**Organisms and Energy Pogil**

**Food chains**

A *food chain* shows what eats what in a particular habitat. For example, grass seed is eaten by a vole, which is eaten by a barn owl. The arrows between each item in the chain always point in the direction of energy flow - in other words, from the food to the feeder.



The Sun is the ultimate source of energy for most communities of living things. Green plants absorb some of the Sun’s light energy to make their own food by *photosynthesis*. The other organisms in a food chain are consumers, because they all get their energy and biomass by consuming - eating - other organisms.

It helps if you can recall the meaning of some common words used with food chains.

| Word | Meaning |
| --- | --- |
| Producers | Green plants - they make food by photosynthesis. |
| Primary consumers | Usually eat plant material - they are herbivores. For example rabbits, caterpillars, cows and sheep. |
| Secondary consumers | Usually eat animal material - they are carnivores. For example cats, dogs and lions. |
| Predators | Kill for food. They are either secondary or tertiary consumers |
| Prey | The animals that predators feed on. |
| Scavengers | Feed on dead animals. For example, crows, vultures and hyenas are scavengers. |
| Decomposers | Feed on dead and decaying organisms, and on the undigested parts of plant and animal matter in feces. |

* **DO NOW**

Fill in the blanks under the diagrams by putting the organisms in the correct order. (Think about who eats what!). Put the sun at the very beginning so that you can remember that all energy comes from the sun.



## Energy loss from a food chain/web

Energy is lost at each stage of a food chain or web. This is due to the organisms using some of the energy they get to survive. Energy is lost from food chains/webs because the organisms need to:

* move
* heat
* reproduce
* carry out chemical reactions

The energy that is passed on is that from growth. The bigger the organism eaten the more energy the next organism can get.

The figure at the below shows energy flow in a simple food chain. Notice that at each level of the food chain, about 90% of the energy is lost in the form of heat. The total energy passed from one level to the next is only about one-tenth of the energy received from the previous organism. This means that an animal eating a plant will only get about ten percent of the energy that the plant gets from the sun. The remainder of the plant's energy is unusable as energy by the animal. Therefore, as you move up the food chain, there is less energy available. 

Most food chains are pretty short. There are rarely more than four stages, because a lot of energy is lost at each stage.

* **DO NOW:** After reading the above.
1. Which organism gets the most energy from the sun?
2. Which organism gets the least energy from the sun?
3. How much energy is lost at each consumer level?
4. Explain where the energy, that is lost, goes to.
5. Explain why it is and effective eating strategy to be a herbivore. (think about the amount of food needed for the energy)
6. Fill in the flow chart below with the following words. Predator, producer, secondary consumer, primary consumer, sun10,000 Joules
7. Fill in the energy that is TRANSFERRED in each level.

**Scavenger**

Scavenging is a feeding behavior in which an animal feeds on either dead animal or dead plant matter. Scavengers are the animals with scavenging habits. Scavengers’ role is vital for the ecosystem as they contribute to the decomposition, while decomposers and detritus feeders are responsible for completing the process. Scavengers do not spend energy to kill their prey, but they sense the smell of food on which they can feed. Vultures, Burying beetle, Raccoons, Jackals, and Hyenas are some prime examples for animal scavengers. Termites and earthworms are good examples for plant scavengers. While the scavengers act on the dead animals and plants, they break them in to small pieces of organic materials. Thus, scavengers start the decomposing process. In addition, big helpers for the decomposition process are the scavengers, while ***detritus*** feeders are the small helpers.

**Decomposer**

Decomposition is a process that small organisms act on dead plants and animals biomass to convert those into molecular levels. Decomposers are the organisms that contribute to the decomposition process. Fungi are the primary decomposers in a forest, while bacteria are also good examples. They are microscopic more often than not. However, the dead matter has to be exposed for bacteria to be able to act upon, while fungi can decompose any dead biomass because of their penetrability. Apart from that, enzymes to decompose lignin in wood are present only in fungi. Decomposers release the organic and inorganic molecules in the form of nutrients for the plants and animals. This process is vital for the recycling of the resources inside an ecosystem.

DO NOW: After reading the above.

1. Define:
	1. Scavenger
	2. Decomposer
2. Explain how scavengers help decomposers.
3. What do you think the word detritus means?
4. Place the names of the organisms in the correct box.

**Foods and energy**

**Energy Density**

Foods that contain more calories per gram are considered more energy dense. The foods highest in energy density tend to be those that are low in water and fiber and high in sugar or fat. While fats always increase the energy density of food, carbohydrates can either increase or decrease energy density depending on the type of carbohydrate, as both sugar and fiber are carbohydrates.

**Carbohydrates**

Carbohydrates, including sugars and starches, contain 4 calories per gram, and are one of the main sources of energy for your body. While fiber is considered a type of complex carbohydrate, your body isn't able to digest it, although bacteria in your intestines break it down somewhat. Fiber only provides 1.5 to 2.5 calories per gram, according to the Centers for Disease Control and Prevention.

**Fats**

Fats provide 9 calories per gram, so they contain more energy than carbohydrates. They are important for brain development, blood clotting and controlling inflammation. While all types of fat contain the same amount of energy, some are healthier than others. Unsaturated fats, including the essential omega-3 and omega-6 fats, may provide some health benefits. However, trans fats and saturated fats are harmful to your health, so limit these types of fat as much as possible.

**ATP**

Adenosine triphosphate (ATP) is the energy molecule used by all cells to do work. It is a nucleotide consisting of a nitrogen-containing base (adenine, thymine, cytosine, or guanine), a 5-carbon sugar, and 3 phosphate groups. ATP is able to store and transport chemical energy within cells. The LAST TWO phosphate groups (PO4), are joined by HIGH-ENERGY bonds. When these bonds are broken, energy is released for cells to use and ADP forms. Enzymes help to break and reform these high-energy bonds.

Answer the following questions after reading the above material.

1. What types(s) of carbon-based molecules (macromolecules) are the source for most of the energy in the foods you eat?
2. Where is the energy stored in these molecules?
3. What does ATP stand for?
4. What is ATP used for in cells?
5. Identify the parts of an ATP molecule below: (label adenosine, ribose, and phosphate molecules)



1. How is energy stored in the ATP molecule?
2. What happens to the ATP molecule when a phosphate group is removed? (what does it turn into?)
3. Label diagram below showing the cycle of ATP and ADP below.





1. What type of organic compounds store the most energy? The least?