. A population of fish currently has 1,000 individuals and is increasing by 100 individuals per year. The carrying capacity for these fish in their current environment is 1,500.
   a) What will happen to the population growth rate in the next 5 years?
      Stay the same increase decrease impossible to say
b) If conditions stay the same, in 20 years the population size will be:

Much smaller than 1,500  Close to 1,500  Much larger than 1,500

18. Match the species relationships below with the term that best describes what kind of interaction they have. Word list: predation, parasitism, plagiarism, communism, commensalism, mutualism, synergism, synapsism. Some terms may be used more than once. Some terms may not be used.

a) A bumblebee pollinates a flower, while the flower provides the bee with nectar to eat.

b) An Acacia plant provides a place for ants to live and food for them to eat. The ants protect the plant from herbivores by attacking anything that tries to eat the acacia plant.

c) A mite hitches a ride on a damselfly by attaching to the fly, which helps the mite disperse. The damselfly is not helped or harmed by the mite.

d) A mosquito lands on a human and sucks her blood for a meal.

e) A cuckoo lays an egg in the nest of a goldfinch. The goldfinch then raises the cuckoo chick as its own using its own resources while the cuckoo parent does not have to contribute anything.

f) A great white shark kills and eats a seal.

g) A fungus lives on the roots of the tree and helps the tree obtain water. The tree provides the fungus with nutrients.

h) A human takes eggs from a chicken and eats them.

i) Seeds from a burdock plant get stuck on the shoelace of a human hiker and later fall off in a different place, where the seeds grow into a new plant.

19. Three batches of radish seeds, each with a starting weight of 1.5g (dry) were placed in Petri dishes and provided only with light or water or both, as shown in the photo. After 1 week, the material in each dish was dried and weighed. The results are shown below.
a) Which of the following processes contributed the most to the increased mass of the “Light, Water” treatment?

   a) Absorption of mineral substances from the roots.
   b) Absorption of organic substances from the roots.
   c) Absorption of CO₂ gas from air into molecules by green leaves.
   d) Absorption of H₂O gas into molecules by green leaves.
   e) Absorption of sunlight into the leaf.

b) Explain why you think your choice contributed the most to the increase in mass.

c) How would you explain the decrease in mass of the “No Light, Water” treatment?

20. Carbon exists in different molecules or substances in nature. Please explain where carbon might exist in a forest. Complete the table below.

<table>
<thead>
<tr>
<th>Question:</th>
<th>YES or NO</th>
<th>If YES, what form would the carbon be?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think you would find carbon in trees?</td>
<td></td>
<td></td>
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<tr>
<td>Do you think you would find carbon in the soil?</td>
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<td></td>
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<tr>
<td>Do you think you would find carbon in animals, like deer and wolves?</td>
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<td></td>
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<tr>
<td>Do you think you would find carbon in bacteria in the soil?</td>
<td></td>
<td></td>
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<tr>
<td>Do you think you would find carbon in the air?</td>
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</tbody>
</table>
21. A tree falls in the forest. After many years, the tree will appear as a long, soft lump barely distinguishable from the surrounding forest floor.

![Tree and forest floor](image)

21a. The mass of the lump on the floor is less than the mass of the original tree. Where would you find the mass that is no longer in the lump? In what form?

21b. What caused the changes in the wood? How did those changes happen?

21c. There are microbes and insects living in and around the dead wood. Where do you think the microbes and insects get their energy?

22. What happens to water when it freezes?
   a. It contracts to take up a smaller volume
   b. It expands to take up a larger volume
   c. The volume of water stays the same

23. What else happens to water when it freezes?
   a. It gains weight and becomes heavier
   b. It loses weight and becomes lighter
   c. The weight of water stays the same

24a. You arrived here in East Lansing in a motor vehicle this morning. Please explain three impacts motor vehicles have had on the environment here in Michigan.

24b. Please list three things you could do to reduce the impact of your riding in motor vehicles on the environment.
Sources:
www.biologycorner.com/worksheets/succession.html
http://www.biologycorner.com/worksheets/kaibab.html


http://incompetech.com/beta/linedGraphPaper/plain.html