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| Quiz(14pts) |  |
| Completeness(10pts) |  |
| **GRADE:** |  |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ APES

Mr. Crisci

**Lab: OWL PELLET BIOMASS** Date: **\_\_\_\_\_\_\_\_\_**

**Part A: Popcorn Energy** **Directions**

1. In this activity, you are to run a relay race using 4-5 people per group. The tallest person with the biggest hands (holds the most “energy”) is first while the shortest person with the smallest hands is last.

2. Fill the hands of the tallest person with popcorn representing energy. Drop the popcorn into a tray and count the kernels. Have them run across the room with open field and then return.

3. Drop the popcorn in the tray and count the kernels before the next person picks them up to run.

4. Repeat the process, transferring the remaining kernels to the next person, counting them when they return.

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| --- | --- | --- | --- | --- | --- | --- |
| Student | Sun (tallest) | Producer | Primary Consumer(Herbivore) | Secondary Consumer | Tertiary Consumer (shortest) |  |
| # of Popcorn Kernels |  |  |  |  |  |  |
| Percent Change |  |  |  |  |  |  |

**Calculate the percent change at each trophic level: % Change = [(original – new)/original] x 100**

**Follow-Up and Discussion Questions:**

1. What does the popcorn represent in this lab?
2. What does the handing off the popcorn represent?
3. What does the running represent?
4. What does the popcorn on the ground represent?
5. Within a food web, how much energy is actually transferred from one trophic level to another? \_\_\_\_\_\_\_
6. A scientist reported that the gross primary productivity of a grassland ecosystem was 65 kJ/m2/year. If the respiration loss was 23 kJ/m2/year, what was the NPP of the grassland ecosystem? Show work:
7. Given the following food chain: *Sun → corn → cow → man.* Why could more people be supported if the cow step was eliminated and people ate the corn?
8. The NPP of a given ecosystem is 3000 calories of energy per square meter per year, how many calories will be passed on at the following levels:
* Primary Consumers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Secondary Consumers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Tertiary Consumers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
1. Draw a diagram of a biomass (energy flow) pyramid based on the calculations from the previous question with the following trophic levels: producers, primary consumers, secondary consumers, and tertiary consumers. Draw your diagram such that the size of each trophic level (drawn as rectangles) reflects its proportional amount of biomass/energy.

**Part B:** **Procedure**

1. The “surgeon” puts on a set of gloves. Remember to wash hands at the end of the procedure. These pellets have been sterilized, but…

2. Use dissecting tools and fingers to gently pry apart the pellet. NOTE: The bones you are looking for are small and easily broken.

3. The ‘detective’ will analyze the bones with the identifications key and identify prey.

4. The best way to count the number of prey is through skulls. If you can’t find any skulls, try to count using bones.

**Data:** Fill in the chart as appropriate. You will not have data for every single species of prey. Remember, owls spit out 2.5 pellets/day on average.

|  |  |  |  |
| --- | --- | --- | --- |
| **Prey** | **Number Found** **(N)** | **Number Eaten per Day****(D = 2.5 x N)** | **Number Eaten per Year****(Y = 365 x D)** |
| **Mouse or Vole** |  |  |  |
| **Mole** |  |  |  |
| **Shrew** |  |  |  |
| **Rat** |  |  |  |
| **Bird** |  |  |  |
|  |   | **Total  YT =**  |  |

Use your data to help analyze the amount of biomass (food) needed at lower trophic levels to support your owl.

Create a Numbers Pyramid for the owl based on the **number eaten per year** with one owl on the top with total annual number of all prey below. Use the assumption that an owl produces an average of 2.5 pellets per day. Assume that the mouse/vole needs to 300x the amount of vegetation to survive:

**Part C:** Use the following facts about the prey to draw a food **web** that is representative of your pellet

|  |  |
| --- | --- |
| **Prey** | **Diet** |
| **Mouse/vole** | Insects and other invertebrates, seeds, fruits, flowers, nuts, and other plant products.  |
| **Mole** | Earthworms, centipedes, millipedes, snails, slugs, grubs, ants, pill bugs, termites, beetles, and crickets  |
| **Shrew** | Beetles, grasshoppers, butterfly and moth larvae, wasps, crickets, spiders, snails, earthworms, slugs, centipedes, and millipedes. Shrews also eat small birds, mice, small snakes, plants |
| **Rat** | The rat's diet typically includes seeds, nuts, grains, vegetables, fruits, fungi, and insects.  |
| **Bird** | Insects, arthropods, seeds, grains nuts, fruit  |

Draw your food web here.

* Arrows point the direction energy is flowing (toward the predator)
* Do NOT write “seed” or “flower, etc.” Those are not organisms. Instead, write “plant”.
* Remember to include decomposers in your food web.

**Part D:** Use this chart to calculate Biomass eaten. 1. Transfer the last column of your data chart to the second column below. 2. Then multiple that number times the third column-- mass (g). 3. Then convert from g to kg. 4. Next, multiple the mass of prey (kg) with the annual food (kg) eat/kg of prey to get the biomass eaten in kg. Add the two columns to get the two totals needed for part D.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Prey** | **1. Number eaten per year (N)** | **Mass (g)****(x N)** | **2. Mass of Prey (g)** | **3. Mass of Prey (kg)** | **Annual Food (kg) Eaten/kg of prey****(Mass kg x this #)** | **4. Biomass Eaten (kg)** |
| **Mouse/vole** |  | 20 g |  |  | **45.6 kg** |  |
| **Mole** |  | 55 g |  |  | **365 kg** |  |
| **Shrew** |  | 5 g |  |  | **1168 kg** |  |
| **Rat** |  | 240 g |  |  | **12.8 kg** |  |
| **Bird** |  | 20 g |  |  | **127 kg** |  |
|  |  |  Total |  |  **Total**  |
|  |  |  |  |  |  |  |

**Part E:** Use the chart from the previous page to create a Biomass Pyramid. For the **top carnivore level** you need to see the opening paragraph to find the mass of Barn Owl. For the **herbivore level** use the total Mass of Prey (kg). For the **producer level**, use the Total Biomass Eaten (kg).

**Conclusion Questions:**

1. Calculate about how many TIMES more energy is at the Producer level (1st trophic level) vs. Herbivore (2nd) level. To calculate, divide the 1st trophic level by the 2nd trophic level and round. **Show your work!**
2. How much more energy is at the herbivore level (2nd) vs. the top carnivore (3rd) level?

1. Calculate how much energy is lost going from the 1st and 2nd trophic level. Use percent change to calculate. To find percent change: (Starting amount - ending amount / starting amount x 100). **Show your work!**
2. How much energy is lost from the 2nd to the 3rd trophic level?
3. Your textbook says 90% of the energy is lost as you go up a trophic level. Are your results 90%? Why or why not? What can you infer?
4. According to the 1st law of thermodynamics, energy is never lost, it just changes form. We say that energy is “lost” as you go up a trophic level, but it’s really not. Explain what we mean using the 2nd law of thermodynamics (aka what does “lost” really mean?)