Name:

Date:

School:

Facilitator:

# **1.04 Energy Pyramid Lab**

## Directions: Visit [Virtual Lab: Model Ecosystems](http://www.mhhe.com/biosci/genbio/virtual_labs/BL_02/BL_02.html) to complete the Energy Pyramid Lab and then answer the lab analysis questions below.

## Before beginning the lab, read the introduction information on the left side of the lab screen under the question, “How does energy flow through an ecosystem?”

## After carefully reading the introduction, begin completing the lab according to the following procedures:

1. Look at the ecosystem selection box just above the Pyramid. It should have a default setting on “Deciduous Forest Ecosystem.”
2. Look at the “Field Notes” column on the right hand side of the page. There are plants and animals listed in the section. Click on the animal or plant and drag it to the appropriate place in the Energy Pyramid. (Only a certain number of organisms will fit in each trophic level. After you have put all the organisms in the appropriate level, click check button at the bottom of the pyramid to see if you placed them appropriately. If the organism is not placed appropriately, it will be moved back to the right. \*\*The “Field Guide” tab and the bottom allow you to read information on each of the ecosystems. This may help in getting the organisms in the correct trophic level.
3. Click “Check” button at the bottom of the pyramid to see if you placed them appropriately. If the organism is not placed appropriately, it will be moved back to the right. Continue until all organisms are placed in the correct level on the pyramid. The number of each individual organism will be listed for each.
4. Click on the “Pyramid of Energy” tab below. This will tell you the amount of total energy in each level (remember: energy is expressed in Joules [J]). Record the total energy in J for each of the trophic levels in Table 1 below.
5. Click on the “Pyramid of Numbers” tab below. This will give you the total number of organisms in each level (this number is all the number of individual organisms added together). Record the total number of organisms for each trophic level in Table 2 below.
6. Repeat steps 1-5 for each of the other ecosystems. You can swap the ecosystem clicking on the dropdown box at the top of the pyramid.

**Table 1: Pyramid of Energy**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecosystem** | **Producers**  (Energy in Joules) | **First Order Heterotrophs**  (Energy in Joules | **Second Order Heterotrophs**  (Energy in Joules) | **Third Order Heterotrophs**  (Energy in Joules) |
| **Deciduous Forest** |  |  |  |  |
| **Hot Desert** |  |  |  |  |
| **Grassland** |  |  |  |  |
| **Antarctic Ocean Shore** |  |  |  |  |
| **Freshwater Lake** |  |  |  |  |

**Table 2: Pyramid of Numbers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecosystem** | **Producers**  (Total Number) | **First Order Heterotrophs**  (Total Number) | **Second Order Heterotrophs**  (Total Number) | **Third Order Heterotrophs**  (Total Number) |
| **Deciduous Forest** |  |  |  |  |
| **Hot Desert** |  |  |  |  |
| **Grassland** |  |  |  |  |
| **Antarctic Ocean Shore** |  |  |  |  |
| **Freshwater Lake** |  |  |  |  |

Use the data that you completed in the charts above as well as information from the content of the lessons to answer the following analysis questions.

1. Which Ecosystem has the greatest amount of energy overall? The least amount?

1. Which Ecosystem has the greatest number of organisms in it? The least number of organisms? (Hint: All trophic levels added together)

1. Using what you know about the energy—matter relationship, explain why the ecosystems with the greater amount of overall energy tend to have a greater number of organisms.

1. Energy conversion efficiency deals with the percentage of energy that is available to the next energy level. Energy conversion efficiency can be determined by dividing the energy at the higher trophic by the energy at the lower level:

Energy (J) higher level = decimal [round decimal to the nearest 10 thousandth place: 4th decimal]

Energy (J) lower level

The higher the number the greater the efficiency. Calculate the energy conversion efficiency for the following a) between the producers and First Order Heterotrophs in the Deciduous Forest ecosystem b) between the 2nd Order Heterotrophs and the 3rd Order Heterotrophs in the Hot Desert ecosystem. Which ecosystem has the greatest energy conversion efficiency overall? [Hint: you will need to compare the lowest trophic level to the highest]

1. In Lesson 1.04, you learned that about 90% of the energy in trophic level is used by the organisms in that trophic level for biological processes. Explain why when you calculate the energy conversion for the Producers and the 1st Order Heterotrophs in the Antarctic Ocean Shore ecosystem you get a value of 0.09723 which translates is 9.723% and not 10%.