



2022-2023

Freshman Biology

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Note to Students: You've learned so much in school this year! It is important that you continue to engage in science content and practices over the summer to help prepare you for a rigorous biology course next school year. In this packet, you will find activities for the Summer Break.

Student Directions: Please print the packet and complete it with a pen or pencil and highlighters. There is detailed information and directions provided on subsequent pages in this packet. Be sure to pace out the tasks so that you and your parents are not overwhelmed. You may use outside, credible, sources to complete the work.

- o Have a clear and complete answer (to each question) that explains your thinking.
- o Be neat and organized.

Good luck and happy summer! Please do not hesitate to contact me. 😊

Ms. Raymond

PRINT STUDENT NAME

Claims, Evidence, and Reasoning

Claim: a statement about the solution to a problem – what you think you know

Evidence: scientific data to support your claim – measurable

Reasoning: justification of how your evidence supports your claim (using scientific principles)

Directions:

Find the Claim, Evidence, and Reasoning in the following paragraphs:

Underline the Claim; Circle the Evidence; and put a box around the Reasoning.

1. A common type of asexual reproduction found in nature is called Mitosis. Mitosis requires less energy than sexual reproduction does. Mitosis can occur in seconds and does not require a mate to reproduce. Sexual reproduction requires two compatible parents. It also requires time to produce the egg and sperm cells and then for fertilization to occur. Energy is required to find a compatible mate, produce sex cells, and for fertilization. Therefore, mitosis requires less energy than sexual reproduction does.
2. Cold air weighs more than hot air. When I filled a 9-centimeter diameter balloon with cold air, it weighed 1 gram and when I weighed the same size balloon with hot air, it weighed 0.5 grams. When molecules are cooled, they move closer together and when they are heated up, they move farther apart. Because of this more molecules can fit into a balloon when the air going in is cold than when the air going in is warm.

Controls and Variables

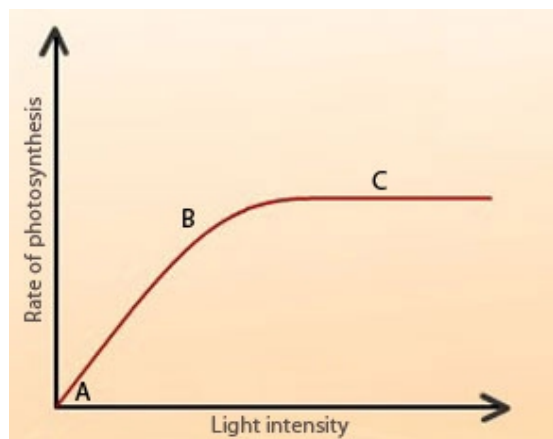
Directions:

Read the description for the experiment and answer the following questions.

Prince Burgers and Fries Prince Burgers and Fries restaurant has created a new sauce that allegedly will reduce the production of an upset stomach associated with eating its gourmet burgers. The manager, Kate, at the restaurant recruits 100 customers with a history of stomach problems. She has 50 of them (Group A) eat gourmet burgers with the new sauce. The other 50 (Group B) eat gourmet burgers with sauce that looks just like new sauce but is just a mixture of mayonnaise and food coloring. Both groups were told that they were getting the sauce that would reduce stomach problems. Two hours after eating the gourmet burgers, 30 customers in Group A reported having fewer upset stomachs and 8 customers in Group B reported having fewer stomach problems.

- A. Which people are in the control group? _____
- B. What is the independent variable? _____
- C. What is the dependent variable? _____
- D. What should the restaurant's conclusion be? _____

Use the graph below to answer the following questions.



- A. What is the independent variable? _____
- B. What is the dependent variable? _____

Experimental Design

Directions:

Read the description for each experiment and use your knowledge of scientific processes to respond to the following questions or scenarios in the space below.

1. Brainiacs: Marie believed that she could improve her brainpower by eating Super Craniums Snacks. To test this hypothesis, she recruited several friends to help her with an experiment. They each ate one snack with every meal daily for three weeks. Each of them took a test before they started eating the snacks, as well as after three weeks.

<i>Participant</i>	Test Results Before Eating Super Cranium Snacks	Test Results After Eating Super Cranium Snacks
<i>Marie</i>	64%	80%
<i>Charles</i>	78%	78%
<i>Rachel</i>	82%	84%
<i>Jonathan</i>	72%	70%

Based on the data provided in the table above, do the Super Cranium Snacks work? Explain your answer.

2. Microwave Miracle: Godfrey believes that fish that eat food exposed to microwaves will become smarter and would be able to swim through a maze faster. He decides to perform an experiment by placing fish food in a microwave for 20 seconds. He has the fish swim through a maze and records the time it takes for each one to make it to the end. He feeds the special food to 10 fish and gives regular food to 10 others. After 1 week, he has the fish swim through the maze again and records the times for each.

Special Food Group (Time in minutes/seconds)			Regular Food Group (Time in minutes/seconds)		
Fish	Before	After	Fish	Before	After
1	1:06	1:00	1	1:09	1:08
2	1:54	1:20	2	1:45	1:30
3	2:04	1:57	3	2:00	2:05
4	2:15	2:20	4	1:30	1:23
5	1:27	1:20	5	1:28	1:24
6	1:45	1:40	6	2:09	2:00
7	1:00	1:15	7	1:25	1:19
8	1:28	1:26	8	1:00	1:15
9	1:09	1:00	9	2:04	1:57
10	2:00	1:43	10	1:34	1:30

- a. What was Godfrey's hypothesis? _____
- b. Which fish are in the control group? _____
- c. What is the independent variable? _____
- d. What is the dependent variable? _____
- e. Look at the results in the charts. What should Godfrey's conclusion be?

Cell Structure and Function

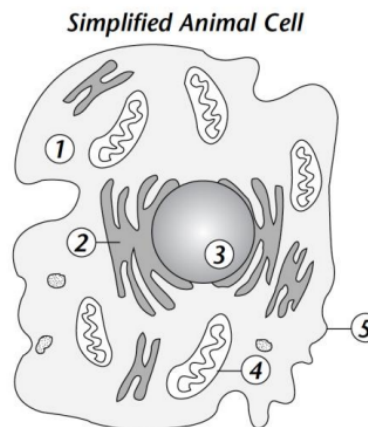
Plant and Animal Cells One of the main differences between plants and animals is usually obvious. Plants are green! But the evidence for this is so tiny you need a microscope to really see it. If you look at a plant cell under a microscope you can see that it has tiny green granules in sacs. These granules are green because they contain the pigment chlorophyll. This pigment absorbs energy from sunlight. This energy is used in an organelle called a chloroplast to make food for the plant. Animal cells do not have chloroplasts or cell walls. Can you think of why this might be? Well, animals cannot make their own food. This is reflected in the fact that they do not have chloroplasts in their cells. Also, animal cells do not have a cell wall because animals do not take on the rigid structures that plants do. Animals have other ways of keeping their shape; some animals have bones. Other animals such as insects have a hard, shell-like covering called an exoskeleton that gives them shape.

Overall, plants and animals have many organelles in common. Both plant and animal cells have organelles to help control, organize, and maintain the cell. These are functions that are mainly done by the cell nucleus, endoplasmic reticulum, cell membrane, cytoplasm, and mitochondria. So even though plants and animals are very different organisms, they have some very similar structures within their cells.

Directions:

Complete the chart below adding the function of each organelle.

Organelle	Function
Mitochondria	
Cell nucleus	
Endoplasmic reticulum	
Golgi apparatus	
Cell membrane	
Cytoplasm	
Vacuole	
Chloroplast	
Cell wall	



Directions: Identify each of the cell structures in the figure.

1. _____
2. _____
3. _____
4. _____
5. _____

Directions: Fill in the blank to complete each statement.

6. _____ are tiny cell structures that carry out specific functions within the cell.
7. The rigid layer of nonliving material that surrounds the cells of plants and other organisms is called the _____.
8. In cells without cell walls, the _____ forms the outside boundary that separates the cell from its environment.
9. The _____ is a large, oval structure that directs all the cell's activities.
10. The region between the cell membrane and the nucleus is called the _____.
11. _____ produce most of the energy the cell needs to carry out its functions.
12. A maze of passageways called the _____ carries proteins and other materials from one part of the cell to another.

Are They Plants or Animals?

www.discoveryeducation.com

Directions: Please read and highlight the following article.

Some scientists believe about 2 million different species of plants, animals, and other organisms live on Earth. Other scientists believe the number of species on Earth may be greater than 5 million! New species are constantly being discovered. When a new organism is discovered, biologists try to identify it. Is it a plant, an animal, or some other type of creature? What kind of environment does the organism live in? What kind of conditions help it survive?

Telling the difference between plants and animals may seem simple. Some organisms are more difficult to categorize than others, however. For example, coral do not move. Their bodies are shaped like some plants, and most types of coral must live in sunlight. But coral are animals! Scientists determined this fact by examining coral very closely. They studied the bodies of different species of coral and learned that coral function more like animals than like plants.

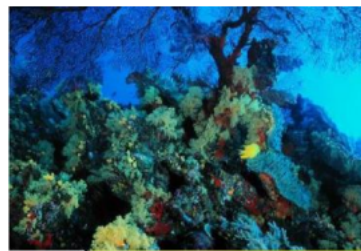
Scientists determined that coral are animals by studying coral cells. Cells are the tiny building blocks that make up all living things. Some cells are very simple. Bacteria cells, for example, have only a few parts. We call organisms with these simple types of cells prokaryotic organisms.

Most cells are more complicated. They contain a nucleus and other parts that help the cells obtain energy, reproduce, and carry out other functions. We call organisms made of these complex cells eukaryotic organisms. All plants, animals, algae, and fungi are eukaryotic organisms.

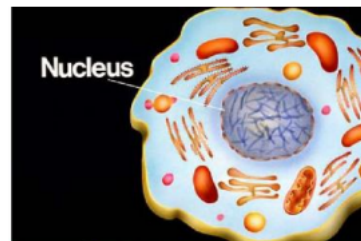
Even though both contain a nucleus, plant cells are very different than animal cells. Animal cells are surrounded by a membrane that allows water and nutrients to pass in and out of the cell. This membrane is like a net. The membrane is not stiff or solid, but it can still hold all the cell parts together.

A membrane also surrounds plants cells. However, plant cells also have a sturdy wall around their exterior. This wall around plant cells contains many gaps that allow water and nutrients to pass into and out of the cell. But even with these gaps, cell walls are very strong. Remember that plants do not have skeletons to hold them upright. Instead, plants are held upright by their cell walls.

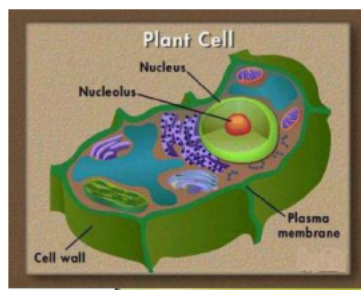
Can you guess what kind of cells scientists discovered in coral? Scientists found cells without walls! This discovery meant that coral were not plants.



Coral live in warm, shallow waters of the ocean.



Most eukaryotic cells contain a **nucleus** that directs their growth and reproduction.



Plant cells contain a cell wall.

Like plants, however, most coral grow best where they receive lots of sunlight. Plants are autotrophic, which means they make their own food. Special parts of a plant's cells use energy from the sun to make food for the plant. Coral cells, however, do not contain these special parts. Coral are heterotrophic; they cannot make their own food.

So why do most coral need sunlight? The reason is algae. For most coral, algae are the main source of food. Algae are autotrophic, so they depend on sunlight to survive. Because the coral depend on the algae, most coral grow in shallow water penetrated by sunlight.

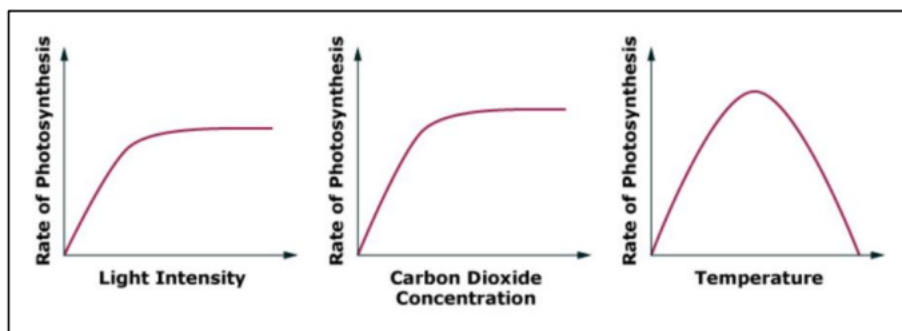
Scientists have determined that coral behave like animals in other ways as well. Like most sea animals, coral reproduce by producing egg and sperm cells that join and begin growing. New coral larvae swim to a sunny, shallow area where they can find food. Then the larvae attach to a hard surface and begin forming their skeletons around the surface. Usually at night, the coral reach their tentacles out to pull food into their mouths.

Scientists continue to study coral to learn what factors in their environments help these animals thrive. In the same way, scientists study newly discovered organisms, hoping to learn more about Earth and the creatures that inhabit it.

Photosynthesis

Photosynthesis is a series of complex chemical reactions. These changes involve the making or breaking of molecules to create new substances. A plant takes in carbon dioxide from the air and water from the soil and turns these into a sugar called glucose, releasing oxygen as a byproduct. A plant uses light energy to power these reactions. The equation that follows represents a simplified version of what occurs during photosynthesis: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$.

Directions: The graphs below show the effects of different factors on the rate of photosynthesis. Choose the correct word or phrase from each set of parentheses to complete the statements about the data.



As light intensity and carbon dioxide concentration increase, the rate of photosynthesis initially (increases, decreases, stays the same). This is because light energy and (carbon dioxide, oxygen, chlorophyll) are inputs for the photosynthesis process. Eventually, increasing the light intensity or carbon dioxide concentration (causes no further increase in the, causes a decrease in the, stops the) rate of photosynthesis. This is because the processes involved in photosynthesis are working as efficiently as they can.

As temperature increases, the rate of photosynthesis initially (increases, decreases, stays the same). Eventually, photosynthesis reaches its maximum rate. The temperature increases and causes the rate of photosynthesis to (increase, decrease, stay the same). This is because the processes involved in photosynthesis work best at a particular temperature.

Respiration

Directions: Fill in the blanks in the table below. Then answer the questions that follow in the spaces provided.

Raw Materials	Products
1.	3.
2.	4.
	5.

6. Where in the cell does the first stage of respiration take place?
7. Where in the cell does the second stage of respiration take place?
8. How does fermentation differ from respiration?
9. Which type of fermentation occurs in yeast?
10. Which type of fermentation sometimes occurs in human muscle cells?

Mitosis

Directions: Please read and highlight the following text.

Interphase is the first stage of the cell cycle. Interphase takes place before the cell divides. In the first part of interphase, the cell grows to its full size. The cell also makes all the cell structures and organelles that it needs. In the second part of interphase, the cell makes an exact copy of its DNA molecule in a process called replication. At the end of DNA replication, the cell has two identical sets of DNA, or genetic material. At the end of interphase, the cell makes the structures it will need to divide.

The second stage of the cell cycle is mitosis. Mitosis is the second stage of the cell cycle. Mitosis is the stage when the cell's nucleus divides into two new nuclei. The threadlike DNA shortens and thickens to form chromosomes. Each chromosome is made up of two rods held together. The two rods are made of DNA that is an exact copy of each other. During mitosis, the two chromosome rods separate from each other and move to opposite sides of the cell. At the end of mitosis, a new nucleus forms around each group of chromosomes, creating two new nuclei. Each new nucleus has one copy of DNA.

Cytokinesis is the final stage in the cell cycle. In cytokinesis, the cytoplasm divides. The organelles are divided up between the two new cells. When cytokinesis is over, two new cells, called daughter cells, have formed. Each daughter cell has the same number of chromosomes as the original parent cell. At the end of cytokinesis, each new cell enters interphase. The cell cycle begins again.

Directions: Answer the following questions in your science journal.

Which stage does each of the following occur?

A. Chromatin condenses into chromosomes _____

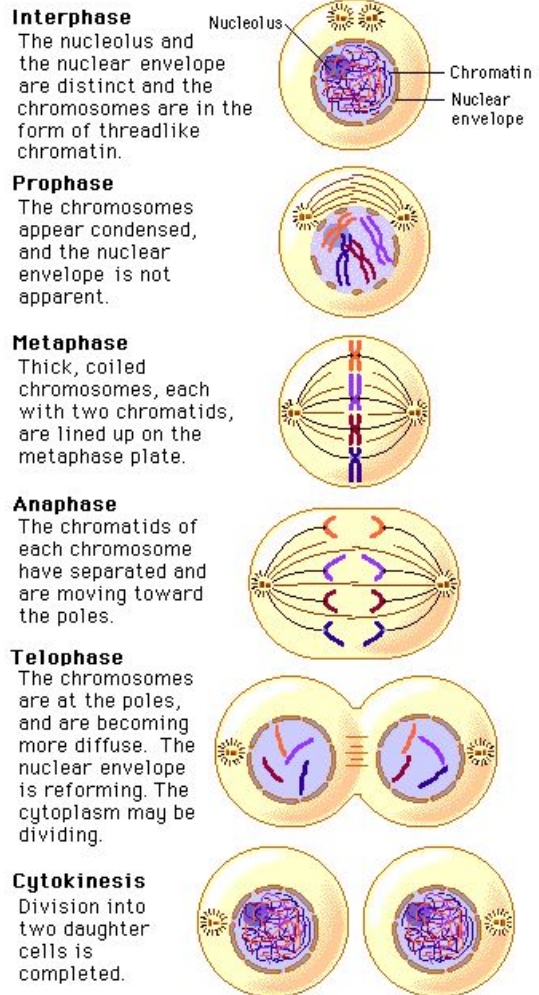
B. Chromosomes align in center of cell. _____

C. Nuclear envelope breaks down. _____

D. Cell is cleaved into two new daughter cells. _____

E. Daughter chromosomes arrive at the poles. _____

F. Chromatids are pulled apart _____



Meiosis

Directions: Please read and highlight the following text.

Getting to Know: Meiosis www.discoveryeducation.com

Think about this: your parents each have a complete set of chromosomes. So do you. You inherited genetic material from your father and from your mother. Since this is the case, why don't you have twice as much genetic material as your parents? The answer to this question has to do with the process of meiosis. Meiosis is needed to produce the egg and sperm cell that combine to produce a fertilized egg. This process ensures that egg and sperm cells each have half the number of chromosomes as other cells in the body.

Why is meiosis important?

Without meiosis, eggs and sperm could not be made. For example, in humans, adult cells have 46 chromosomes. They are diploid. If two adult cells combined, the new cell would have too many chromosomes. Meiosis is the way that cells divide to reduce the number of chromosomes by half. In humans, meiosis results in cells with 23 chromosomes. These cells form eggs in the female and sperm in the male. When the egg and sperm combine, they form a new cell with 46 chromosomes. Meiosis ensures that all future generations are diploid.

What is the point of meiosis?

Without meiosis, cells could only reproduce asexually. The advantage of meiosis is that it combines the DNA from two individuals. The new combination might express traits or characteristics that were absent in either parent. Therefore children are always slightly different from either parent. Meiosis increases genetic diversity in a population. Genetic diversity is important because if the environment changes, a diversity of traits enables adaptation.

What happens during the process of meiosis?

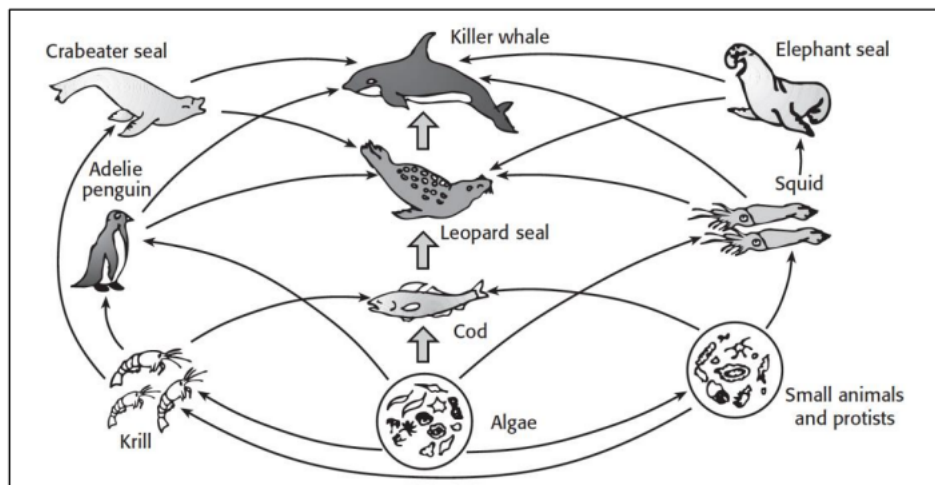
Meiosis takes place in cells in the ovaries in females and in the testicles in males. It involves a complex series of steps. The first step is Meiosis 1, which halves the number of chromosomes. Remember that in a 46-chromosome cell, 23 chromosomes each have a duplicate. One duplicate was from the mother and the other from the father. Before meiosis, the cell's DNA replicates. The result is two exact copies of each of the 23 duplicate chromosomes. The copies are called homologs. In mitosis, the cell at this point divides in two, resulting in two cells identical to the parent. However, during Meiosis 1, the cell does not divide right away. First each of the homologs pairs up and swaps DNA randomly. This chromosomal crossing over, or recombination, is a major reason why offspring are genetically distinct from their parents.

How does a cell halve the number of chromosomes?

After recombination, the chromosomes separate and attach to protein scaffolding inside the cell. The scaffolding then pulls the chromosomes apart. The two resulting cells each contain 23 pairs of chromosomes. During Meiosis 2, these two cells undergo another division. Each pair of chromosomes is separated. The four new cells that result each have only one of the original 23 pairs. The new cell is called a gamete. Because the gamete has only half the number of chromosomes of the diploid cell, it is called haploid.

Energy in Ecosystems: Food Chains and Food Webs

Directions: Use the figure below, which shows the food web of an aquatic ecosystem, to complete the questions/statements below (1-3)



1. In the food web above, there are eight food chains that include krill. Identify all the organisms in the order in which they occur in four of these eight food chains.
-

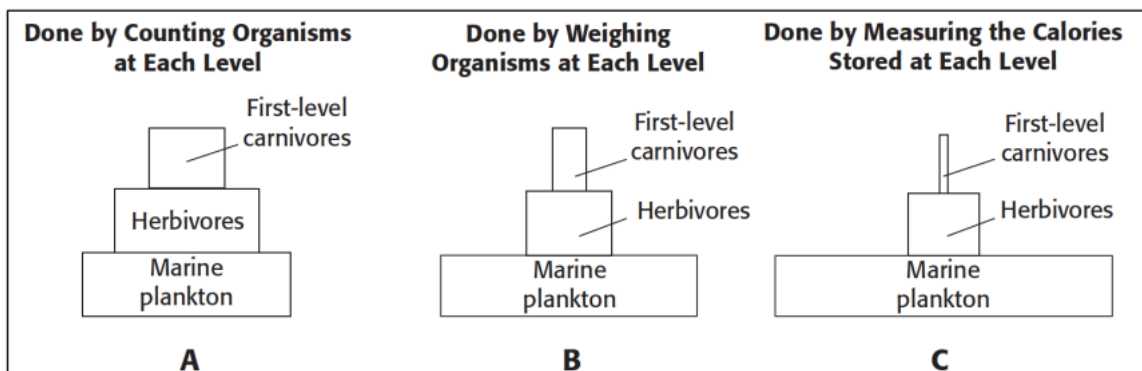
2. List all the organisms that eat squid.
-

3. How many producers are in the food web? Name them.
-

Trophic Levels

Directions: Use the figures below, which show trophic levels in an ecosystem, to complete items 4–6.

Study the three pyramids below. In the space provided, identify which pyramid is the most accurate indicator of each item below by writing the correct letter (A–C) in the space provided.



___ 4. number of individual organisms

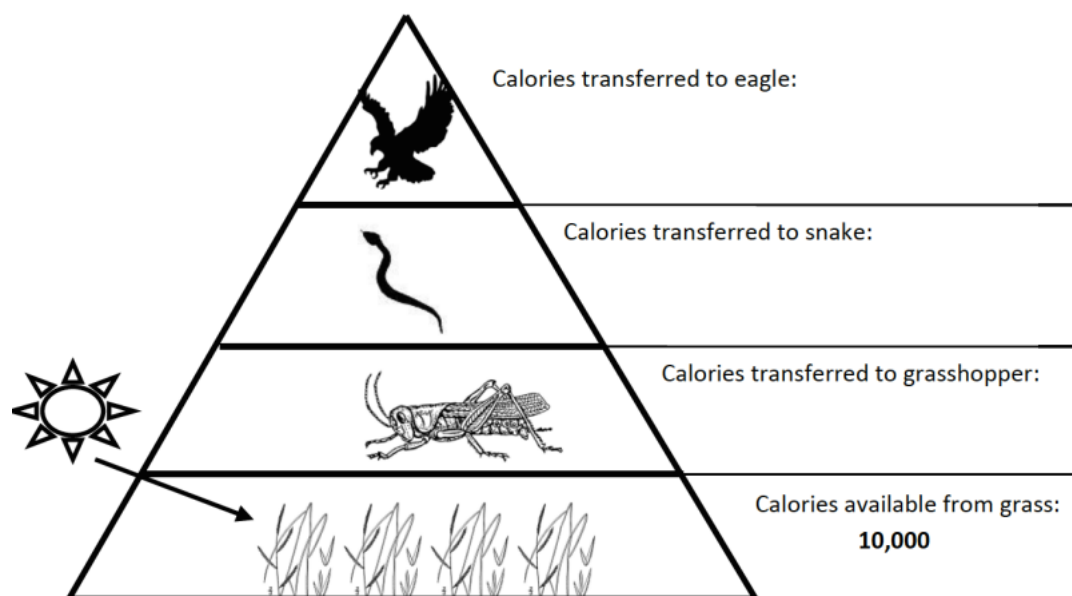
___ 5. measurement of productivity

___ 6. measurement of biomass

Energy Pyramid

The amount of available energy at each trophic (feeding) level decreases as it moves through an ecosystem. As little as 10 percent of the energy at any level is transferred up to the next level.

In the energy pyramid below, calculate the amount of energy that is passed up from one trophic level to the next, assuming only 10% of the energy from the previous level is available for the next level.



Directions: Answer the following questions on another piece of paper.

1. Assume that the grasshopper in the food pyramid above must eat half its body weight in grass each day. If an average-size grasshopper weighs 2 grams, and 1 blade of grass weighs 0.1grams (one tenth of a gram), how many blades of grass does the grasshopper need to eat each day?
2. Assume a snake must eat 5 grasshoppers per day, while an eagle must eat 2 snakes per day. Use this information along with your answer from Question #1 to calculate how many blades of grass are needed to keep an eagle alive for a day?
3. How many blades of grass are needed to support a family of four eagles for a week?
4. If only 10% of the energy from one trophic level passes up to the next level, what happens to the 90% energy that is not passed on?
5. Do you think a pyramid is a good shape to represent how matter and energy transfer in an ecosystem? Why or why not?