

ENERGY PYRAMID AND BATS

OBJECTIVE:

Students will explore the energy pyramid and the 10% rule and how it affects the Mexican free-tailed bat.

NGSS: MS-LS2-1, MS-LS2-3, MS-LS1-7

NGSS CONNECTION:
MS-LS2-2

**MATERIALS:**

- A beaker or graduated cylinder labeled “Energy Available” with 500 mL of water
- A beaker or graduated cylinder labeled with “Metabolic Processes and Heat Given Off”
- Partial Food Web of Mexican free-tailed bat diagram (per student/group)
- The article -The 10% Rule and Energy Pyramid document



TIME: 1 hour

Teacher preparation

- Copy Partial Food Web of Mexican free-tailed bat diagram for each student or group.
- Copy The article -The 10% Rule and Energy Pyramid document for each student

Engage

Show students the diagram of the partial food web. Ask students what they know about the food web the Mexican free-tailed bat is found in. Noticings should include, but are not limited to:

- Where the ecosystem is found
- The biotic/abiotic factors available
- What the producers and consumers in the food web are
- How the energy in the food web flows

Explore/explain

1. Students will read the article The 10% Rule. Discuss with students what the 10% Rule is how it affects the flow of energy through a food web.
2. The teacher will model the 10% Rule by doing the following:
 - » Show students a beaker or graduated cylinder labeled “Energy Available” with 500 mL of water. Remind students this 500 mL of energy was produced by the Sun. Have another beaker or graduated cylinder labeled with “Metabolic Processes and Heat Given Off” ready.
 - » Ask students if only 10% of this energy is available to the next trophic level, how much energy would move to the primary consumers? $500 \times .10 = 50$ mL
 - » Ask how much is used for metabolic processes and heat given off. 450 mL Pour that amount of water into the appropriate beaker or graduated cylinder.
 - » Now ask students if only 10% of the energy is available to the next trophic level, how much how much energy would move to the secondary consumers? $10 \times .10 = 5$ mL

- » Ask how much is used for metabolic processes and heat given off. 445 mL Pour that amount of water into the appropriate beaker or graduated cylinder.
 - » Call students attention to the beaker labeled “Energy” and discuss how 5 mL of water is left and this represents the amount of energy available to the next trophic level, the tertiary consumers.
 - » Students will figure out how much will go to the final level. $5 \times .1 = 0.5$ mL (about 10 drops of water)
 - » Have students compare the two beakers or graduated cylinders and what do they notice about the flow of energy through food webs.
3. Have student look at the food web again. They will place the organisms from the food web in the correct trophic level on the student page.
 4. Discuss the following questions after the students have placed the organisms in the pyramid.
 - » What level is the Mexican free-tailed bat found in?
 - » Would all species of bats be found in the same level?
 - » What biotic factors does the Mexican free-tailed bat depend on?
 - » Describe how the available energy changes in the tertiary level.
 - » How would the Mexican free-tailed bat be affected if soybean and corn crops were destroyed by insects?
 - » What would happen to the bat’s remains?

Evaluate

Have students discuss or record their answers to the following prompts:

- Three things that they have learned from this lesson.
- Two questions that they still have.
- One aspect of lesson that they enjoyed.

Elaborate

Teacher can have students research and give examples of predatory, competitive and symbiotic relationships between other organisms and the Mexican free-tailed bat as well as any other bat studied.

ELPS

Group students strategically for students with various abilities. Students who need additional support should be paired with others.