**SCORING**

TOTAL # CORRECT:\_\_\_\_\_\_ /72

# CORRECT TIE BREAKER #1: \_\_\_\_\_/6

# CORRECT TIE BREAKER #2: \_\_\_\_\_/7

**Virginia Science Olympiad Regional Ecology Test**

(1 point each, unless otherwise noted.)

1. Acid deposition causes:

**a) Lakes and forests to die.**

b) The greenhouse effect to lessen

c) Acid indigestion in humans

d) Pest to increase decomposition.

2. Photosynthesis and respiration belong to which cycle?

a) Nitrogen cycle

**b) Carbon cycle**

c) Phosphorus cycle

d) Hydrologic cycle

3. The part of Earth in which all living things exist is called the:

1. Biome
2. Community
3. Ecosystem
4. **Biosphere**

4. The lowest level of environmental complexity that includes living and nonliving factors is the:

1. Biome
2. Community
3. **Ecosystem**
4. Biosphere

5. An organism that cannot make its own food is called a(an):

1. **Heterotroph**
2. Chemotroph
3. Autotroph
4. Producer

6. Which type of pyramid shows the amount of living tissue at each trophic level in an ecosystem?

1. A numbers pyramid
2. An energy pyramid
3. **A biomass pyramid**
4. A food pyramid

7. Organisms that are diurnal

1. Hibernate every other year
2. Live two separate lives
3. **Are only active during the day**
4. Live in two different places throughout the year

8. Several species of warblers can live in the same spruce tree ONLY because they:

1. Have different habitats within the tree
2. Eat different foods within the tree
3. **Occupy different niches within the tree**
4. Can find different temperatures within the tree

9. The number of organisms that an environment can support over a relatively long period of time is called:

1. **Carrying capacity**
2. Logistic growth
3. Exponential growth
4. Limiting factor

10. Which would be least likely to be affected by a density-dependent limiting factor?

1. **a small, scattered population**
2. a population with a high birthrate
3. a large, dense population
4. a population with a high immigration rate

11. All of the members of a particular species that live in one area are called a(an):

1. Biome
2. **Population**
3. Community
4. Ecosystem

12. What is desertification?

1. A serious world problem when deserts disappear due to increasing rainfall.
2. A rapid increase in the number of desert species over a period of 5-10 years.
3. A rapid decrease in the number of desert species over a period of 5-10 years.
4. **A serious world problem when deserts encroach an arable land**

13. Honeyguides are African birds that excitedly lead the way to a bee’s nest, and ratels are the honey and bee eating mammals that open up and scatter the contents of the bee’s nests, allowing both the ratels and the honeyguides to feed on the contents. The relationship between the Honeyguides and the ratels is:

1. Predation
2. Competition
3. Commemsnsalism
4. **Mutualism**
5. Parasitism

14. An ecosystem contains:

a) Only the biotic components of the environment

b) Only the abiotic components of the environment

c) Only the energy flow components of an environment

**d) Both the living organisms and the abiotic components of the environment**

e) Only the food relationships found in an environment

15. Energy flow in an ecosystem is not cyclic because energy is:

a) Destroyed as it is used

b) Evenly spread out over many organisms

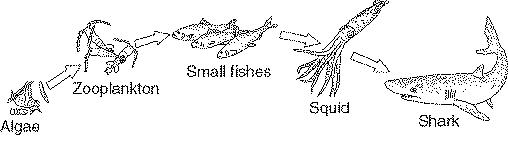
c) Converted to many kinds of useful energy

d) Increased as you go up the energy pyramid

**e) Lost as heat or used**

16. Close interaction between organisms of different species over an extended period of time, in which one individual benefits while the other individual neither benefits nor is harmed by the relationship, is know as:

1. Predation
2. Competition
3. **Commemsnsalism**
4. Mutualism
5. Parasitism

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**Figure 1**

17. The algae at the beginning of the food chain in Figure 1 are:

1. Consumers
2. Decomposers
3. **Producers**
4. Heterotrophs

18. An organism that uses energy to produce its own food supply from inorganic compounds is called a(an):

1. Heterotroph
2. Consumer
3. Detritivore
4. **Autotroph**

 19. The greenhouse effect is:

1. The result of an excess of carbon dioxide in the atmosphere
2. **A natural phenomenon that maintains Earth’s temperature range**
3. The result of the differences in the angle of the sun’s rays
4. An unnatural phenomenon that causes heat energy to be radiated back into the atmosphere

20. Most of a desert consists of:

1. **sand**
2. gravels (pebbles and cobbles)
3. exposed bedrock outcrops
4. vegetation

21. During a long period when there is no rainfall, a mountain lion may temporarily leave its usual hunting territory to drink from a farm pond. This behavior is probably due to

1. Its need to find different foods to eat
2. **The change in an abiotic factor in its environment**
3. Its need to find a new habitat
4. The change in a biotic factor in its environment

22. Why is acid rain, or acid deposition, considered to be harmful?

1. Moisture in the air becomes acidified and then falls on plants and the soil below, harming them.
2. Acid rain leeches essential nutrients out of the soil (e.g. potassium and calcium) and kills decomposers in the soil
3. Dead, or weakened, plants make soil much more susceptible to erosion
4. **All of the above**

23. Which may be a secondary or tertiary consumer?

a) Decomposer

b) Herbivore

c) Detritovore

d) Autotroph

**e) Carnivore**

24. Process by which atmospheric nitrogen gas is changed to forms that plants can use:

a) Biogeochemical Fixation

b) Hydrologic Fixation

**c) Nitrogen Fixation**

d) Carbon Fixation

e) Phosphorus Fixation

25. What is one way plants have adapted to the scarcity of water and heat?

1. **Growing small leaves**
2. Keeping their leaves during the dry period
3. Crovasculating water from the stems of nearby plants
4. Opening their stomata, or pores, during the day

26. At nighttime, desert temperatures

1. Stay scorching hot
2. Cool down to a warm and balmy temperature
3. **Often cool down to freezing temperatures**
4. Vary significantly from desert to desert

27. The pattern of dispersal of individuals with in an area is the:

4a) Population density

**b) Population distribution**

c) Carrying capacity

d) Intrinsic rate of reproduction

e) Limiting factors

28. The factor(s) that determine(s) if an organism can live in an area is/are:

a) Population density

b) Population distribution

c) Carrying capacity

d) Intrinsic rate of reproduction

e) **Limiting factors**

29. Which of the following threaten the world’s prairies and grasslands?

1. [Invasive species](about:blank)
2. [Unchecked development](about:blank)
3. [Climate change](about:blank)
4. [**All of the above**](about:blank)

30. Which of the following describes a type I survivorship curve?

**a) Most individuals die of old age**

b) Individuals die at a constant rate throughout time

c) Many individuals die early in life

d) Most individuals die during their reproductive years

31. Which of the following describes a type II survivorship curve?

a) Most individuals die of old age

**b) Individuals die at a constant rate throughout time**

c) Many individuals die early in life

d) Most individuals die during their reproductive years

32. A food chain for a prairie could be as follows: grass, rabbit, snake, hawk. The snake represents which of the following?

1. Autotroph
2. **Secondary consumer or second trophic level**
3. Tertiary consumer or third trophic level
4. Herbivore
5. Primary consumer or first trophic level

33. Which of these is not a grassland bird species?

1. [Bobolink](about:blank)
2. [**Behn’s fat finch**](about:blank)
3. [Dickcissel](about:blank)
4. [McCown's Longspur](about:blank)

34. What are the main conditions that determine the plant life of a given biome?

1. **rainfall and temperature**
2. rainfall and sunlight
3. sunlight and temperature
4. altitude and temperature

35. Which of the following is not a type of desert?

1. Rain shadow desert
2. Coastal desert
3. Remote interior basins
4. **All of the above are types of deserts**

36. Which of the following is an example of a population?

1. All of the organisms on school campus
2. All of the animals on school campus
3. All of the plants on school campus
4. **All the squirrels within 1 km of this building**

37. The Brazilan Cerrado is home to how many species of plants?

1. [Less than 100](about:blank)
2. [Less than 2,000](about:blank)
3. [More than 2,000](about:blank)
4. [**More than 10,000**](about:blank)

38. Which of the following will usually happen in stabilizing selection?

1. **The trait will become more clustered around the mean**
2. The trait will become more clustered around one extreme
3. The trait will become more clustered around both extremes
4. The trait will become evenly distributed among all individuals

39. An organism that makes its own food is considered a(n):

1. **Primary producer**
2. Primary consumer
3. Secondary consumer
4. Decomposer

An ecologist studied the number of organisms in an area over a three year period and obtained the following results:

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Rabbits** | **Owls** | **Coyotes** |
| 1 | 220 | 15 | 1 |
| 2 | 140 | 16 | 0 |
| 3 | 115 | 14 | 5 |

For the following questions (38-40), pick from the following choices

1. increase in owl population
2. decrease in owl population
3. migration of coyotes into area
4. decrease in number of producers in area

40. What is the best explanation for the decrease in rabbit population from year 1 to year 2?

***(d)***

41. What is best explanation for decrease in rabbit population from year 2 to year 3?

***(c)***

42. By what percent did rabbit population decrease from year 1 to year 3?

***105/220== about 48%***

Use the following information to answer the following questions

Organisms A, B, C, D, are counted in three different areas, and the results appear below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **# A** | **# B** | **#C** | **#D** |
| 1 | 17 | 6 | 1 | 2 |
| 2 | 15 | 8 | 9 | 1 |
| 3 | 8 | 9 | 15 | 9 |
| Total | 40 | 23 | 25 | 12 |

43. What percent of organisms in area 2 are Type A?

***(15/33 about 45%)***

44. What percent of the total organisms are Type C?

***(25/100= 25%)***

45. Which area has the greatest biodiversity?

***(3****)*

(#46, Tie Breaker #2)

(7 points)

46. Match the plant with the most likely biome to find it. Some answers may be used more than once, others not at all. There is only one answer per biome.

**Biome**

1. Taiga *(****D****)*
2. Tundra (**E**)
3. Savanna *(****B****)*
4. Tropical rain forest (**G**)
5. Desert (**A**)
6. Chaparral (**F**)
7. Temperate deciduous forest (**C**)

**Plant**

A. cactus

B. grasses

C. oak, other hardwoods

D. pine trees

E. reindeer moss

F. small bushes with waxy leaves

G. answer not given

47. Farmers grow alfalfa or clover on fields to improve the soil. What gets added to the soil when these plants are present?

1. Sodium
2. Hydrogen
3. Lead
4. **Nitrogen**

48. The top layer of soil in a forest or grassland contains decaying plant and animal material called:

1. Topsoil
2. **Litter**
3. Subsoil
4. Bedrock

49. Big bluestem (a prairie grass) grows to a height of 6-8 feet. How deep do its roots reach?

1. [**More than 10 feet**](about:blank)
2. [Up to 6 feet](about:blank)
3. [About 2 feet](about:blank)
4. [Less than 6 inches](about:blank)

50. There are 150 Saguaro cacti plants per square kilometer in a certain area of Arizona desert. To which population characteristic does this information refer?

1. Growth rate
2. Geographic distribution
3. Age structure
4. **Population density**

51. What does the range of a population tell you that density does not?

1. the number that live in an area
2. **the areas inhabited by a population**
3. the births per unit area
4. the deaths per unit area

52. In the nitrogen cycle, the bacteria that replenish the atmosphere with N2 are:

1. **Denitrifying bacteria**
2. Nitrogen-fixing bacteria
3. Rhizobium bacteria
4. Methanogenic protozoans
5. Nitrifying bacteria

53. The symbiotic relationship between a flower and the insect that feeds on its nectar is an example of:

1. **Mutualism because the flower provides the insect with food, and the insect pollinates the flower**
2. Parasitism because the insect lives off the nectar from the flower
3. Commensalism because the insect doesn’t harm the flower and the flower doesn’t benefit from the relationship
4. Predation because the insect feeds on the flower

54. The following questions refer to the organisms in a grassland ecosystem listed below. Each term may be used once, more than once, or not at all.  
  
hawks  
snakes  
shrews  
grasshoppers  
grass  
  
an autotroph \_\_\_Grass\_\_\_\_\_ a herbivore \_Grasshoppers

55. What general name is applied to desert plants that store water?

**Succulent Plants**

56. What amount of water in millimeters characterizes a desert?

**Less than 250**

57. How does emigration affect population size?

**Emigration means leaving a population and joining another. Emigration will reduce a population if all other factors remain constant.**

58. Name the four major deserts in the United States:

**Hot and Dry, Semiarid, Coastal, Cold**

59. Why are food chains usually relatively short?

**Answer should address the fact that useable energy is lost in going from one trophic**

**level to the next**

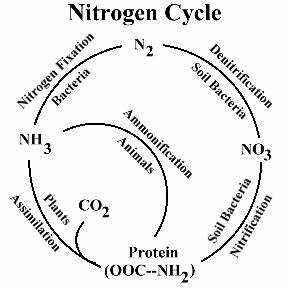
60. True or false: America’s tallgrass prairie is considered the most-imperiled grassland in the world, with less than 1 percent of it surviving.

* 1. [**True**](about:blank)
  2. [False](about:blank)

(#61, Tie Breaker #1)

(6 points)

61. Draw and label the Nitrogen cycle. Use arrows to show direction of the flow of materials. (1 point for the picture and 1 points for each of the activities if they identify them.)



## **Nitrogen Cycle**

Proteins, nucleic acids, and other organic chemicals contain nitrogen, so nitrogen is a very important atom in biological organisms. Nitrogen makes up 79% of Earth's atmosphere, but most organisms can not use nitrogen gas (N2). N2 enters the trophic system through a process called **nitrogen fixation**. Bacteria found on the roots of some plants can fix N2 to organic molecules, making proteins. Again, animals get their nitrogen by eating plants. But after this point, the nitrogen cycle gets far more complicated than the carbon cycle.

Animals releases nitrogen in their urine. Fish releases NH3, but NH3 when concentrated, is poisonous to living organisms. So organisms must dilute NH3 with a lot of water. Living in water, fish have no problem with this requirements, but terrestrial animals have problems. They convert NH3 into urine, or another chemical that is not as poisonous as NH3. The process of releases NH3 is called **ammonification**.

Because NH3 is poisonous, most of the NH3 which is released is untouchable. But soil bacteria have the ability to assimilate NH3 into proteins. These bacteria effectively eats the NH3, and make proteins from it. This process is called **assimilation**.

Some soil bacteria does not convert NH3 into proteins, but they make nitrate NO3- instead. This process is called **nitrification**. Some plants can use NO3-, consuming nitrate and making proteins. Some soil bacteria, however, takes NO3-, and converts it into N2, returning nitrogen gas back into the atmosphere. This last process is called **denitrification**, because it breaks nitrate apart.