CSEL Science

Content Handout

CSEL CENTER FOR THE SUCCESS of ENGLISH LEARNERS

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Design Principles

Phenomenon-Based Learning, Three Dimensional Design, and 5E Model

- Align with:
    - State science and English language arts standards
    - District's scope and sequence
- Utilize:
    - **Phenomenon-based learning**
        - Students learn by investigating natural events or occurrences
        - As a basis for teaching, CSEL Science uses events or occurrences that are: real, relatable, observable, and/or local.
    - **Three-dimensional design**
        - Disciplinary core ideas:
            - Big ideas or key concepts in science that students need to know
        - Engagement in scientific practices:
            - Doing things that scientists do, like developing models and analyzing data
        - Cross-cutting concepts:
            - Ideas that apply to many different areas of science that help students connect what they learn in one area of science to another
    - **5E model for teaching science**
        - The 5E model is a teaching framework designed to promote active learning and help students build a deeper understanding of science concepts.
        - The five stages are:
            - Engage: Teachers capture students' interest by asking a question, presenting a problem, or showing something intriguing
            - Explore: Students actively investigate the topic through hands-on activities
            - Explain: Students discuss their findings; the teacher helps explain the scientific concept behind what they've discovered
            - Elaborate: Students apply what they've learned to new situations or challenges
            - Evaluate: Students and teachers assess what has been learned

Design Principles: Examples

Each session starts with an activity called “Set the Context,” which provides or activates essential background knowledge.

- In this session, students develop a food web model for the Chesapeake Bay.
- This activity provides essential background knowledge about what the Chesapeake Bay is, where it is located, and what kind of water body it is.

Phenomenon:

Students investigate a local ecosystem, learn about the organisms that live there, and create a food web model.

5E Alignment:

Engage - The teacher captures students' interest by showing a labeled illustration and asking students to work with a partner to answer questions about the illustration.

ACTIVITY 1: SET THE CONTEXT

Directions: Listen and follow along as your teacher reads the text aloud. Work individually or with a partner to answer the questions in writing. Then, debrief as a class.

In this session, we will explore the feeding **relationships** of **organisms** in the Chesapeake Bay. Then, we will explore what happens when an **ecological disturbance** hurts a **species** that has an important *role (job)* in the ecosystem. You’ll apply what you’ve learned to the problem in Guam.

The Chesapeake Bay

The Chesapeake Bay is a body of water on the east coast of the United States. Chesapeake Bay refers to a long, thin body of water between Maryland and Virginia.

The Chesapeake Bay is the largest estuary in the United States. An estuary is an area of water where rivers meet the ocean. The fresh water from rivers mixes with salty water in the ocean. When the water mixes, it creates *brackish (slightly salty)* water.

1. ***Where is the Chesapeake Bay?***

The Chesapeake Bay is...

2. ***What is an estuary?***

An estuary is an area of water where...

Partner Talk

What kinds of organisms do you think live in or around the Chesapeake Bay? Name one organism and say how you think that organism gets the energy it needs to live, grow, and *reproduce (have children)*.

Students become familiar with organisms in the Chesapeake Bay and sort them according to their role in the ecosystem.

- The teacher reads text about 12 organisms in the Chesapeake Bay.
- Students sort the organisms into categories (producers, consumers, and decomposers).

5E Alignment:

Explore - Students investigate the topic through hands-on activities

ACTIVITY 2: IDENTIFY PRODUCERS, CONSUMERS, AND DECOMPOSERS

Directions: Listen and follow along as your teacher reads the text on each organism tile. Work individually or with a partner to re-read the text about each organism in the bank. For each organism, decide if it is a producer, consumer, or decomposer. Drag and drop the organism or write the organism name in the correct column. Then, debrief as a class.

Organism Bank:

green algae

Plant-like organisms that make food by photosynthesis

blue crab

A type of *crab (an animal with a shell)* that lives in water

osprey

A large bird that hunts for food while flying above water

diamondback terrapin

A kind of turtle that lives most of the time in water

phytoplankton

Very small plants made of one cell

American shad

A medium-sized fish that grows to about two feet long

menhaden

A medium-sized fish that grows to about one foot long

bristle worm

A kind of worm that lives in water and eats dead organisms

eastern oyster

An organism with two hard shells that lives in water

zooplankton

Very small animals that live in water

bald eagle

A large bird that lives near water

benthic diatoms

Single-cell (one-cell) organisms that eat dead matter and waste

Producers
(an organism that makes its own food)

Consumers
(an organism that eats other organisms)

striped bass

A large fish that can grow up to three feet long

Decomposers
(an organism that eats dead matter and waste)

Students use the feeding relationships to “solve the puzzle” and develop a food web model of the Chesapeake Bay.

Three Dimensional Design:

- **Disciplinary core idea** - Students engage in activities that help them diagram and analyze the flow of energy through a real ecosystem
- **Scientific practice** - Develop models to represent systems
- **Cross-cutting concept** - The total energy in a system does not change, but can be transferred between objects in a system

5E Alignment:

Explore - Students investigate the topic through hands-on activities

ACTIVITY 3: CREATE A MODEL OF THE CHESAPEAKE BAY FOOD WEB

Directions: Collect the materials listed in the green box below from your teacher. Listen and follow along as your teacher reads the feeding relationships of organisms in the Chesapeake Bay. Work individually or with a partner to use the feeding relationships to build your food web. Then, debrief as a class.

Materials:

- Organism Tile handout
- 1 sheet of flip-chart paper or poster board
- Scissors
- Pencil
- Glue or tape
- Marker

Building Your Food Web:

1. Cut out each organism tile along the dotted line.
2. Read the feeding relationship text below and lay out your tiles on the paper or poster board.
3. Draw arrows in pencil to show the flow of energy between organisms. Do not glue/tape your tiles to the poster yet.
4. Ask your teacher to review your layout. Make necessary changes.
5. Ask your teacher to approve your layout
6. Once your layout is approved, glue/tape the tiles to your poster and draw your arrows in marker.

Feeding Relationships:

- ☐ Phytoplankton and green algae are **producers**. Phytoplankton and green algae use the sun’s **energy** to make their own food.
  - ➔ Draw the sun in the top left-hand corner of your **food web** poster.
  - ➔ Draw an arrow from the sun to the phytoplankton and green algae.
- ☐ Zooplankton eats phytoplankton.
- ☐ American shad eats zooplankton.
- ☐ Menhaden eats both zooplankton and phytoplankton.
- ☐ Oysters eat zooplankton, phytoplankton, and green algae.
- ☐ Blue crabs and diamondback terrapins eat oysters.
- ☐ Diamondback terrapins also eat blue crabs.

Students answer questions using their food web model.

- Some questions ask students to find concrete information in their food web model.
- Other questions require higher-order thinking.

5E Alignment:

Explain - Students explain the science concepts they explored in the previous phase and demonstrate their understanding of discipline-specific vocabulary

ACTIVITY 3: FOOD WEB SCAVENGER HUNT AND ANALYSIS

Directions: After you have finished your food web, work individually or with a partner to answer the questions. Use the food web you created to help you answer the questions. Then, debrief as a class.

1. ***Which organisms are the producers in your food web?*** *[choose all that apply]*

☐ green algae ☐ benthic diatoms ☐ common sea star ☐ zooplankton

2. ***What is the job of producers in the food web?***

The job of producers is to...

3. ***What is an herbivore?***

☐ a consumer that only eats animals ☐ a consumer that eats plants and animals ☐ a consumer that only eats plants

4. ***Which organism in your food web is an herbivore?***

☐ eastern oyster ☐ menhaden ☐ American shad ☐ zooplankton

13. ***Explain how food chains and food webs are similar (the same).***

Food chains and food webs are similar because...

14. ***Explain how food chains and food webs are different.***

Food chains and food webs are different because...

15. ***Phytoplankton and green algae are producers. What would happen if there were no phytoplankton and green algae in the food web?***

If there were no phytoplankton and green algae in the food web...

Students apply what they learned to Guam's ecosystem by analyzing part of the food web before and after an invasive species was introduced.

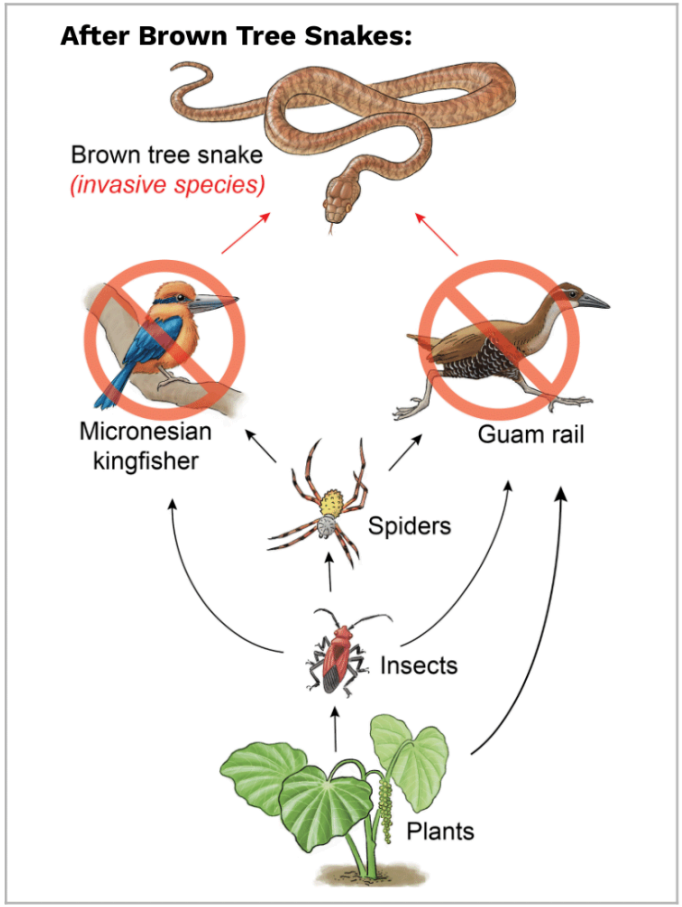
- The overarching phenomenon for the unit is the impact of an invasive snake species on the island of Guam.
- Other questions require higher-order thinking.
- Students connect and apply what they learned while developing and analyzing their local food web model to the ecosystem in Guam.

5E Alignment:

Elaborate - Students apply what they've learned to new situations or challenges

The food web to the right shows how Guam's food web *was impacted (changed)* when brown tree snakes were *introduced (brought in)* to the ecosystem.

Use this food web to answer Question 4.



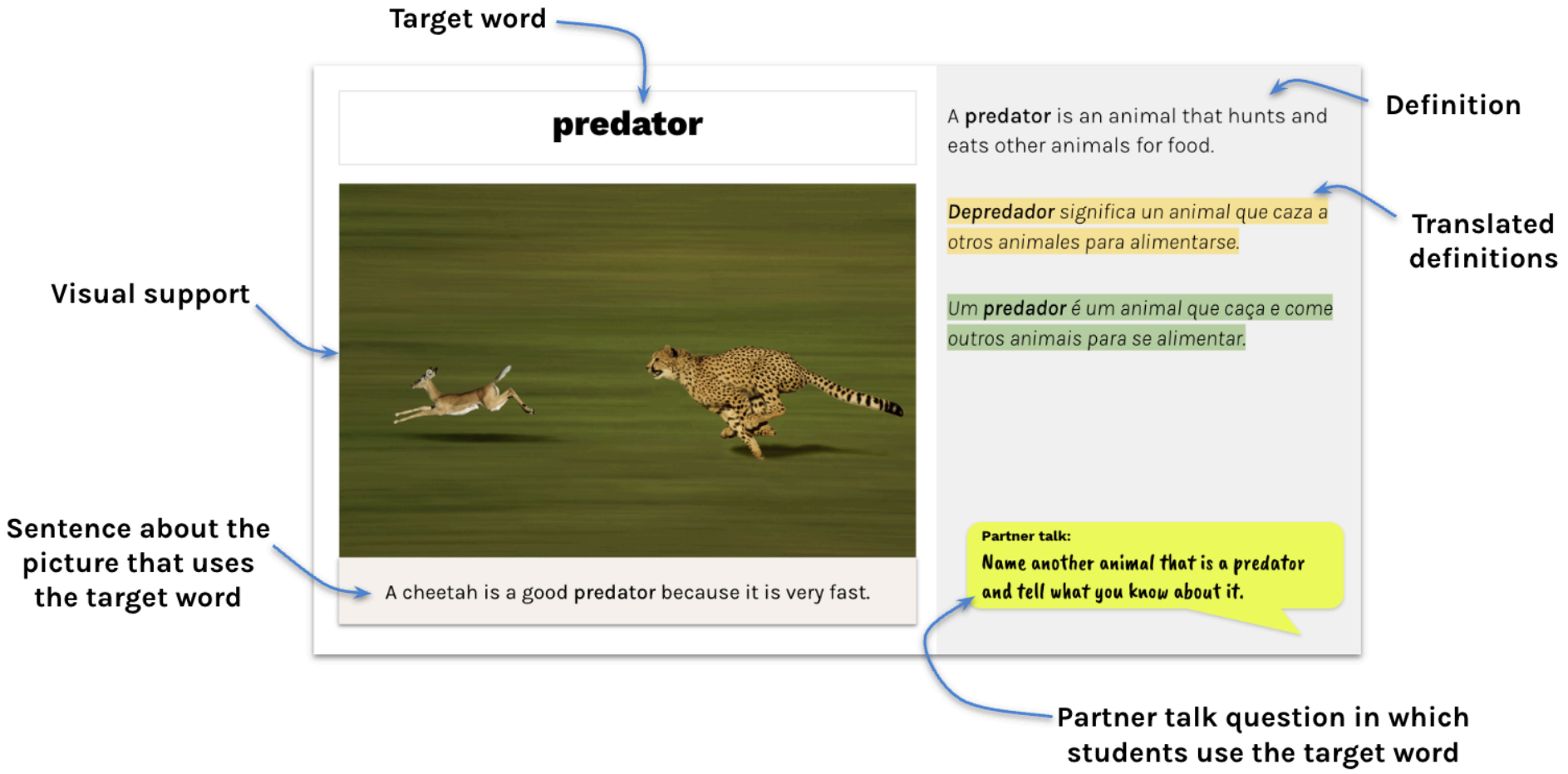
4. ***If the two native bird species went extinct do you think the spider population would increase** (get bigger) **or decrease** (get smaller)? **Why?***
   - ➔ *Hint: Look at the food web. Do any other organisms in the food web eat spiders?*

I think the spider population would _____ [increase or decrease] because...

Linguistic and Visual Supports

Previewing Key Science Academic Vocabulary with Picture Cards

Prior to each session, teachers preview key academic vocabulary that appears in the session using slides.



Defining Vocabulary in Context and in the Margins, Interactive Questioning and Labeled Visuals

Defining in context provides definitions for challenging words and phrases within the text itself

Interactive questioning and discussion supports supports students in understanding the text

Labeled visual supports illustrate important information

Defining in the margins provides definitions for glossary words as they appear in the text

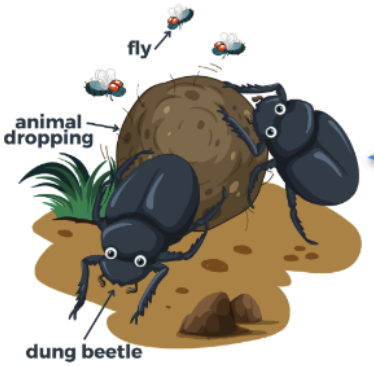
2.3 Directions: Listen and follow along as your teacher reads the text about decomposers. Work individually or with a partner to answer the questions in writing. Then, debrief as a class.

Decomposers are **organisms** that eat dead organisms and all the waste that **organisms** get rid of during their lives.

Most decomposers are *microscopic (very small)* organisms, like bacteria.

Other **decomposers** are big enough to see without a microscope. For example, dung beetles and flies are **decomposers** that eat animal droppings.

Decomposers make sure that no food is left unused. They get the last bits of available **energy** out of waste and dead **organisms**. **Decomposers** ***recycle nutrients*** *(put nutrients back into the environment). A nutrient is any substance an* ***organism*** *needs to live and grow.* Plants then use nutrients to grow. Herbivores eat the plants, and the cycle starts again.



NOTE: Waste is anything that a living thing takes in or makes but does not need or have use for and gets rid of.

1. ***What do decomposers eat?***

Decomposers eat...

2. ***Name three organisms that are decomposers.***

Three organisms that are decomposers are...

3. ***In your own words explain the role (job) decomposers have in an ecosystem.***

The role decomposers play is...

→ ***decomposers:*** *organisms that break down dead matter*

→ ***organism:*** *a living thing such as a plant or animal*

→ ***energy:*** *what is needed to do work (like moving) or make changes (like growing)*

Differentiation

Differentiated Support for Responding

Group 1

Sentence stems and sentence frames to support students in answering questions.

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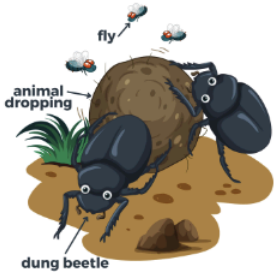

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Group 2

No sentence stems or sentence frames

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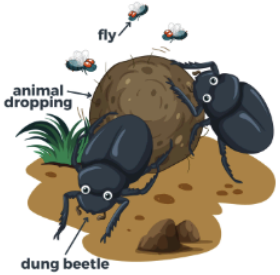

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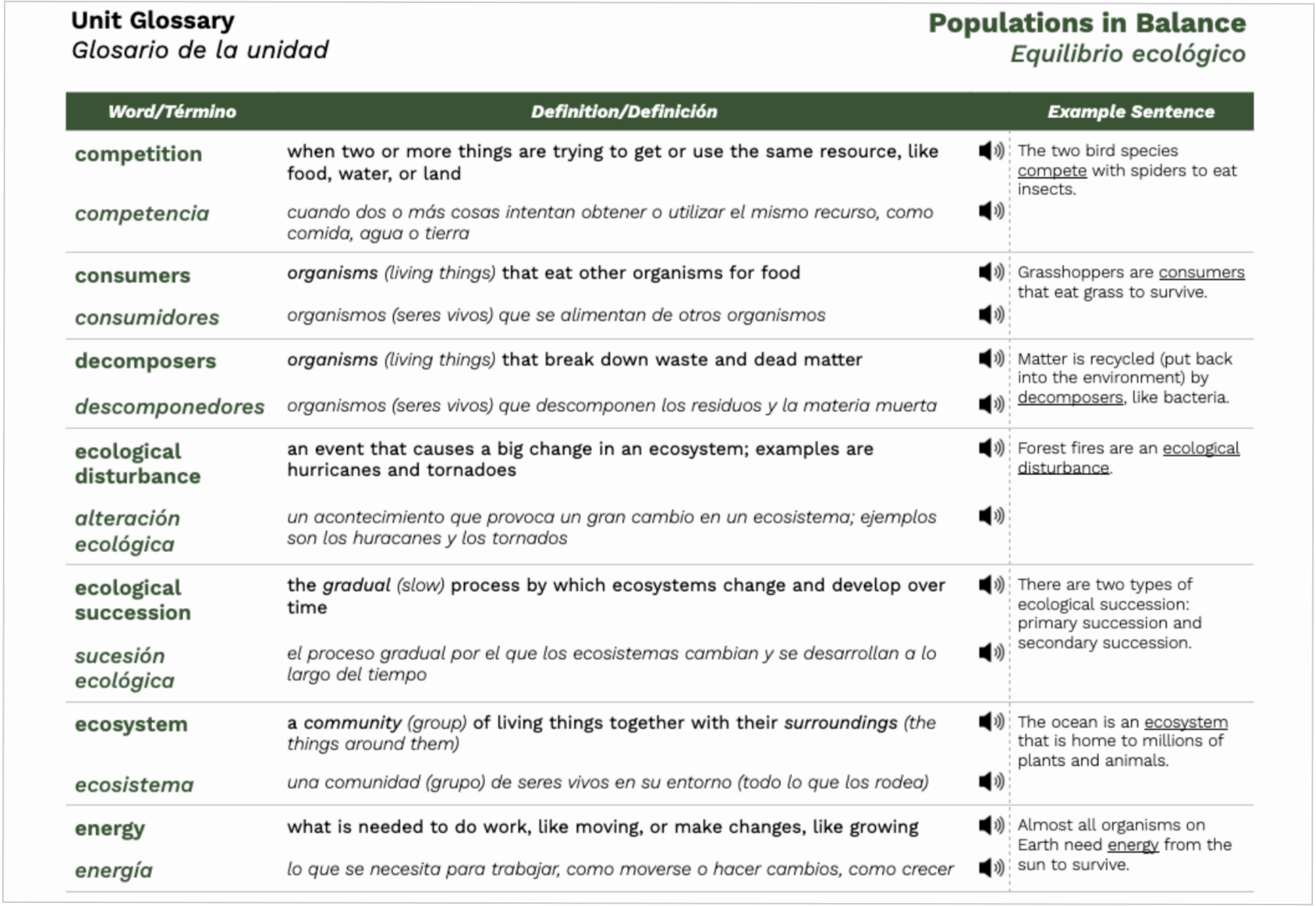
2. ***Name three organisms that are decomposers.***

3. ***In your own words explain the role (job) decomposers have in an ecosystem.***

Providing Home Language Support (Example 1)

Bilingual unit glossaries translate target words and definitions into a student's home language. Students can click on the speaker button to hear the word and definition read aloud.



Unit Glossary
Glosario de la unidad

Populations in Balance
Equilibrio ecológico

Word/Término	Definition/Definición	Example Sentence
competition	when two or more things are trying to get or use the same resource, like food, water, or land	The two bird species compete with spiders to eat insects.
competencia	*cuando dos o más cosas intentan obtener o utilizar el mismo recurso, como comida, agua o tierra*	
consumers	***organisms** (living things)* **that eat other organisms for food**	Grasshoppers are consumers that eat grass to survive.
consumidores	*organismos (seres vivos) que se alimentan de otros organismos*	
decomposers	***organisms** (living things)* **that break down waste and dead matter**	Matter is recycled (put back into the environment) by decomposers, like bacteria.
descomponedores	*organismos (seres vivos) que descomponen los residuos y la materia muerta*	
ecological disturbance	**an event that causes a big change in an ecosystem; examples are hurricanes and tornadoes**	Forest fires are an ecological disturbance.
alteración ecológica	*un acontecimiento que provoca un gran cambio en un ecosistema; ejemplos son los huracanes y los tornados*	
ecological succession	**the *gradual** (slow)* **process by which ecosystems change and develop over time**	There are two types of ecological succession: primary succession and secondary succession.
sucesión ecológica	*el proceso gradual por el que los ecosistemas cambian y se desarrollan a lo largo del tiempo*	
ecosystem	**a *community** (group)* **of living things together with their *surroundings** (the things around them)*	The ocean is an ecosystem that is home to millions of plants and animals.
ecosistema	*una comunidad (grupo) de seres vivos en su entorno (todo lo que los rodea)*	
energy	**what is needed to do work, like moving, or make changes, like growing**	Almost all organisms on Earth need energy from the sun to survive.
energía	*lo que se necesita para trabajar, como moverse o hacer cambios, como crecer*	

Providing Home Language Support (Example 2)

Summaries of core content and associated questions in students' home languages. Text and questions are presented side-by-side in English and the student's home language.

¿Cómo obtienen energía los grupos de organismos?

Podemos agrupar los organismos en tres categorías en función de cómo obtienen la energía que necesitan.

Productores

Los productores son organismos que utilizan la energía del sol para fabricar su propio alimento. Fabrican su propio alimento mediante la fotosíntesis. Las plantas, las bacterias y las algas, como el fitoplancton, son ejemplos de productores.

5. ¿Qué son los productores?

Los productores utilizan la energía del sol

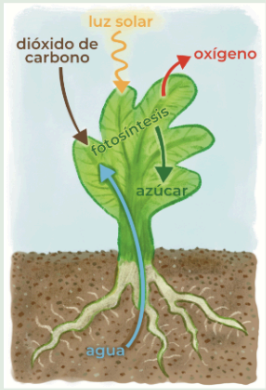
para

4. ¿Cuáles de los siguientes son productores?

- ☐ saltamontes
- ☐ árbol
- ☐ flor
- ☐ rana
- ☐ fitoplancton

¿Qué es la fotosíntesis?

La fotosíntesis es el *proceso (serie de acciones)* en el que las plantas utilizan la luz solar, el dióxido de carbono y el agua para fabricar su propio alimento. Durante la fotosíntesis, las plantas producen oxígeno y lo liberan al aire.



How do groups of organisms get energy?

We can group organisms into three categories based on how they get the energy they need.

Producers

Producers are organisms that use energy from the sun to make their own food. They make their own food through photosynthesis. Plants, bacteria and algae, like phytoplankton, are examples of producers.

5. What are producers?

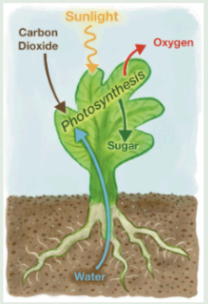
Producers use energy from the sun to make their own...

6. Which of the following are producers?

- ☐ grasshopper
- ☐ tree
- ☐ flower
- ☐ frog
- ☐ phytoplankton

What is photosynthesis?

Photosynthesis is the *process (series of actions)* in which plants use sunlight, carbon dioxide, and water to make their own food. During photosynthesis, plants *produce (make)* oxygen and *release (let out)* the oxygen into the air.



Providing Extension Activities

Extension activities are available for students who complete classwork early. Teachers have offered extension activities as extra credit opportunities or homework assignments. Teachers have chosen to implement some extensions as a class, time permitting.

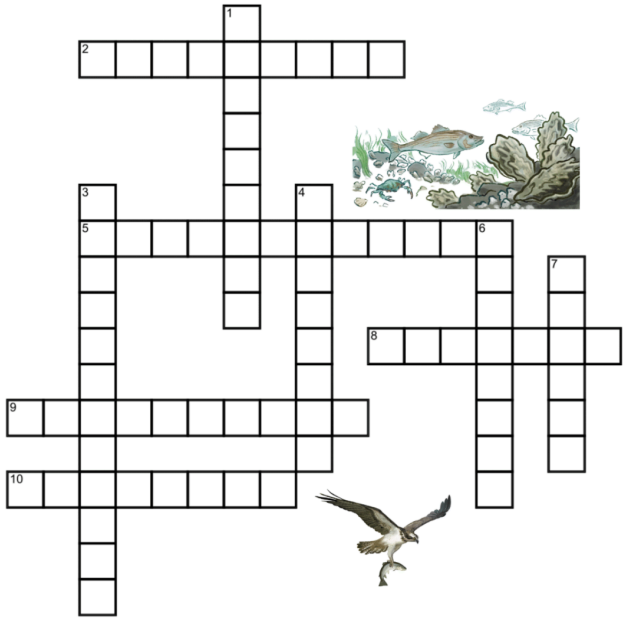
Shorter extensions like crossword puzzles, word searches, and Blooket question sets can be used to fill shorter gaps of time.

Name: _____

Populations in Balance Crossword Puzzle

Words in this puzzle appeared in Sessions 4-5.

Directions: Work individually or with a partner to complete the crossword puzzle. Use the clues to figure out where vocabulary words belong in the crossword puzzle. There is a word bank to help you.



Word Bank

consumer
decomposer
ecosystem
energy
food chain
food web
predator
producer
relationship
trophic level

Across Clues

2 a simple model that shows the order in which organisms get energy by eating

5 a connection between two or more things

8 a complex model that shows how food chains connect with each other

9 an organism that breaks down dead matter

10 an animal that hunts and eats other animals for food

Down Clues

1 a group of living things together with their *surroundings* *(the things around them)*

3 a group of organisms that are at the same feeding level

4 an organism that eats other organisms for food

6 an organism that makes their own food

7 what is needed to do work (like moving) or make changes (like growing)

More elaborate extensions are included at the end of most sessions. These extensions relate to and extend student learning from the session.

EXTENSION ACTIVITY: FIND AN AT-RISK SPECIES IN YOUR AREA

Part 1 Directions: Find a species in your area that is at-risk. Describe the species and where it lives. Research and describe why the species is at-risk. An example is completed for you.

→ Use this website to help you find a local at-risk species.

MODEL

Species Name:
Piping Plover

Picture/Drawing:

Habitat, or where it lives:
Piping plovers build their nests on coastal beaches in the United States and Canada

Description (color, size, etc.):
Small white or tan bird that is about seven inches long

Why is it at risk?

→ **Threats with Natural Causes:**
Flooding and erosion of nesting areas. Erosion is when water, wind, or storms *wear away (hurt)* the places where piping plovers build nests. Flooding is when there is a sudden strong flow of water.

→ **Threats with Human Causes:**
Human activity that damages their nesting habitat or crushes eggs. For example, people and pets using beaches in the summer bother nests if they get too close. Piping plovers only lay about four eggs each year in the spring or summer months.

YOUR TURN

Species Name:	**Picture/Drawing:**
Habitat, or where it lives:	
Description (color, size, etc.):	

Why is it at risk?

→ **Threats with Natural Causes:**

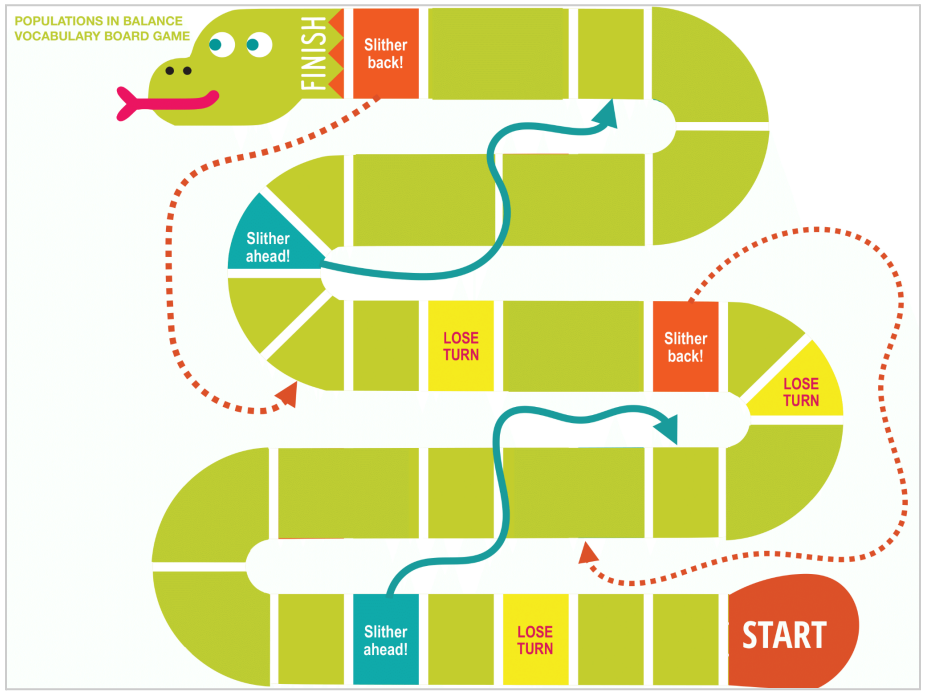
→ **Threats with Human Causes:**

Review and Assessment

Review Games

Board games are used to review unit vocabulary in small groups.

Example Game Board:



Example Game Cards:

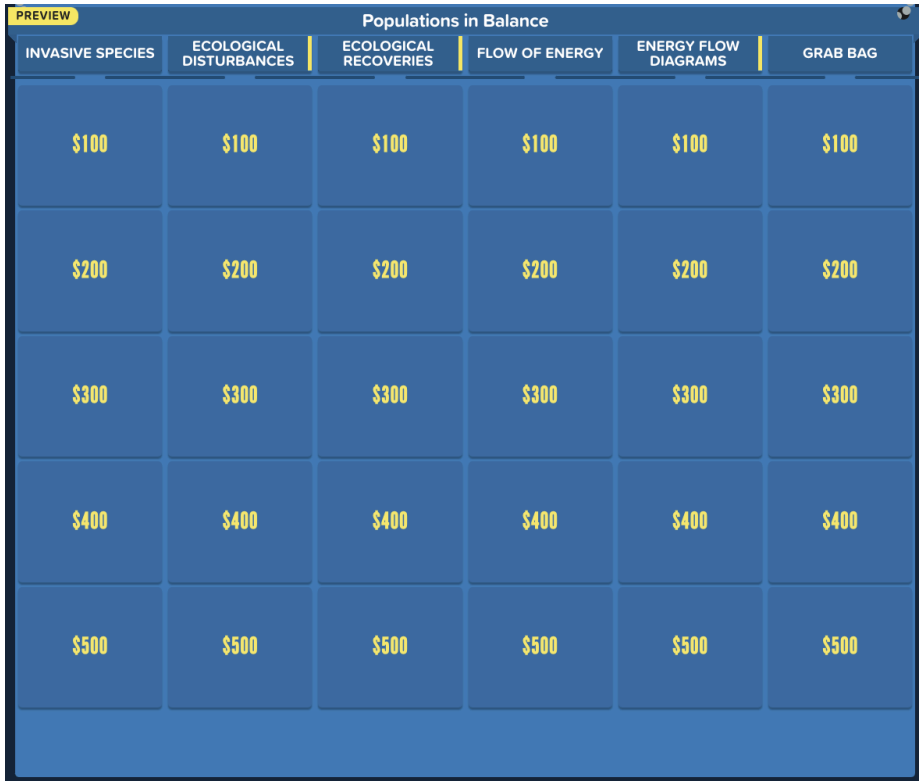
when two or more organisms are trying to get or use the same resource, like food

competition

a group of organisms of the same species, like humans, that live in the same place at the same time

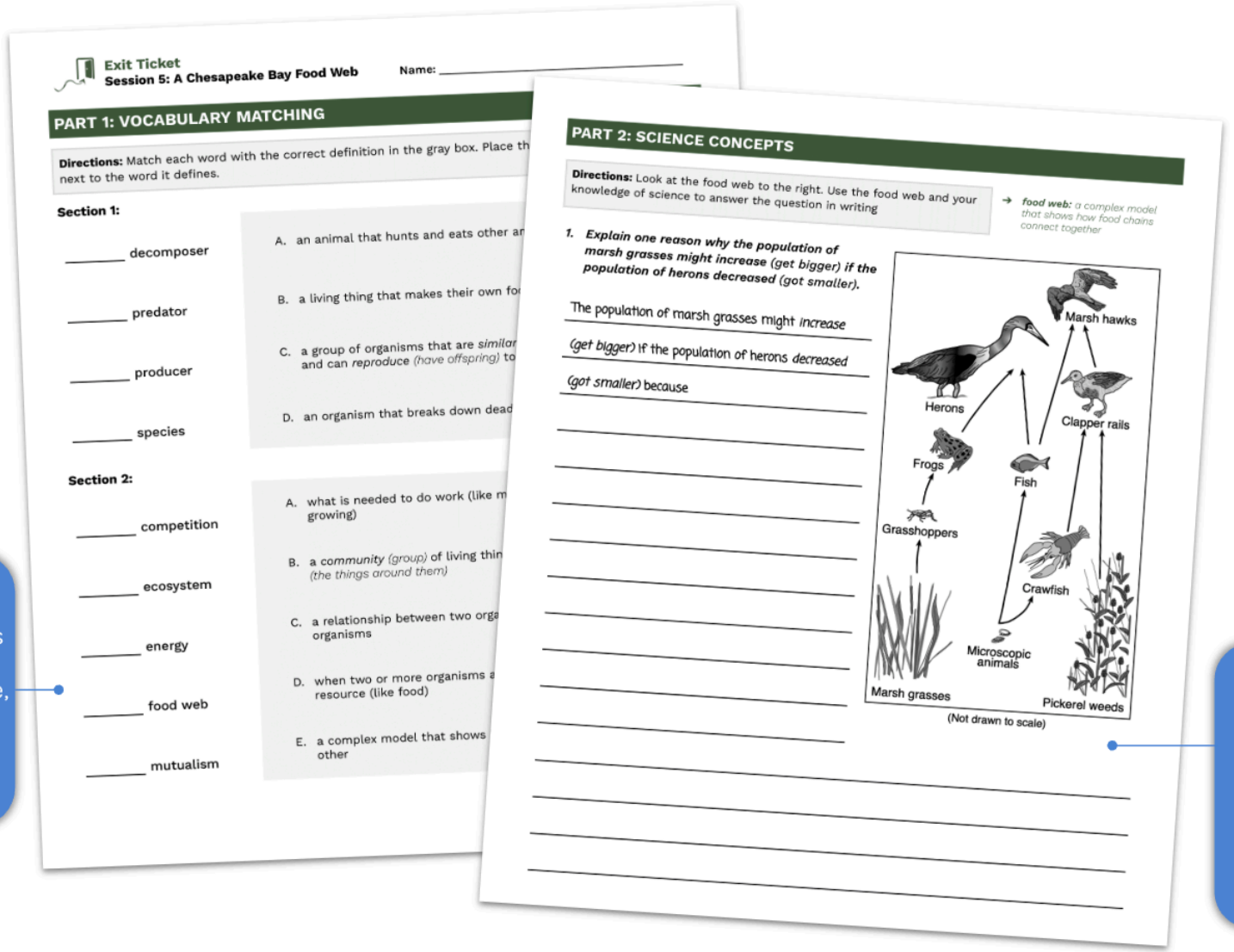
population

Jeopardy to review key science concepts as a class with students working in teams



Exit Tickets

There is an exit ticket at the end of each session.



Exit Ticket
Session 5: A Chesapeake Bay Food Web
Name: _____

PART 1: VOCABULARY MATCHING

Directions: Match each word with the correct definition in the gray box. Place th
next to the word it defines.

Section 1:

_____ decomposer
_____ predator
_____ producer
_____ species

A. an animal that hunts and eats other an
B. a living thing that makes their own fo
C. a group of organisms that are *similar* and can *reproduce* *(have offspring)* to
D. an organism that breaks down dead

Section 2:

_____ competition
_____ ecosystem
_____ energy
_____ food web
_____ mutualism

A. what is needed to do work (like m growing)
B. a *community* *(group)* of living thin *(the things around them)*
C. a relationship between two orga organisms
D. when two or more organisms a resource (like food)
E. a complex model that shows other

PART 2: SCIENCE CONCEPTS

Directions: Look at the food web to the right. Use the food web and your knowledge of science to answer the question in writing

→ ***food web:*** *a complex model that shows how food chains connect together*

1. ***Explain one reason why the population of marsh grasses might increase (get bigger) if the population of herons decreased (got smaller).***

The population of marsh grasses might *increase*
(get bigger) if the population of herons *decreased*
(got smaller) because

Marsh hawks
Herons
Clapper rails
Frogs
Fish
Grasshoppers
Crawfish
Microscopic animals
Marsh grasses
Pickerel weeds
(Not drawn to scale)

The first part of each exit ticket is an academic language exercise, generally vocabulary matching.

The second part focuses on key science concepts from the session, generally a released state assessment item.

Quizzes

There is a quiz after each chunk of content in a unit. For example, there is a quiz after the two sessions focused on food chains, food webs, and energy pyramids.

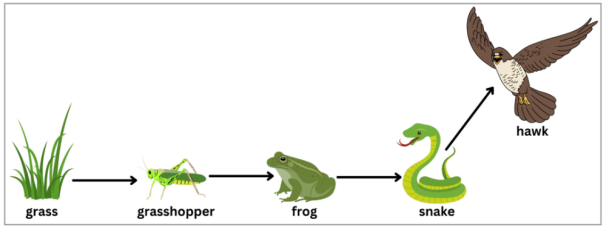
Quizzes include multiple choice questions related to unit content, science concepts, and vocabulary. Quizzes may also include: matching activities, labeling activities, and/or interpreting data and diagrams

PART 3: MULTIPLE CHOICE QUESTIONS

Directions: Read each question carefully and choose the best answer. Circle the letter in front of the answer you choose.

Use the food chain to answer questions 1-4.

Food Chain:



1. In the food chain above, which organism **gives** energy to the frog?
   a. snake
   b. grasshopper
   c. hawk
   d. grass

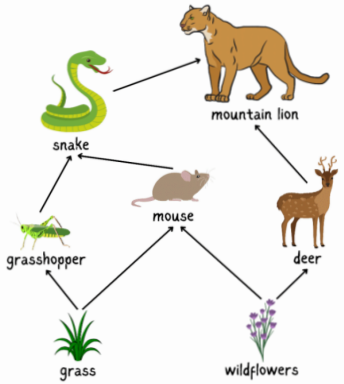
2. In the food chain above, which organism ***receives*** *(gets)* energy from the snake?
   a. frog
   b. grasshopper
   c. hawk
   d. grass

3. In the food chain above, what **gives** energy to the grass?
   a. grasshopper
   b. sun
   c. hawk
   d. *soil (dirt)*

4. What *type (kind)* of organisms are **missing** from the food chain above?
   a. plants
   b. primary consumers
   c. animals
   d. decomposers

PART 4: FLOW OF ENERGY OPEN-RESPONSE QUESTIONS

Directions: Read each question carefully. Then, answer each question in writing. Use the food web to help you answer the questions.



1. ***Find and list three food chains from the food web above. An example is provided for you.***

Example wildflowers → deer → mountain lion

a. _____ → _____ → _____ → _____

b. _____ → _____ → _____ → _____

c. _____ → _____ → _____ → _____

2. ***If grass was removed*** *(taken out)* ***from the food web, do you think the population of snakes would increase*** *(get bigger)* ***or decrease*** *(get smaller)****? Say why you think that.***

I think the population of snakes would _____ [increase or decrease] because _____