How does energy flow through the environment?
Make-Up

Pre-Laboratory Questions: (2 pts)

1. Define the terms autotroph, heterotroph, and niche. **(1 pt)**

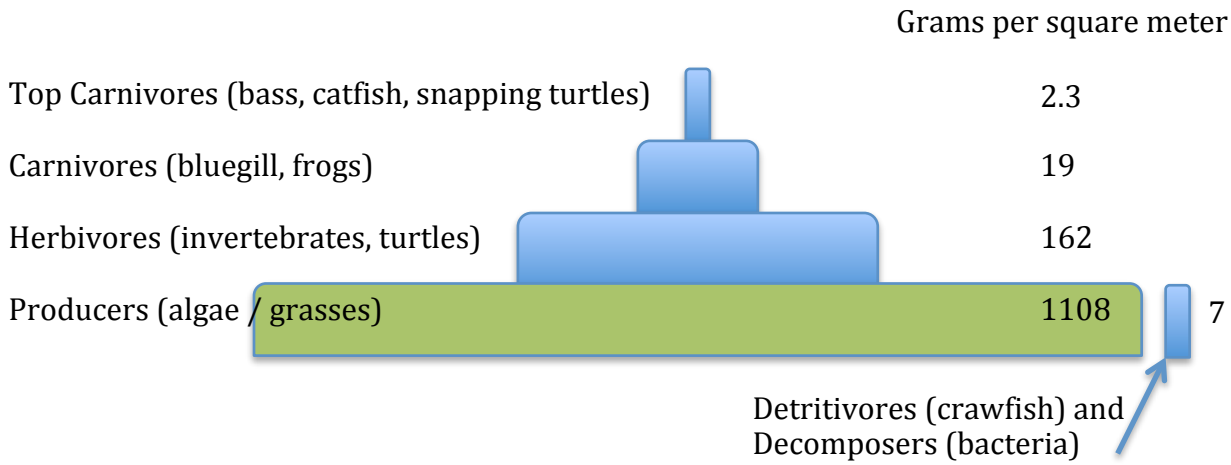
2. Distinguish between a food chain and a food web. Why would each be a valuable tool for biologists? **(1 pt)**

Introduction:
The study of ecology looks at the interactions between organisms as well as between organisms and their environment. An important aspect of those interactions is energy flow. Energy in biological systems starts from only one source – the sun. The process of passing energy from one organism to another, however, is very inefficient. Only about 10% of the energy an organism consumes is available for use and growth.

Objectives

- To understand the efficiency of energy flow through an ecosystem.
- To understand how various trophic levels interconnect.
- To understand how invasive species may affect an ecosystem.

PART 1: Energy Flow (2 pts)
Energy flow up a food chain tends to be only about 10% efficient, that is, only about 10% of the energy consumed in a food source can be utilized for extra activities such as growth and reproduction. Examine the food chain below representing the amount of *biomass* (total mass of living material) in an ecosystem.



1. What would you expect to happen if half of the algae (per mass) were to die in this community? **(1 pt)**

2. What would happen if, under the right conditions, there was an explosion of bluegill reproduction, with an exceptional number of juveniles added to the population? **(1 pt)**

PART 2: Producers and Consumers (4.5 pts)

3. Below in Table 1 is a list of 20 organisms representing a community. Begin by identifying each as an autotroph, heterotroph, or N/A. **(1 pt)**

4. On a separate sheet of paper, arrange the 20 organisms into a *food web*. In doing so, you will draw arrows in the direction of energy flow from one organism to another representing the relationships involved. **(2 pts)**

5. Is it possible for an organism to have multiple arrows going to or from it? Explain your answer. **(0.5 pt)**

6. Identify at least one example from your food web for each of the following relationships: **(1 pt total)**
   - Mutualism: Both species benefit from the relationship
   - Commensalism: One species benefits while the other is neither harmed nor helped by the relationship
   - Predation: One species benefits while the other is harmed in the relationship
   - Competition: Both species are harmed by the relationship

PART 3: Invasive Species (5.5 pts)

7. Table 2 contains a new set of organisms, from which you will complete a second food web on another sheet of paper. **(1.5 pts)**

8. Speculate what would happen if zebra mussels were introduced into the community. Do a quick internet search to find out some information about zebra mussels. What would be their effect on other species? Explain, and be specific about the effect for at least 5 other species in this community. **(2 pts)**

9. If the population of frogs and salamanders were to crash due to habitat destruction (as is happening in Ohio right now), what would be the effect on the community? Explain your answer, giving specific examples in support. **(1 pts)**

10. List at least three characteristics that might make an invasive species particularly successful? **(1 pt)**

11. Speculate on at least three activities that humans do that promote the introduction of invasive species. **(1 pt)**

Study Questions (4 pts)

1. Why is the world not full of top predators, such as lions, tigers, and killer whales? **(1 pt)**

2. A complicating factor of pollutants in the environment (like the pesticide DDT) is the idea of *biomagnification*, or the accumulation of pollutants and their effects in organisms higher up the food chain.
   a. Explain why individuals at the top of the food chain may be at higher risk for the toxic effects of pollutants. **(1 pt)**

3. Is it possible for an organism or species to change its niche? Explain your answer, and if it is possible, what would be the consequences to the food web? **(1 pt)**

4. What happens to the chemicals within molecules such as glucose once decomposers have broken it down through respiration? **(1 pt)**

5. How could two species that prey on the same type of food survive in the same habitat? Is it possible at all? **(1 pt)**

Table 1 Organism List

	Species	Description
1	Sun	External Energy Source
2	Bald Eagle	Detritivore / Carnivore
3	Cardinal	Omnivore
4	Bullfrog	Insectivore
5	Bluegill	Insectivore / Carnivore
6	White-tailed Deer	Herbivore
7	Mayfly	Omnivore
8	Grasshopper	Herbivore
9	Chipmunk	Omnivore
10	Buckeye Tree	Primary Producer
11	Big Blue Stem Grass	Primary Producer
12	Cherry Tree	Primary Producer
13	American Burying Beetle	Detritivore
14	Rabbit	Herbivore
15	Wolverine	Carnivore
16	Coyote	Carnivore
17	Mushroom	Decomposer / Detritivore
18	Detritus	Dead Stuff
19	Barn Swallow	Insectivore
20	Honeybee	Herbivore

Table 2 Food Web List

1	Sun	External Energy Source
2	Coontail	Producer
3	Phytoplankton	Producer
4	Snail	Herbivore
5	Mayfly	Herbivore
6	Shad	Detritivore / Planktivore
7	Mallard Duck	Insectivore / Herbivore
8	Canada Goose	Insectivore / Herbivore
9	Oligochaete (worm)	Detritivore
10	*Gammarus*	Herbivore
11	*Daphnia*	Herbivore / Planktivore
12	Leech	Parasite (Carnivore)
13	Crayfish	Carnivore / Detritivore
14	Freshwater Mussel	Planktivore
15	Yellow Perch	Carnivore / Planktivore
16	Water Snake	Carnivore
17	Bluegill	Insectivore / Planktivore
18	Great Blue Heron	Carnivore
19	Muskie	Carnivore
20	Smallmouth Bass	Carnivore
21	Lilly pads	Producer
22	Bladderwort	Producer / Carnivore
23	Duckweed	Producer
24	Mosquito Larvae	Herbivore / Planktivore
25	Mudpuppy	Carnivore
26	Detritus	Dead Stuff