



# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?

Elementary Lesson



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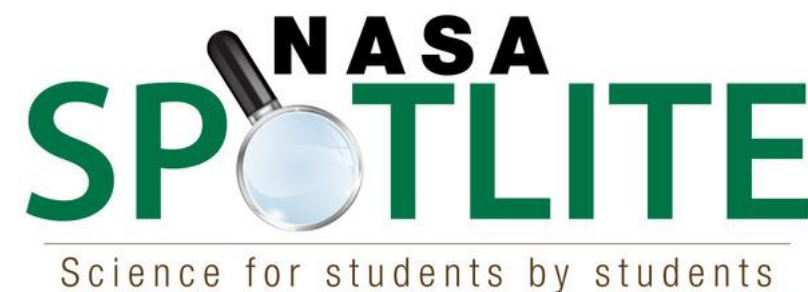


# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

## What are NASA Spotlights?

NASA Spotlights are 90-120 second student-produced video segments that address common science misconceptions as determined by reputable assessment sources such as the National Assessment of Educational Progress (NAEP), National Science Foundation (NSF) Factual Knowledge Questions, and the Misconceptions-Oriented Standards-based Assessment Resources for Teachers (MOSART).

NASA Spotlights are designed to increase scientific literacy in a standards-based classroom. By producing Spotlight videos, students gain production experience, as well as deepen their understanding of science content. Approved NASA Spotlights can be found at the NASA eClips website.  
<https://nasaclips.arc.nasa.gov/>



## 5E Lesson Model

NASA eClips™ Guides use the 5E constructivist model developed by Biological Sciences Curriculum Study. Constructivism is an educational philosophy that promotes student-centered learning where students build their own understanding of new ideas. The 5E instructional model consists of five stages for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.



**Click to play this video.**

This video is a collection of images with text read aloud and set to music.

[The video is also located on the NASA eClips website linked here.](#)

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### Pages for Learners

#### **Engage**

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#### Science Misconception

#### **Explore** Activities

#### **Explain** Activities

#### Frayer Model Vocabulary Development

#### **Extend** Activities

#### **Evaluate** Assessment



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

## Lesson Overview

### Science Misconceptions

Phytoplankton are only found in oceans.

### Standards

#### Next Generation Science Standards

- 4-LS1-1 From Molecules to Organisms: Structures and Processes
  - Performance Expectation: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 5-PS3-1 Energy in Chemical Processes and Everyday Life
  - Performance Expectation: Use models to describe that energy in animals' food was once energy from the Sun.

### Objective

As a result of watching Spotlight videos, learning the vocabulary collaboratively, and completing investigations and activities, learners will identify phytoplankton as primary producers in aquatic ecosystems and explain their importance in supporting life on Earth.

### Safety

- Review digital citizenship before learners use online resources.
- Have learners wear safety goggles to protect their eyes and gloves to protect their hands.
- Use caution and monitor learners when using tools and equipment like scissors and microscopes.

### Materials

#### Assessment

##### Per student:

- copy of pretest and posttest
- Frayer Model Activity

##### Per classroom:

- chart paper for posting final vocabulary definitions

##### Per small group:

- copy of a digital Frayer Model (alternatively, this can be printed)

### Explore

#### For each group of students:

##### Activity 1

- string or yarn
- hangers or sticks
- index cards or paper
- markers or crayons
- tape or hole punch

##### Activity 2

- large clear jar with lid that is clean and dry
- mud from the bottom of pond, lake, ocean or other natural body of water
- sample of plants from the same body of water
- water from the same location

##### Activity 3

- microscopes
- prepared slides of phytoplankton and zooplankton or live samples
- labels for slides (to identify organisms)
- handout or guide with images of plankton for reference
- gloves and goggles (if using live water samples)

### Target Vocabulary

ecosystem  
global ocean  
food web  
survive  
oxygen  
photosynthesis  
phytoplankton  
producer  
consumer  
decomposer  
organism  
aquatic  
microscopic  
zooplankton

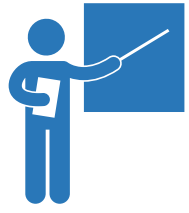
### Time Frame

Between two and five 45-minute class periods (depending on the activities conducted):

Day 1 - Engage and Explore

Day 2 - Explain and Elaborate/Extend

Day 3 - Evaluate



### Materials

#### Assessment

##### Per student:

- copy of pretest and posttest
- Frayer Model Activity

##### Per classroom:

- chart paper for posting final vocabulary definitions

##### Per small group:

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- gloves and goggles (if using live water samples)

### Lesson Big Ideas

- Phytoplankton are microscopic, primary producers that form the base of most aquatic food webs.
- Phytoplankton capture solar energy through photosynthesis and convert it into chemical energy stored in sugars, which fuels aquatic ecosystems.
- Environmental factors such as temperature, sunlight availability, nutrient concentrations, pH, and water circulation patterns influence the distribution and abundance of phytoplankton.
- Because phytoplankton play a critical role in aquatic food webs, oxygen production, and carbon sequestration, scientists monitor them to better understand changes in Earth's interconnected systems.





# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Background Information

Plankton is the term for organisms found in marine and freshwater environments. This includes certain algae, bacteria, protozoans, crustaceans, mollusks, and coelenterates.

Most exist in a drifting state because they are nonmotile or too small or weak to swim against the current.

Plankton can be categorized into two main groups.

1. Phytoplankton include organisms that carry out photosynthesis and produce food. Phytoplankton can be found in fresh and salt water.
2. Zooplankton are animal-like plankton that feed on phytoplankton.

## Importance of Phytoplankton

Ecosystem Support:

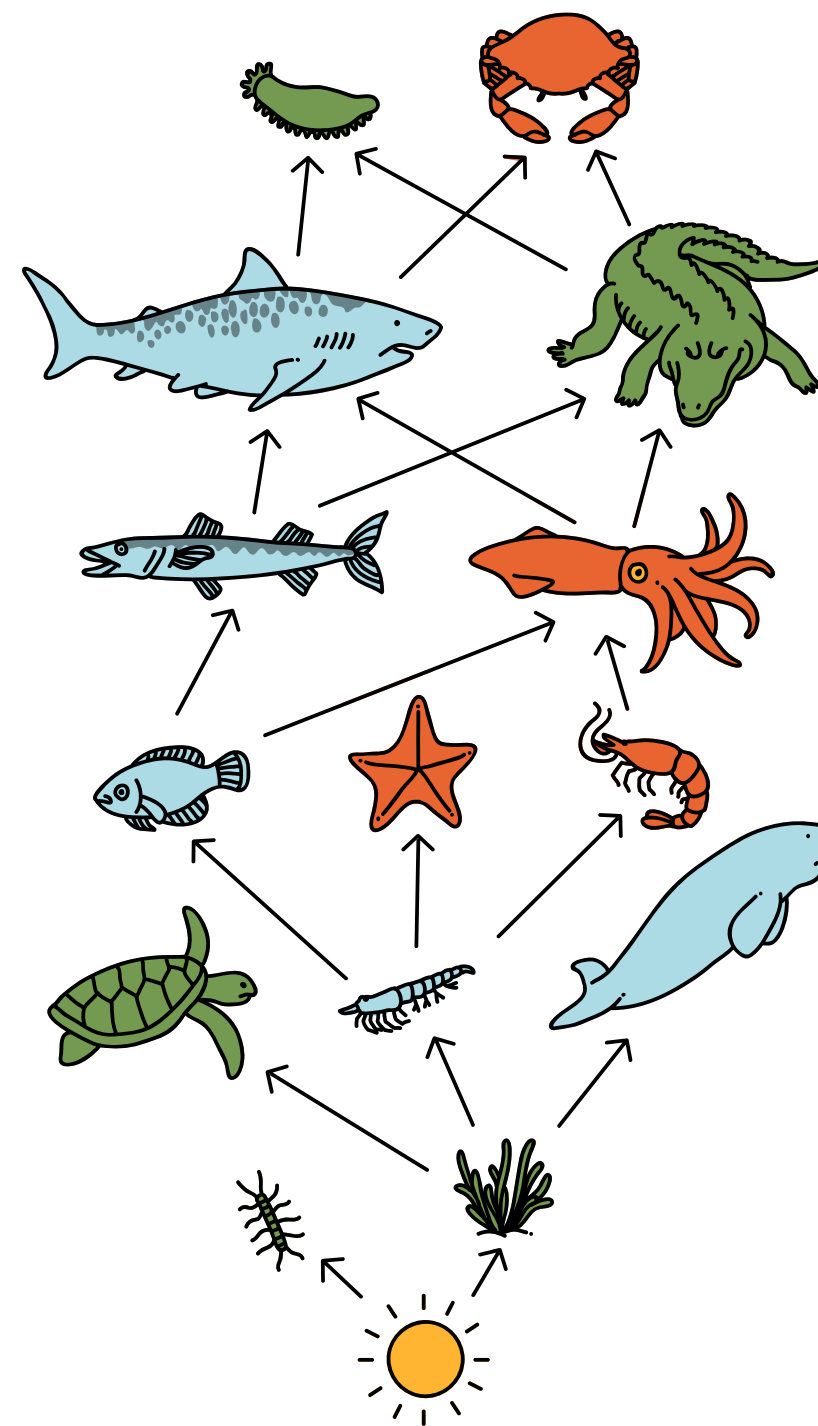
- Phytoplankton serve as the foundation of aquatic ecosystems, feeding zooplankton, fish, and larger organisms.

Oxygen Production:

- They contribute at least 50% of Earth's oxygen through photosynthesis.
- Phytoplankton are critical to maintaining the balance of oxygen in the atmosphere. Changes in water temperature, light availability, or nutrient levels impact phytoplankton populations and marine ecosystems.

Carbon Sequestration:

- They absorb CO<sub>2</sub> during photosynthesis. When phytoplankton die, some sink to the ocean floor, trapping carbon in sediments for centuries.
- Carbon dioxide is a greenhouse gas that can trap heat, impacting global climate change.





# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Background Information

## Abiotic Factors Affecting Phytoplankton

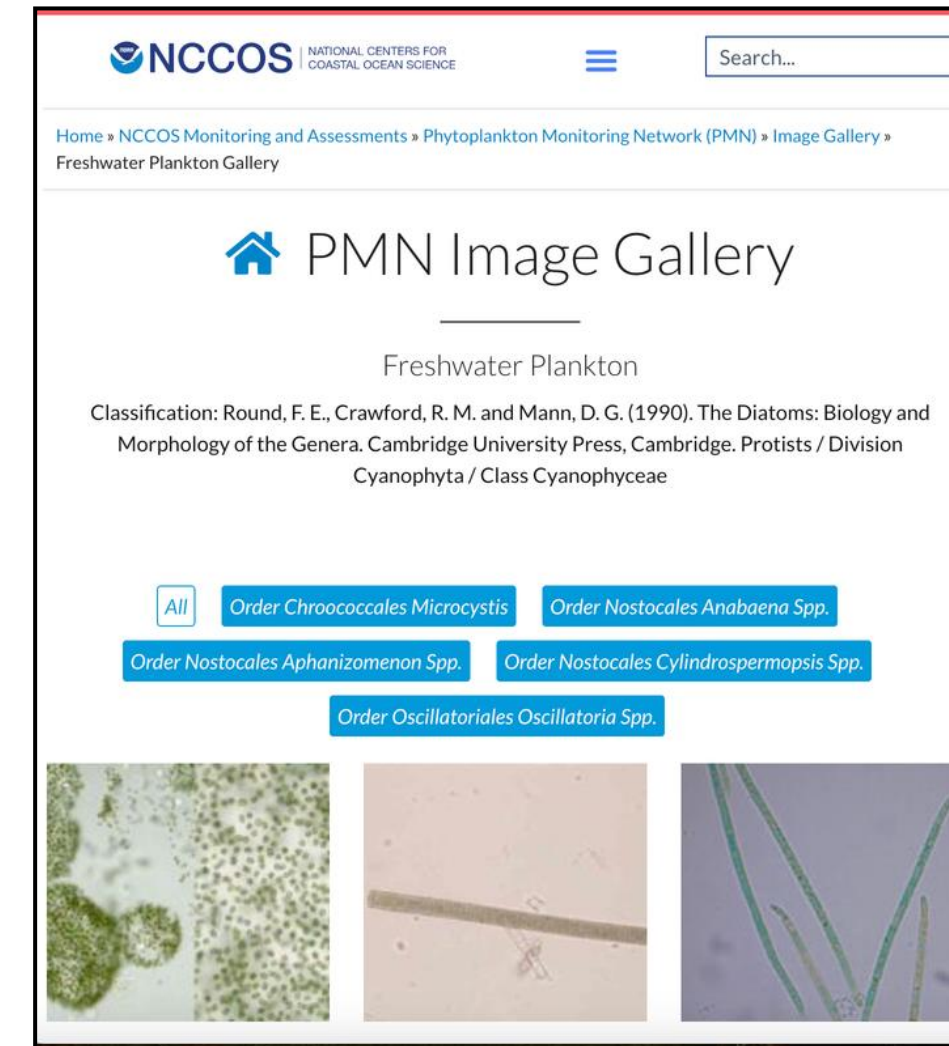
- Sunlight - Phytoplankton depend on sunlight for photosynthesis, so they are found near the surface of the water.
- Nutrients - Phytoplankton thrive in nutrient-rich waters, often near coastlines or upwelling zones. However, excess nutrients from agricultural runoff can lead to harmful algal blooms.
- Rising ocean temperatures and changing pH levels can alter phytoplankton populations, impacting global ecosystems.

Upwelling zones are areas in the ocean where deep, cold, nutrient-rich water rises to the surface. This process brings nutrients like nitrogen and phosphorus from the ocean's depths to the surface, where they support phytoplankton growth.

## Why Are Upwelling Zones Important?

1. Phytoplankton Growth: The nutrients in upwelling zones provide an ideal environment for phytoplankton to thrive, which supports the entire marine food web.
2. Fishing Grounds: Because of the high concentration of nutrients, upwelling zones are often areas with abundant fish and other marine life, making them important for the fishing industry.
3. Carbon Cycling: Phytoplankton in upwelling zones absorb carbon dioxide during photosynthesis, contributing to carbon sequestration in the ocean.

The National Centers for Coastal Ocean Science's website has images of freshwater plankton.



Freshwater Plankton Images link

<https://coastalscience.noaa.gov/monitoring-and-assessments/pmn/image-gallery/freshwater-plankton-gallery/>



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Background Information

## Carbon Cycle:

The carbon cycle is the natural process through which carbon moves between the atmosphere, land, water, and living things. This continuous cycle ensures carbon is reused and redistributed throughout Earth's systems, maintaining balance in the environment. Here are the main steps:

### 1. Carbon in the Atmosphere

- Carbon exists in the atmosphere as carbon dioxide (CO<sub>2</sub>).

### 2. Photosynthesis

- Plants and phytoplankton absorb CO<sub>2</sub> from the air or water.
- They use sunlight to convert CO<sub>2</sub> and water into food (sugars) and release oxygen.

### 3. Carbon in Living Organisms

- Animals eat plants or other animals, transferring carbon into their bodies.
- Carbon becomes part of their tissues (muscles, bones, etc.).

### 4. Respiration

- Plants, animals, and even microorganisms release CO<sub>2</sub> back into the atmosphere through respiration when they breathe or break down food for energy.



A copepod (shown here) is a type of zooplankton, a planktonic crustacean distantly related to shrimp and crabs. Copepods are one of the most common and easily recognized types of zooplankton, found in almost every ocean, sea, and freshwater habitat, even in underground caverns. Image credit: NASA

### 5. Decomposition

- When plants and animals die, decomposers like bacteria and fungi break down their bodies.
- Some of the carbon is released as CO<sub>2</sub> into the atmosphere, while some is stored in the soil.

### 6. Carbon in the Oceans

- CO<sub>2</sub> dissolves in ocean water and is used by marine organisms, including phytoplankton, to grow.
- When these organisms die, some carbon sinks to the ocean floor and is stored in sediments.

### 7. Carbon Storage in Fossil Fuels

- Over millions of years, carbon from dead plants and animals placed under high heat and pressure can become fossil fuels (like coal, oil, and natural gas).

### 8. Release of Stored Carbon

- Burning fossil fuels or natural events like volcanic eruptions release stored carbon back into the atmosphere as CO<sub>2</sub>.



Krill are often pinkish and opaque and feed on phytoplankton. Photo: Sophie Webb/NOAA/Point Blue



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Engage

## Pre-assessment

Probe for students' prior knowledge using the pre-assessment.

1. [Pretest linked here.](#)
2. Essential questions

## Essential Questions

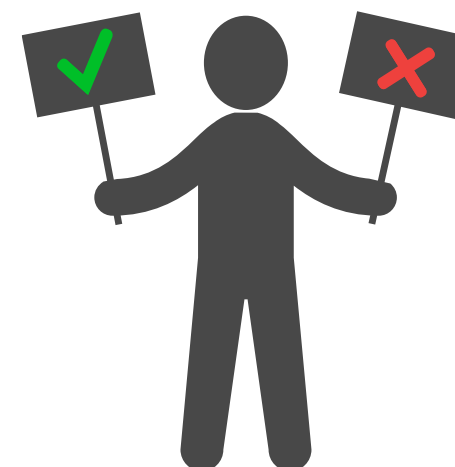
- What are phytoplankton?
- Why are they important to life in the water and on land?
- What essential roles do phytoplankton play in aquatic ecosystems?
- How do phytoplankton get energy to survive?
- What role does sunlight play in their life cycle?

## Today's Lesson

In today's lesson, you will learn about the role phytoplankton play in food webs. After watching Spotlight videos, learning the vocabulary collaboratively, and exploring where phytoplankton are found, you will explain the role they play in aquatic ecosystems.

## True or False?

**Phytoplankton are only found in oceans.**





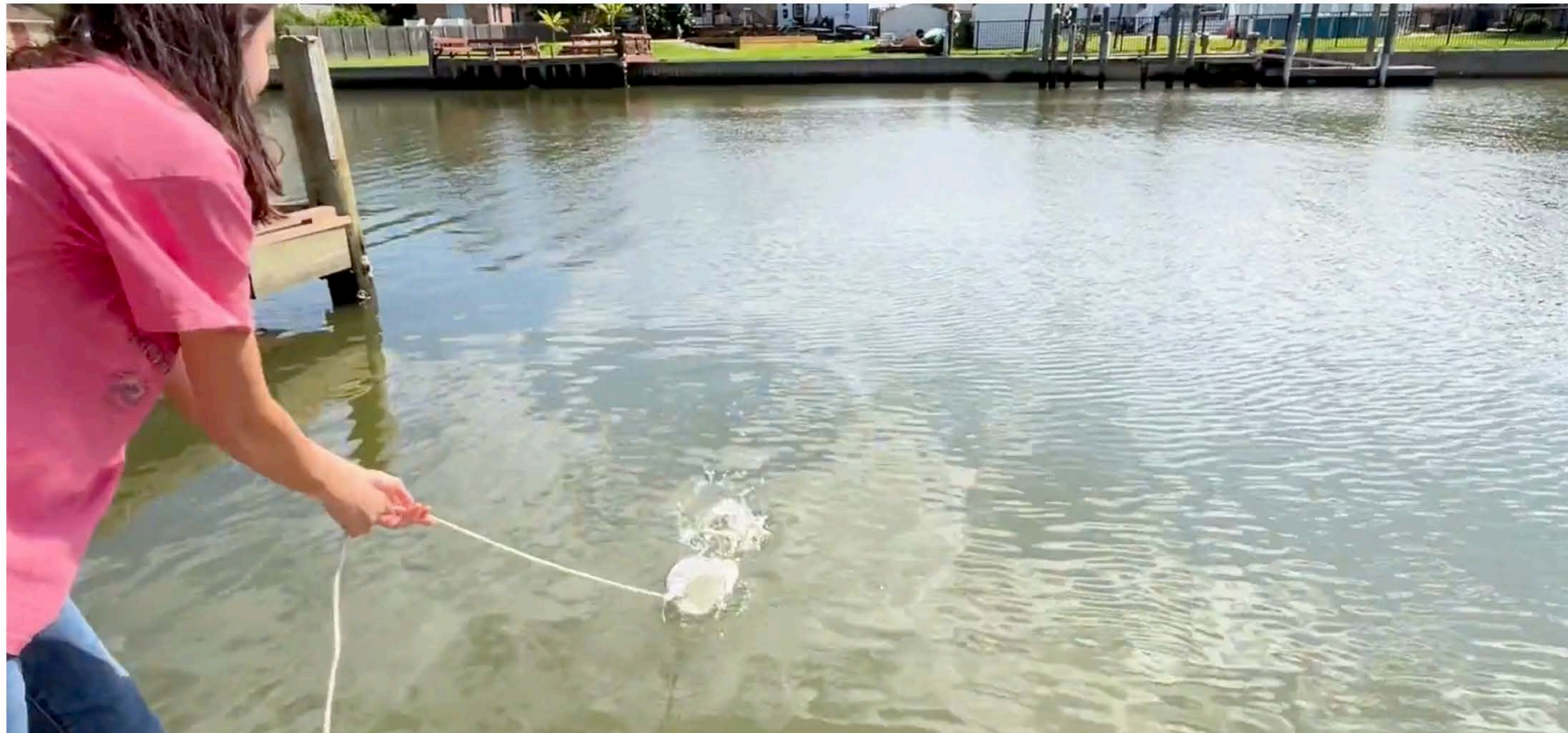
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Engage

## NASA Spotlight Video

Next, watch this clip about phytoplankton. As you watch the video, identify a misconception about where phytoplankton can be found.

## Spotlite: Where can you find phytoplankton?



## Class Discussion

- What are phytoplankton, and why are they important to life in the water and on land?
- How do phytoplankton get energy to survive, and what role does sunlight play in their life cycle?
- What would happen to aquatic life if phytoplankton disappeared?
- How do scientists study phytoplankton, and what can we learn from their work?

Link to NASA Spotlight Video: Where Can Your Find Phytoplankton? <https://science.nasa.gov/eclips/videos/where-can-you-find-phytoplankton/>



# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?

Explore

## Activities

Next, you will complete some activities to explore the importance of phytoplankton.

**Activity 1 - Aquatic Food Web Energy Model - Create a food web using examples of producers, consumers, and decomposers.**

1. Gather materials :

- string or yarn
- hangers or sticks
- index cards or paper
- markers or crayons
- tape
- hole punch and scissors



2. Start with the source of all our energy - the Sun. Sketch out the flow of energy from the Sun to the organisms in the ocean food web.

Include and label:

- producers
- consumers
- decomposers

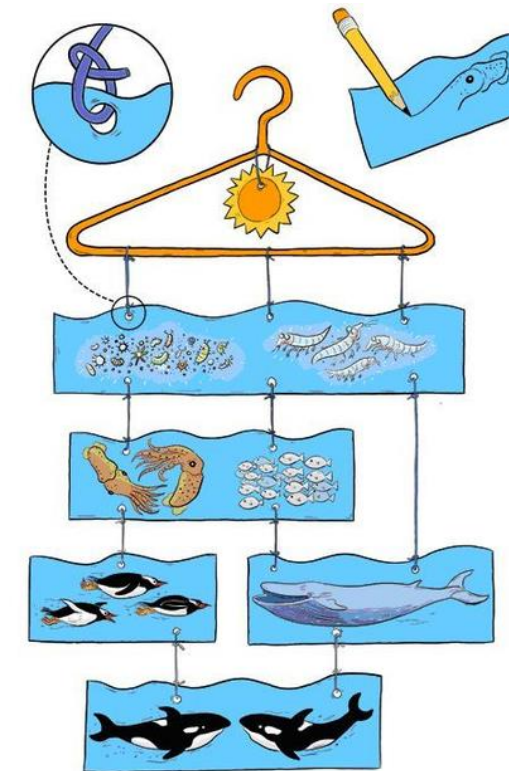
Use arrows to show the flow of energy.


\*\*Remember that the arrows always point to the organism doing the eating.



3. Use the materials to construct at least 3 different food chains from your web.

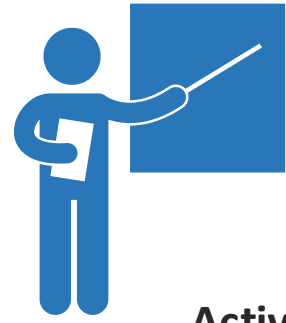
4. Describe the flow of energy in your model.





**Safety:**

- Use caution when using scissors and the hole punch.
- Use all materials appropriately.



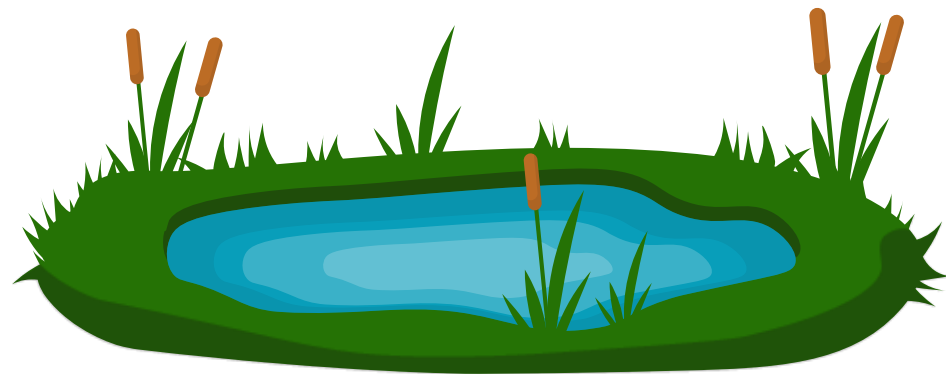
# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?

Explore

## Activity 2- Plankton Observation Jar - Making a Temporary Habitat for Plankton

### 1. Gather materials :

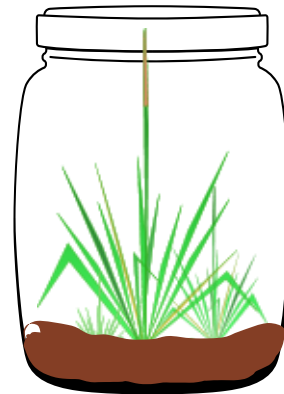
- large clear jar with lid that is clean and dry
- sediment from the bottom of pond, lake, or other natural body of water sample
- sample of plants from the same body of water from the same location



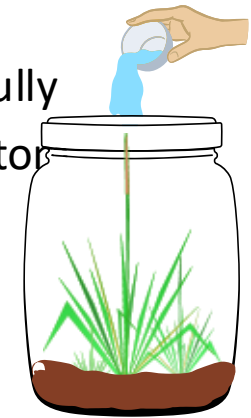
### 2. Carefully put some sediment in the bottom of the jar.



### 3. Add a few plants on top of the sediment.



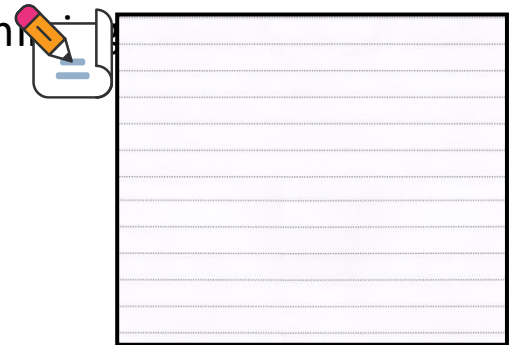
### 4. Pour in the water slowly and carefully so that the sediment stays at the bottom of the jar.



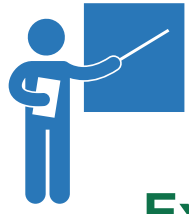
### 5. Wait 10 to 15 minutes so things in the jar can settle.



### 6. Look at the habitat with a magnifying glass. Make and record your observations.



*Return the contents of the container to where it was collected when you complete your observations .*



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

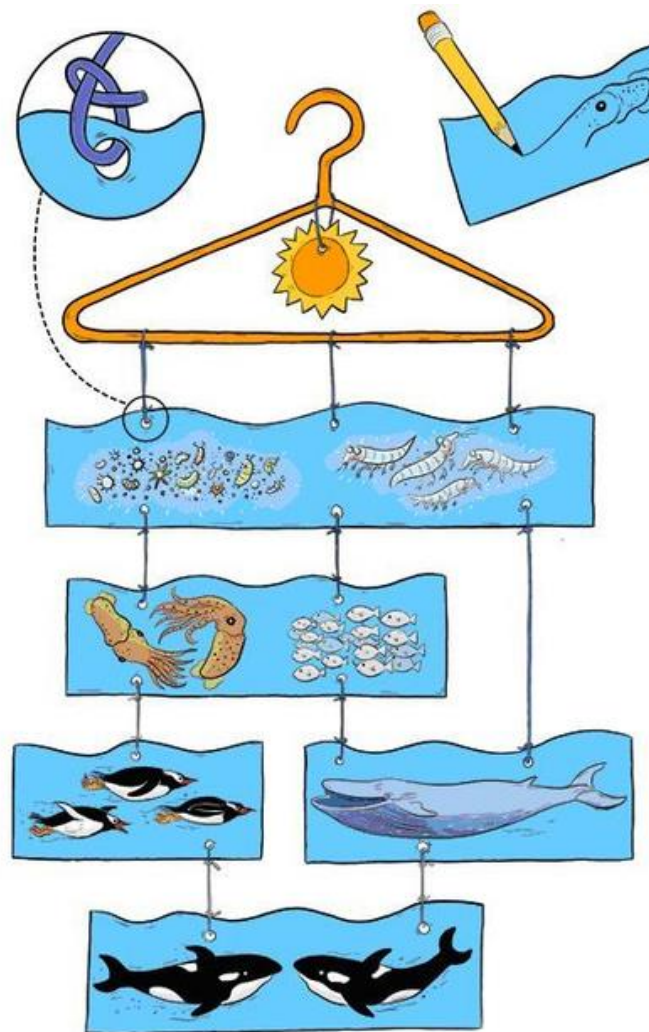
## Explore Activities

During the “explain” of a 5E lesson, the teacher clarifies key ideas, introduces formal terminology, and helps students connect their experiences to scientific principles. Here are some some guiding questions to help learners understand the concepts in this activity.

**Activity 1 - Aquatic Food Web Energy Model** - Create a food web using examples of producers, consumers, and decomposers.

Discussion Questions:

- What role does each organism in your model play in the food web?
- Why are producers placed at the beginning of the food web?
- What happens to energy as it moves from one level (organism) to the next?
- Why are decomposers important in this system?



Help students understand the roles of producers, consumers, and decomposers in ocean ecosystems, and how energy flows through each level of the food web.

“Your arrows show energy flow. Remember, energy moves in one direction—from the Sun to producers, then through consumers.”

Energy Flow in the Aquatic Food Web:

- The Sun is the source of energy driving food chains and food webs.
- Producers (like phytoplankton and seaweed) use sunlight to make their own food through photosynthesis.
- Primary consumers (like zooplankton and small fish) can't photosynthesize and eat producers to get their energy needs met.
- Secondary and tertiary consumers (larger fish, squid, seals, sharks) eat other animals.
- Decomposers (like bacteria and some fungi) break down dead organisms and recycle nutrients back into the ecosystem.
- “Phytoplankton are producers—they make their own food using sunlight. That's why they're at the beginning of the food web.”
- “Zooplankton eat phytoplankton, so they are consumers. What kind of consumer are they —herbivores, carnivores, or omnivores?”
- “Decomposers break down what's left over after animals die. Without them, nutrients wouldn't return to the environment.”



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

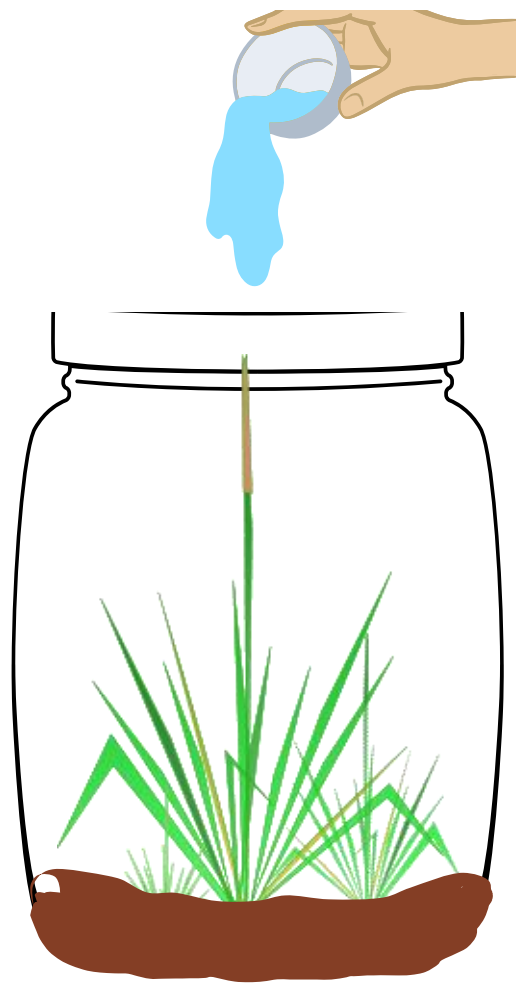
## Explore Activities

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### Activity 2 - Plankton Observation Jar- Making a Temporary Habitat for Plankton

#### Discussion Questions:

- What did you notice about where the floating particles moved?
- What do you think those tiny things need to stay alive in the jar?
- Why do you think the water had to be added slowly?



Help students understand where plankton live in the water and why they live in those locations.

"Now that we've built our Plankton Observation Jars and had time to make observations, let's think about what we're actually seeing and what this activity helps us understand."

"Plankton are tiny living things that float in water. There are two main kinds: phytoplankton, which are like underwater plants that make their own food, and zooplankton, tiny animal-like organisms that eat other plankton."

(Holding up a jar)

"When we added sediment, plants, and water, we created a mini habitat that's similar to a pond or shallow ocean environment. The sediment is like the pond or ocean floor. The phytoplankton provide oxygen and food. Plants also provide oxygen and food, while also giving shelter. Plankton live in the water."

"You might have seen little things floating or tiny specks moving. Some of those are probably plankton. Plankton need sunlight, water, and nutrients to survive—just like larger living things!"

#### Clarifying Scientific Concepts:

"One of the things we're learning is that plankton live at different layers of the water. Phytoplankton float near the surface because they need sunlight to make food. Zooplankton may move around, but will mostly be found where there are phytoplankton, their primary food source."

#### Making Connections:

"Scientists study plankton to learn about aquatic health and climate. NASA uses satellites to measure where plankton live and how many there are—because that helps them understand changes happening in the ocean."



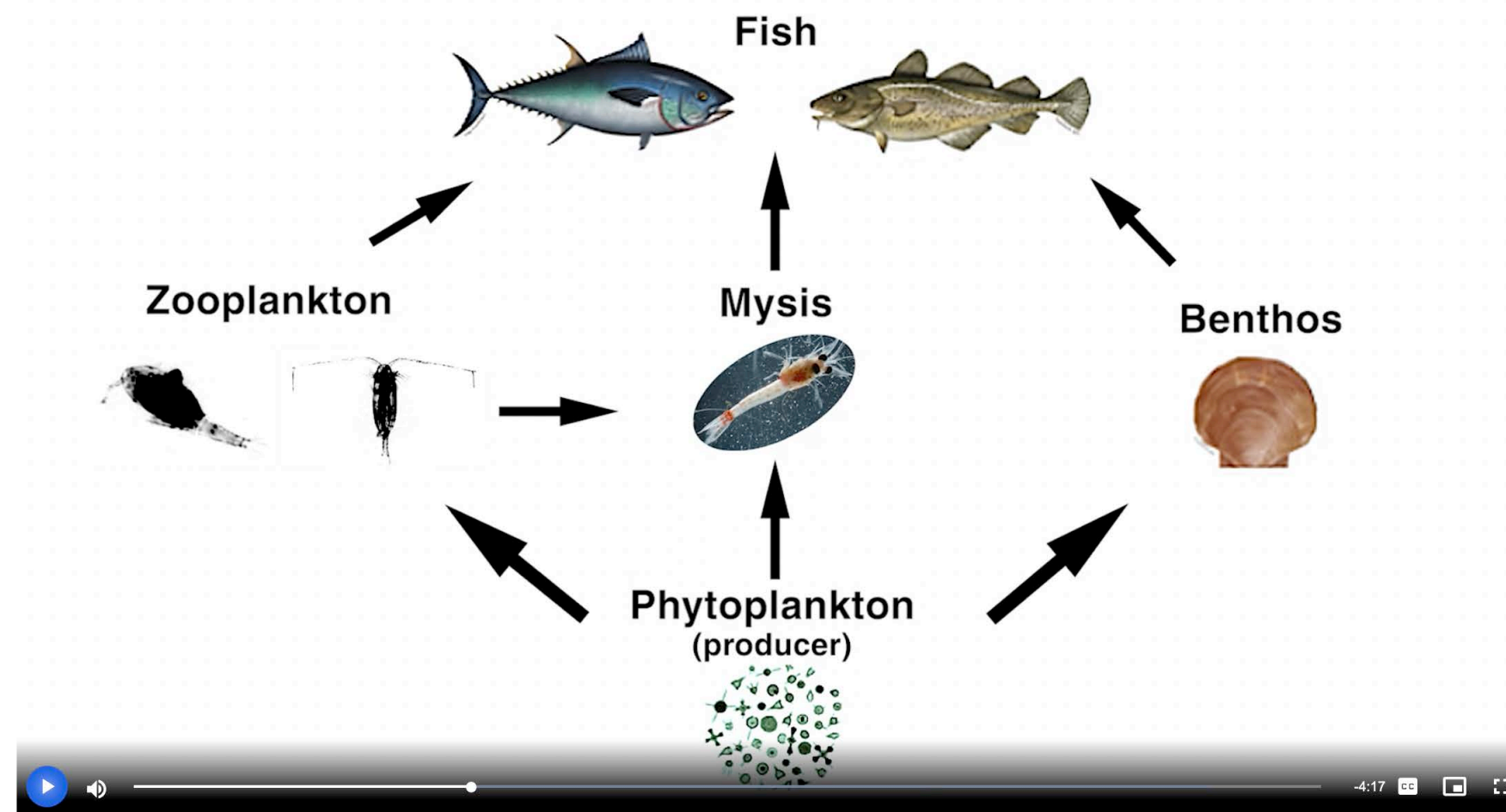
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

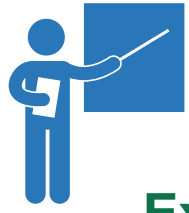
## NASA Connection

Watch the NASA eClips video **Our World: Phytoplankton - Powering the Ocean Food Web** to learn more about phytoplankton and how NASA's PACE mission studies these tiny organisms. Why do you think scientists call phytoplankton "heroes"? Write or talk about how phytoplankton help both animals in the water and people on land.

## Our World: Phytoplankton – Powering the Ocean Food Web



Our World: Phytoplankton - Powering the Ocean Food Web  
<https://science.nasa.gov/eclips/videos/phytoplankton-powering-the-ocean-food-web/>



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Explain Resources

During the “explain” of a 5E lesson, the teacher clarifies key ideas, introduces formal terminology, and helps students connect their experiences to scientific principles. Here are resources for helping learners understand the concepts in each activity.

Watch this video to learn more about plankton and their importance.

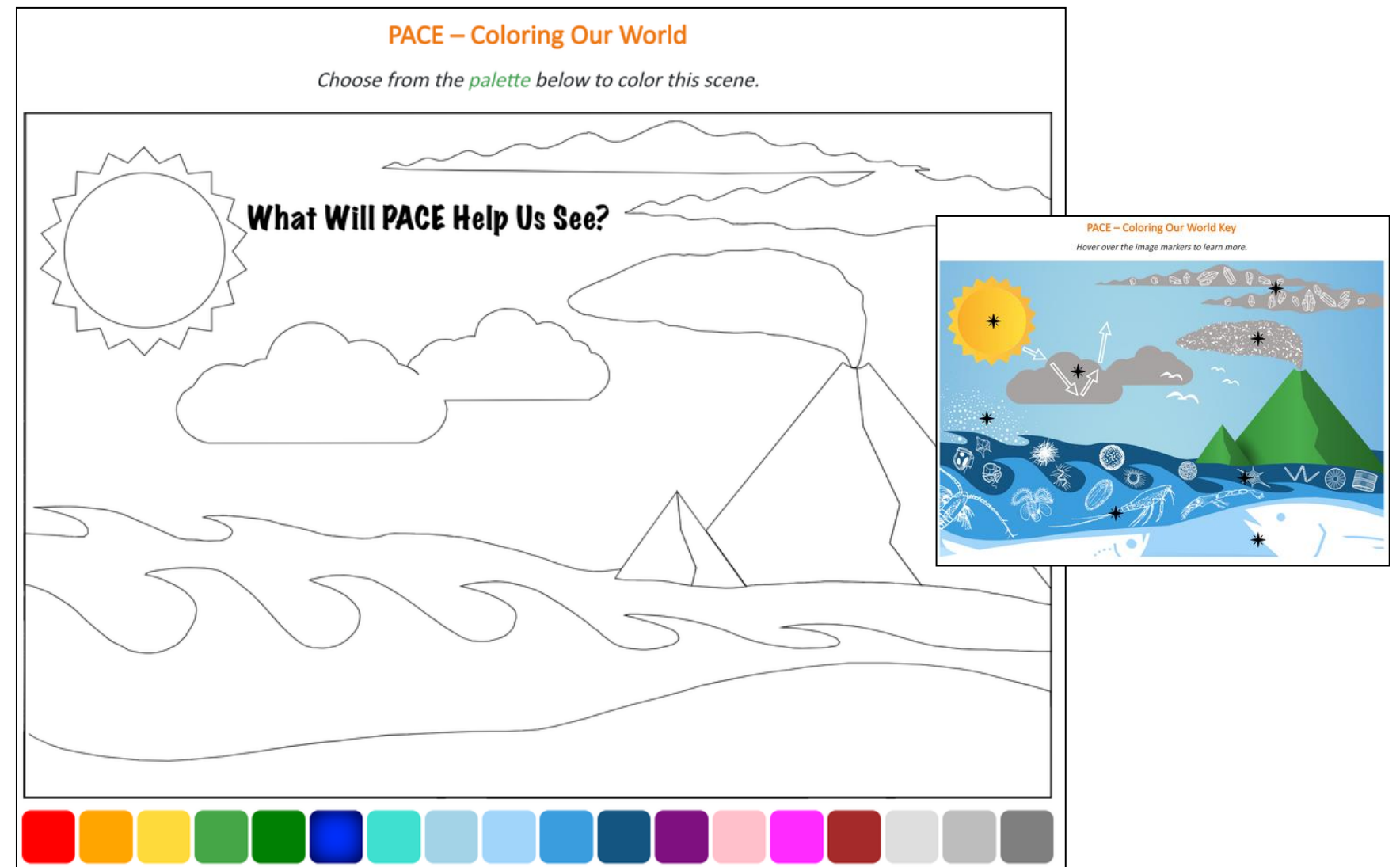


From Drifter to Dynamo: The Story of Plankton | Deep Look

[From Drifter to Dynamo: The Story of Plankton | Deep Look](https://youtu.be/jUvJ5ANH86I?feature=shared)

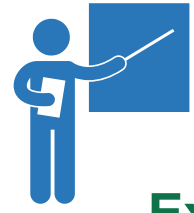
Link - <https://youtu.be/jUvJ5ANH86I?feature=shared>

PACE is a mission NASA uses to study phytoplankton. Color the picture to reveal what PACE tools can help us see.



[What Will PACE Help Us See?](https://pace.oceansciences.org/learn_more.htm?id=46)

Link - [https://pace.oceansciences.org/learn\\_more.htm?id=46](https://pace.oceansciences.org/learn_more.htm?id=46)



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Explain Resources

During the “explain” of a 5E lesson, the teacher clarifies key ideas, introduces formal terminology, and helps students connect their experiences to scientific principles. Here is a short article with guiding questions to help learners understand more about phytoplankton.

Share this article about phytoplankton. Use the questions to guide discussions.

**EPISODE ONE RESOURCE PACK** ACTUALLY IT'S PHYTO-PLANKTON!

If you like to breathe air and eat food, you should thank phytoplankton. Here's why:

**FOOD**  
TINY PHYTOPLANKTON FEED EVERYONE

**AIR**  
PHYTOPLANKTON ARE CARBON CONVERTERS

Microscopic phytoplankton are at the bottom of the marine food web and are eaten by everything that is bigger than they are. Energy that starts with phytoplankton provides fuel for life on our planet; including humans.

Just like rainforests, they are carbon converters. They change carbon dioxide to oxygen. Half of the oxygen in the air we breathe is made by phytoplankton.

**BLOOM**  
PHYTOPLANKTON BLOOMS VISIBLE FROM SPACE

If you can only see phytoplankton using a microscope, why can we see them from space?

Phytoplankton bloom in large amounts. From space we can see huge swirling marble patterns of green and red. You could see them with your own eyes from the International Space Station, but scientists use satellites to monitor them every day of the year. Scientists can be very precise with current satellites to know how much Phytoplankton is in the ocean. This is called biomass. However, we are not very good at knowing which *types* are there. NASA's PACE Mission will launch a new satellite that will be able to sense not just how much phytoplankton, but what types too.

The Chatham Rise - New Zealand  
AQUA/MODIS March 1 2020

Image Credit: Norman Kuring (NASA GSFC)

**WATER ALONE IS BLUE**

The ocean is blue right? Well... ?

Yes, water on its own looks blue. Sunlight is a spectrum of rainbow colours. When light hits the ocean surface, red light is absorbed (so we don't see it) and blue light is reflected. We see the blue light because the ocean bounces it back to our eyes like a mirror.

Phytoplankton are better at reflecting more colours than just blue. When there are large amounts of phytoplankton in the ocean, they literally change the colour of the water.

**REFLECT BLUE**

**ABSORB RED**

**WATER WITH LIFE IS COLOURFUL**

Image Credit: Norman Kuring (NASA GSFC)

**ACTUALLY IT'S PHYTO-PLANKTON! RESOURCE PACK**

PROUDLY SUPPORTED BY: ADVANCE QUEENSLAND Queensland Government

1. What organisms are at the beginning of most ocean food webs?
2. Phytoplankton, like rainforests, are \_\_\_\_\_ converters.
3. What are some ways to describe the large amounts of phytoplankton in the ocean?
4. What impact can a large amount of phytoplankton have on the color of ocean water?
5. How might changes in ocean color clue scientists that something is affecting the health of the ocean?

Sentence Starters:

- Changes in ocean color can show that...
- Scientists use these changes to...
- This might mean the ocean is...

Link -[https://pace.oceansciences.org/docs/Episode\\_1\\_Resource\\_Pack\\_AIP.pdf](https://pace.oceansciences.org/docs/Episode_1_Resource_Pack_AIP.pdf)



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Explain Resources

During the “explain” of a 5E lesson, the teacher clarifies key ideas, introduces formal terminology, and helps students connect their experiences to scientific principles. The Ocean Color Wheel is an interactive tool that learners can create, containing suggested language to help them understand the concepts in each activity.

(source - [https://pace.oceansciences.org/learn\\_more.htm?id=1](https://pace.oceansciences.org/learn_more.htm?id=1))

**Ocean Color Wheel**

*Materials needed: Card stock or thick paper, round head fastener (1" or smaller), paste or glue.*

**Assembly Instructions:**

- 1) Print all pages single-sided on card stock or thick paper.
- 2) Cut out the three wheels (top, center, back) using the pink solid lines as a guide.
- 3) Cut out the windows on "top" wheel using the dashed lines as your guide.
- 4) Carefully punch a small hole through the center of the top and center wheels.
- 5) Attach page the center wheel behind the top wheel with the fastener so that the round head is on the front.
- 6) Glue the back of the wheel to the blank side of the center wheel.

Page 1: Top wheel, with cut out windows.

**Page 2: Center wheel.** Attach to the top wheel (page 1) in the center using the round head fastener. The information on the center should align with the windows on the front wheel as it is turned.

Page 2: Center wheel, showing various phytoplankton species and their characteristics:

- Emiliania huxleyi:** "Hubbers" help reduce carbon dioxide. Can be toxic and glow.
- Trichodesmium:** key source of nitrogen for food web.
- Synechococcus:** Thrives where other phytoplankton fail.
- Prochlorococcus:** Thrives in the open ocean.
- Rhizosolenia:** Moves nitrogen from depth to surface.
- Phaeocystis:** Helps form clouds and beach foam.
- Alexandrium:** Can make shellfish poisonous.
- Chaetoceros debilis:** Very common and potentially harmful. Dense blooms can turn water red.
- Myrionecta rubra:** Dense blooms can turn water red.
- Microcystis:** Freshwater species that is harmful.
- Dinophytes:** Some species eat din.

Page 2: Center wheel, showing various phytoplankton species and their characteristics.

**Page 3: Bottom wheel.** should be glued to the back of the center wheel (page 2).

**Plankton, Aerosol, Cloud, ocean Ecosystem (PACE)**

*If the ocean were empty of life, it would be blue.* Sunlight is made up of a rainbow of colors. When it enters the ocean, water strongly absorbs red and scatters blue. The result? A big, empty blue sea.

Thankfully, our ocean is full of life and color. Its largest inhabitants depend on its tiniest ones: microscopic algae known as “phytoplankton.” Why? Phytoplankton are the building blocks of the marine food web. This means they feed larger organisms who then are eaten by even larger ones... all the way up to whales! If this weren't enough, there's another reason to be grateful for phytoplankton. Like plants on land, they convert carbon dioxide into oxygen. In fact, they produce about half the oxygen on Earth.

Phytoplankton come in a variety of shapes, sizes, and colors. They also play diverse roles in our ocean. Some species bloom quickly, some produce toxins, some move carbon to the deep ocean, and some even help to produce clouds!

Like water, phytoplankton absorb and scatter sunlight. So, the ocean's color depends on the type of phytoplankton suspended in seawater. PACE will carry NASA's most advanced color sensor ever, designed to help identify phytoplankton communities from space! It will improve our ability to understand Earth's changing marine ecosystems, manage fisheries and detect harmful algal blooms.

Want to learn more? Answer four questions to discover which of these diverse organisms is most like you!

[pace.gsfc.nasa.gov](https://pace.gsfc.nasa.gov)

Page 3: Bottom wheel, showing text about PACE and phytoplankton.

[https://pace.oceansciences.org/docs/pace\\_ocean\\_color\\_wheel.pdf](https://pace.oceansciences.org/docs/pace_ocean_color_wheel.pdf)



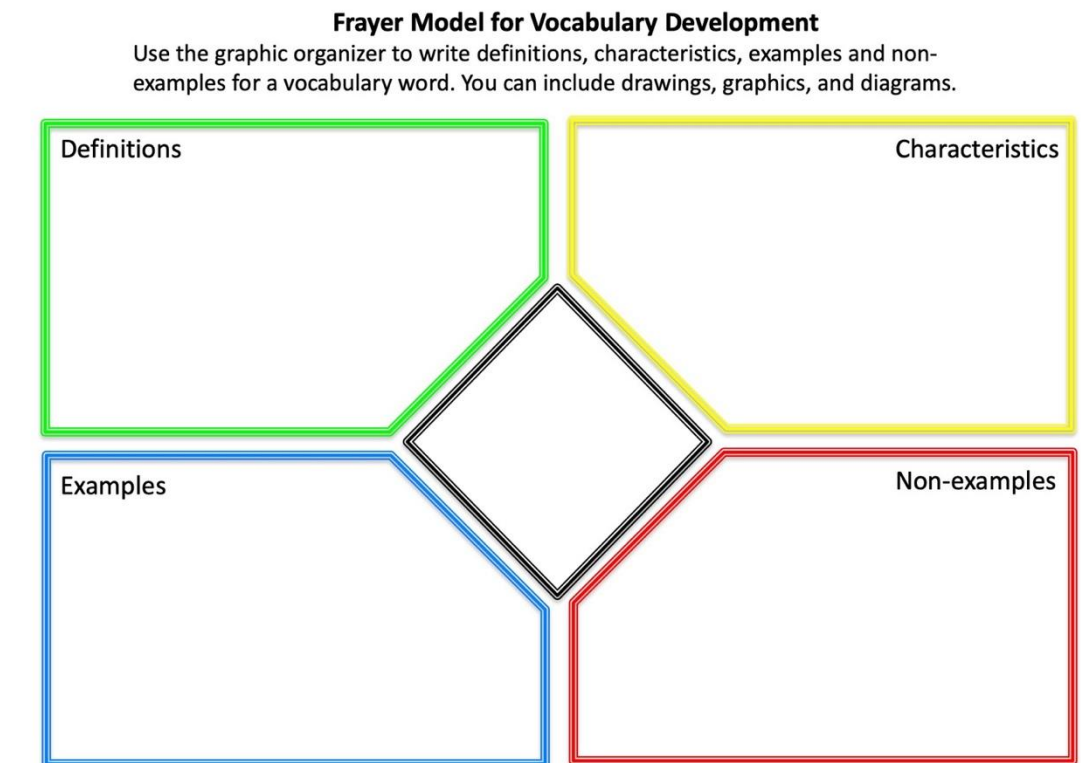
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Vocabulary Development

It's almost impossible to learn science concepts without also learning vocabulary words. Vocabulary words are important because they help people discuss science concepts. However, knowing vocabulary words is not the same as understanding science concepts. This section is designed to help your students do more than memorize definitions as they connect the vocabulary to the science concepts that they have explored.

1. Place the term "**photosynthesis**" in the center of the graphic organizer. ([Link to a fillable Frayer Model](#)) Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. Ask students to brainstorm **characteristics** of "**photosynthesis**" and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their textbook and notes.
4. Next, ask students to add **examples** and **non-examples** in the Frayer Model. Emphasize the higher-level thinking skill of comparing and contrasting. How are the examples alike/different than the non-examples?
5. Using the information provided, ask students to develop their own **definition** of the term "**photosynthesis**" that is clear and concise.
6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively. The group will complete the Frayer Model graphic organizer using their assigned word.
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word. Refer to definitions in the Explain section. ([Link to Definitions](#))
8. Compile and post final definitions so all students have access for later reference.





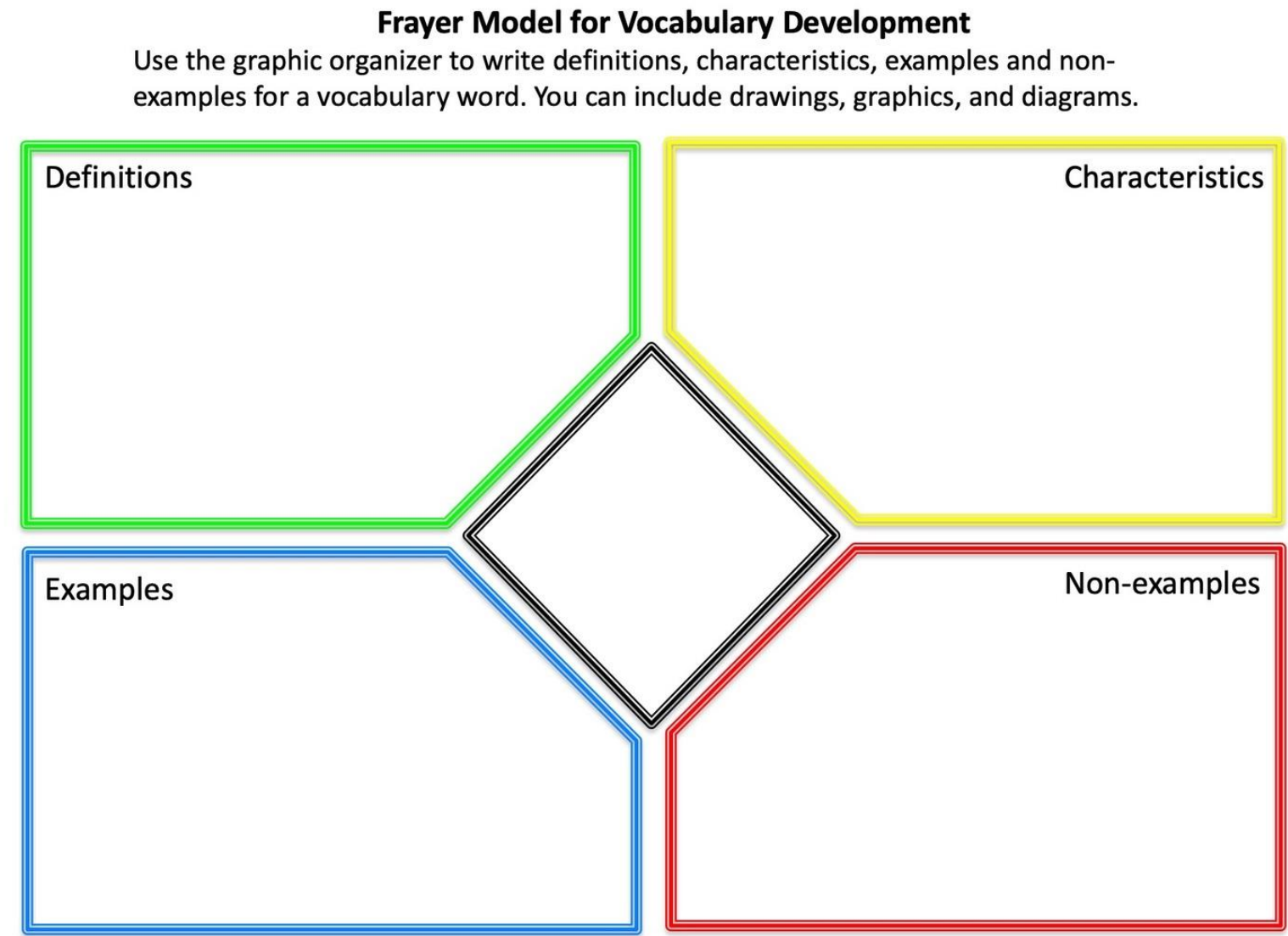
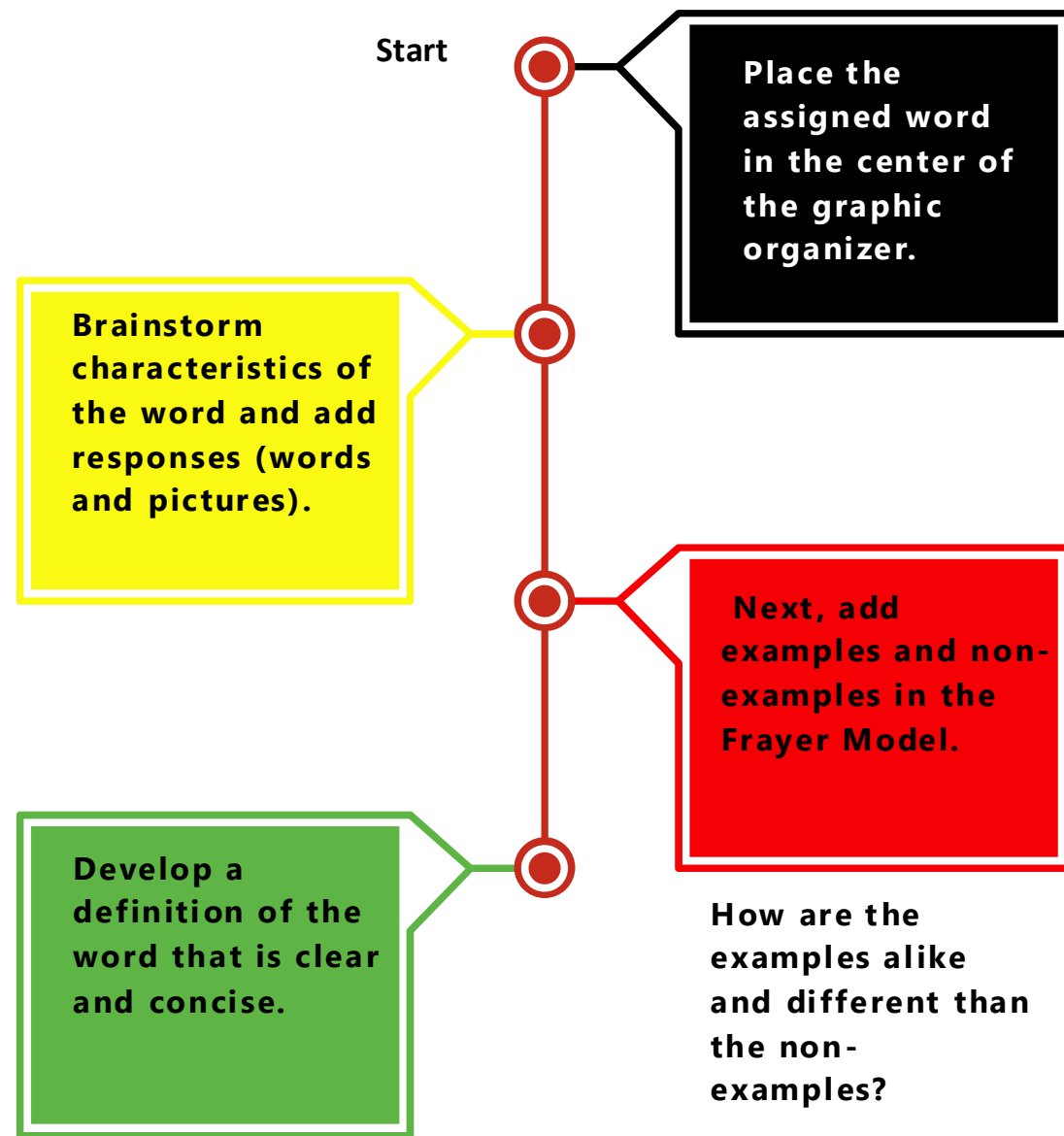
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

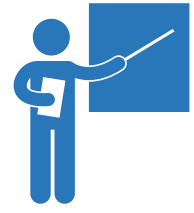
Explain

## Vocabulary Development

It's almost impossible to learn science concepts without also learning vocabulary words. Vocabulary words help people discuss science concepts.

Complete a Frayer Model with your group using your assigned word and fill in the graphic organizer. We will share some as a class.





# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Evaluate

## Post-Assessment

Check students' understanding with these activities.

1. Identify misconception
2. Discussion questions
3. Vocabulary Review
4. [Posttest items linked here](#)

## Identify Misconception

What is a common misconception people have about phytoplankton? How can you correct this misconception?

## Discussion Question(s)

1. What makes phytoplankton so important?
2. What would happen if phytoplankton died off?

## NASA Spotlight Videos

Carefully re-watch the NASA Spotlight video about phytoplankton.

### Spotlite: Where can you find phytoplankton?



NASA Spotlight: Where is Phytoplankton?

Link <https://science.nasa.gov/eclips/videos/where-can-you-find-phytoplankton/>

## Vocabulary Review

Use your new vocabulary words and knowledge about phytoplankton to answer the prompt below.

Imagine you've just been shrunk down to the size of a phytoplankton and dropped into the Plankton Observation Jar you made!

- What do you see around you in your new tiny habitat?
- What challenges do you face as phytoplankton?
- How do you get what you need to survive?
- What other living things do you meet in your habitat? Are they helpful or harmful?
- If a NASA satellite flew over your jar from space, what might it notice about your environment?

## Pretest & Posttest

1. The picture shows some examples of phytoplankton. What are phytoplankton?

- A. Tiny rocks in the water
- B. Mostly microscopic ocean plants that make oxygen \*\*\***
- C. Small fish that eat plants
- D. Sediments at the bottom of an aquatic environment



2. Where do phytoplankton live?

- A. On land
- B. At the bottom of a body of water
- C. Floating near the surface of a body of water \*\*\***
- D. Only in oceans

3. What do all phytoplankton need to live and grow?

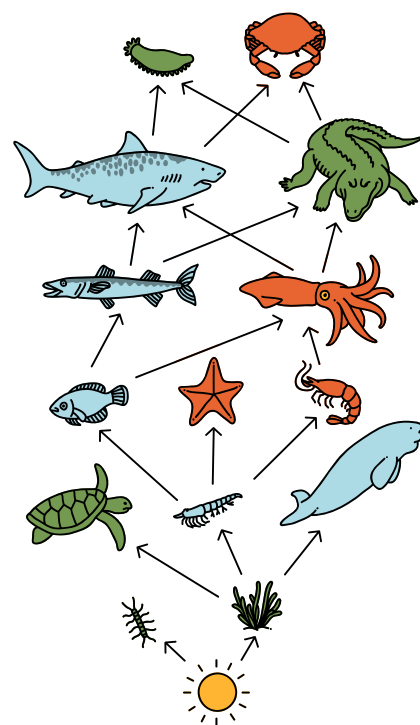
- A. Moonlight and nutrients
- B. Darkness and carbon dioxide
- C. Sunlight, water, and nutrients \*\*\***
- D. Sunlight and salt

4. How do phytoplankton make their food?

- A. By photosynthesis, using sunlight \*\*\***
- B. By taking in saltwater
- C. By eating other organisms
- D. By releasing wastes

5. What gas do phytoplankton produce that we breathe?

- A. Carbon dioxide
- B. Nitrogen
- C. Helium
- D. Oxygen \*\*\***



6. Why are phytoplankton important?

- A. They make the ocean blue
- B. They help boats float
- C. They give oxygen and food to aquatic animals \*\*\***
- D. They are important decomposers in the food web

7. What animals eat phytoplankton?

- A. Algae
- B. Zooplankton \*\*\***
- C. Only penguins
- D. Most land animals

8. Why are phytoplankton found near the surface of the water?

- A. They need air
- B. They need to stay warm
- C. To get sunlight \*\*\***
- D. Because zooplankton are only found at the surface

9. What does NASA use to study phytoplankton?

- A. Telescopes
- B. Submarines
- C. Satellites \*\*\***
- D. Rockets

10. Study the food web. What might happen if there were no phytoplankton?

- A. Nothing would change
- B. The ocean would be red
- C. There would not be enough food and oxygen to support aquatic animals\*\*\***
- D. There would be less carbon dioxide in the water



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Extend

## Engineering Challenge

### Wonderful Wanderers

Adapted from Deep C Consortium' The Great Plankton Race- <https://education.gulfresearchinitiative.org/wp-content/uploads/2015/09/LP-The-Great-Plankton-Race.pdf>

The word plankton comes from the Greek word “planktos,” which means “wandering.” Plankton drift in the water at the mercy of the currents. Their lack of mobility separates plankton from the nekton, which are organisms (such as fish) that can propel themselves through the water.

Organisms that spend their whole lives drifting are called holoplankton; those spending only part of their lives as plankton are called meroplankton. Most meroplankton are the larvae of animals that spend their adult lives either on the bottom or free swimming.

To avoid sinking, plankton must maintain neutral buoyancy. An object that has neutral buoyancy will neither sink nor rise. Although plankton can't control their movements against the current, they are able to control their buoyancy by increasing their surface area-to-volume ratio as well as by producing and releasing lipids (fats).

#### Materials for testing station:

- clear aquariums, storage containers, or buckets (5-10 gallons) filled with water
- stopwatch or watch with a second hand

#### Materials for construction (below are suggestions):

- toothpicks
- feathers
- sponges
- beads
- straws
- metal washers
- milk caps

# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?

## Learner Pages





# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Engage

## Today's Lesson

In today's lesson, you will learn about the role phytoplankton play in food webs. After watching the Spotlight video, learning the vocabulary collaboratively, and exploring where phytoplankton are found, you will be able to explain the role they play in aquatic ecosystems.

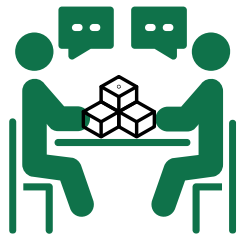
## True or False?

**Phytoplankton are only found in oceans.**



## Essential Questions

- What are phytoplankton?
- Why are they important to life in the water and on land?
- What essential roles do phytoplankton play in aquatic ecosystems?
- How do phytoplankton get energy to survive?
- What role does sunlight play in their life cycle?



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Engage

## NASA Spotlight Video

Next, watch this clip about phytoplankton. As you watch the video, identify a misconception about where phytoplankton can be found.

### Spotlite: Where can you find phytoplankton?



### Class Discussion

- What are phytoplankton, and why are they important to life in the water and on land?
- How do phytoplankton get energy to survive, and what role does sunlight play in their life cycle?
- What would happen to aquatic life if phytoplankton disappeared from the ocean?
- How do scientists study phytoplankton, and what can we learn from their work?

NASA Spotlight: Where is Phytoplankton?  
Link <https://science.nasa.gov/eclips/videos/where-can-you-find-phytoplankton/>



# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?



## Activities

Next, you will complete some activities to explore the importance of phytoplankton.

**Activity 1 - Aquatic Food Web Energy Model - Create a food web using examples of producers, consumers, and decomposers.**

### 1. Gather materials :

- string or yarn
- hangers or sticks
- index cards or paper
- markers or crayons
- tape
- hole punch and scissors



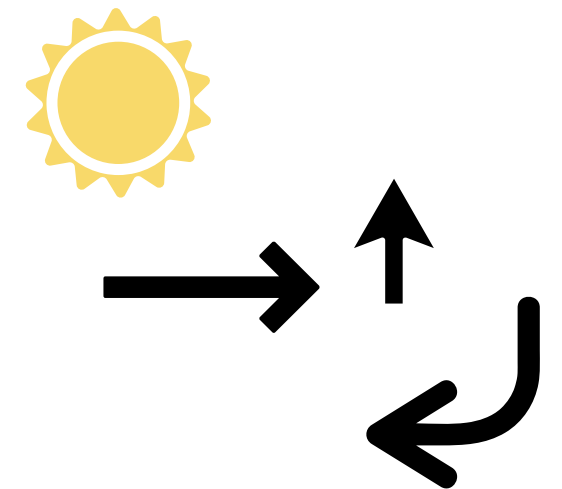
2. Start with the source of all our energy - the Sun. Sketch out the flow of energy from the Sun to the organisms in the ocean food web.

Include and label:

- producers
- consumers
- decomposers

Use arrows to show the flow of energy.

\*\*Remember that the arrows always point to the organism doing the eating.



**Safety:**

- Use caution when using scissors and the hole punch.
- Use all materials appropriately.



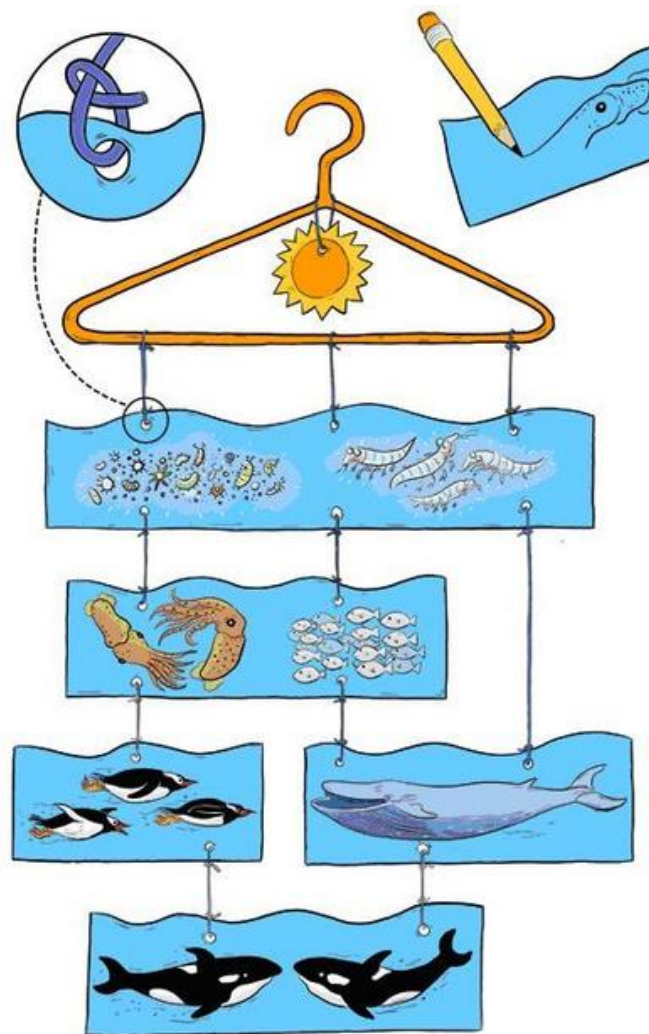
# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?

Explore

Activity 1 - Aquatic Food Web Energy Model - Create a food web model using examples of producers, consumers, and decomposers.

3. Use the materials to create at least 3 different food chains from your web.

4. Describe the flow of energy shown in your model.



A large rectangular area with horizontal dashed lines for writing, intended for describing the flow of energy in the food web model.






# NASA Spotlite Interactive Lesson: Who Needs Phytoplankton?

Explore

## Activities

Next, you will complete some activities to explore the importance of phytoplankton.

### Activity 2- Plankton Observation Jar - Making a Temporary Habitat for Plankton



**Safety:**

- **Be sure to wear eye and skin protection as needed.**
  - Wear goggles to protect your eyes.
  - Wear gloves and long sleeves to protect your skin.
- Use caution when using equipment and tools.
- Get permission and adult supervision before collecting any mud, plants, and water samples.



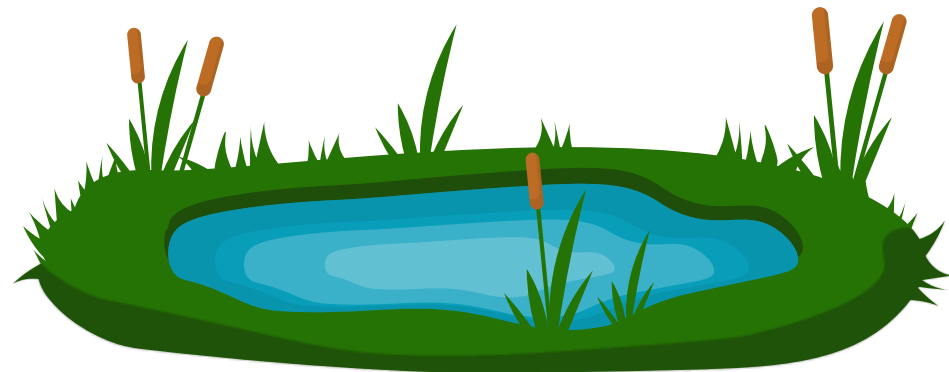
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explore

## Activity 2- Plankton Observation Jar- Making a Temporary Habitat for Plankton

### 1. Gather materials :

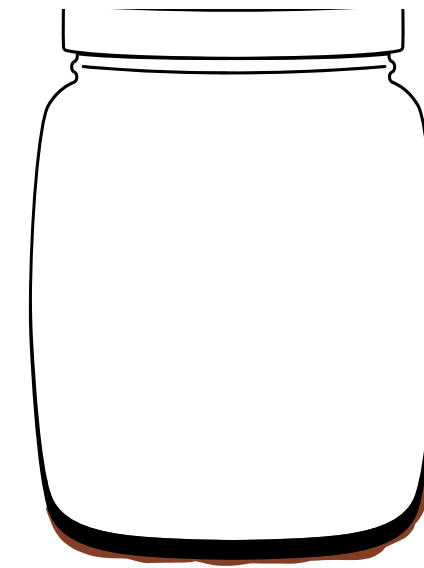
- large clear jar with lid that is clean and dry
- sediment from the bottom of pond, lake, ocean or other natural body of water
- sample of plants from the same body of water
- water from the same location
- magnifying glass



### 2. Carefully put some sediment in the bottom of the jar.



### 3. Add a few plants on top of the sediment.







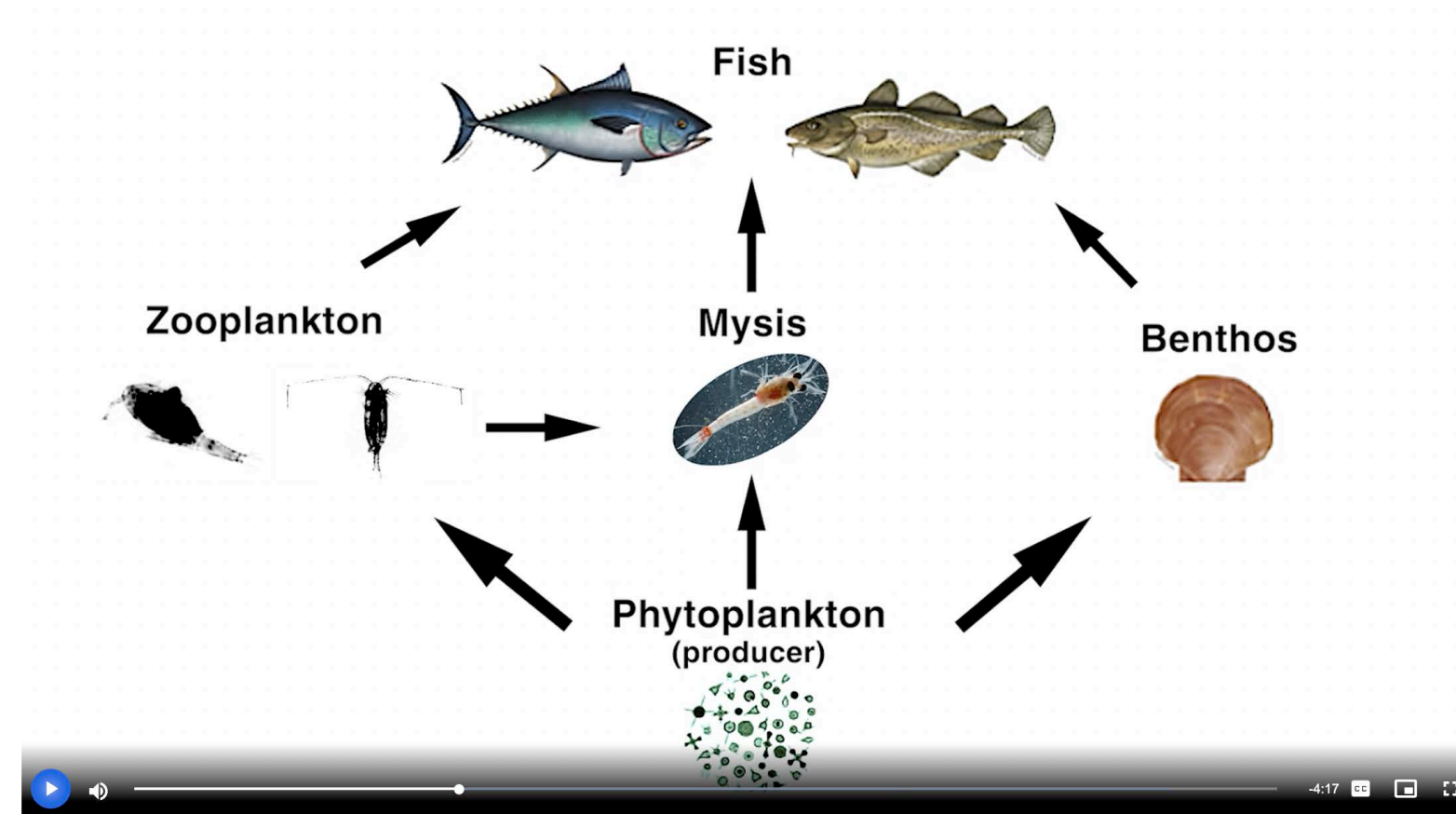
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## NASA Connection

Watch the NASA eClips video **Our World: Phytoplankton - Powering the Ocean Food Web** to learn more about phytoplankton and how NASA's PACE mission studies these tiny organisms. Why do you think scientists call phytoplankton "heroes"? Write or talk about how phytoplankton help both animals in the ocean and people on land.

## Our World: Phytoplankton – Powering the Ocean Food Web



Our World: Phytoplankton - Powering the Ocean Food Web

Link - <https://science.nasa.gov/eclips/videos/phytoplankton-powering-the-ocean-food-web/>

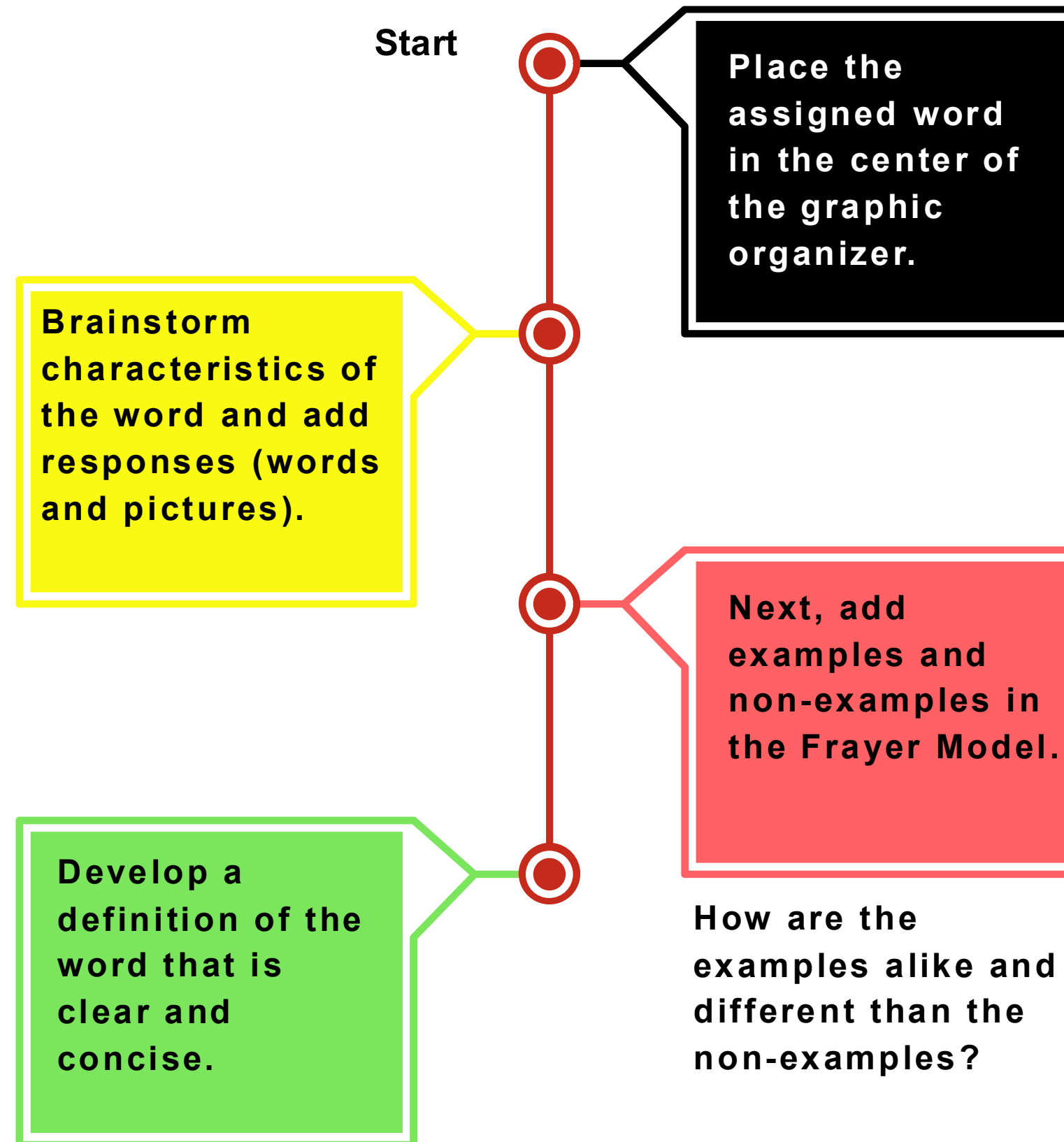


# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Vocabulary Development

It's almost impossible to learn science concepts without also learning vocabulary words. Vocabulary words help people discuss science concepts.





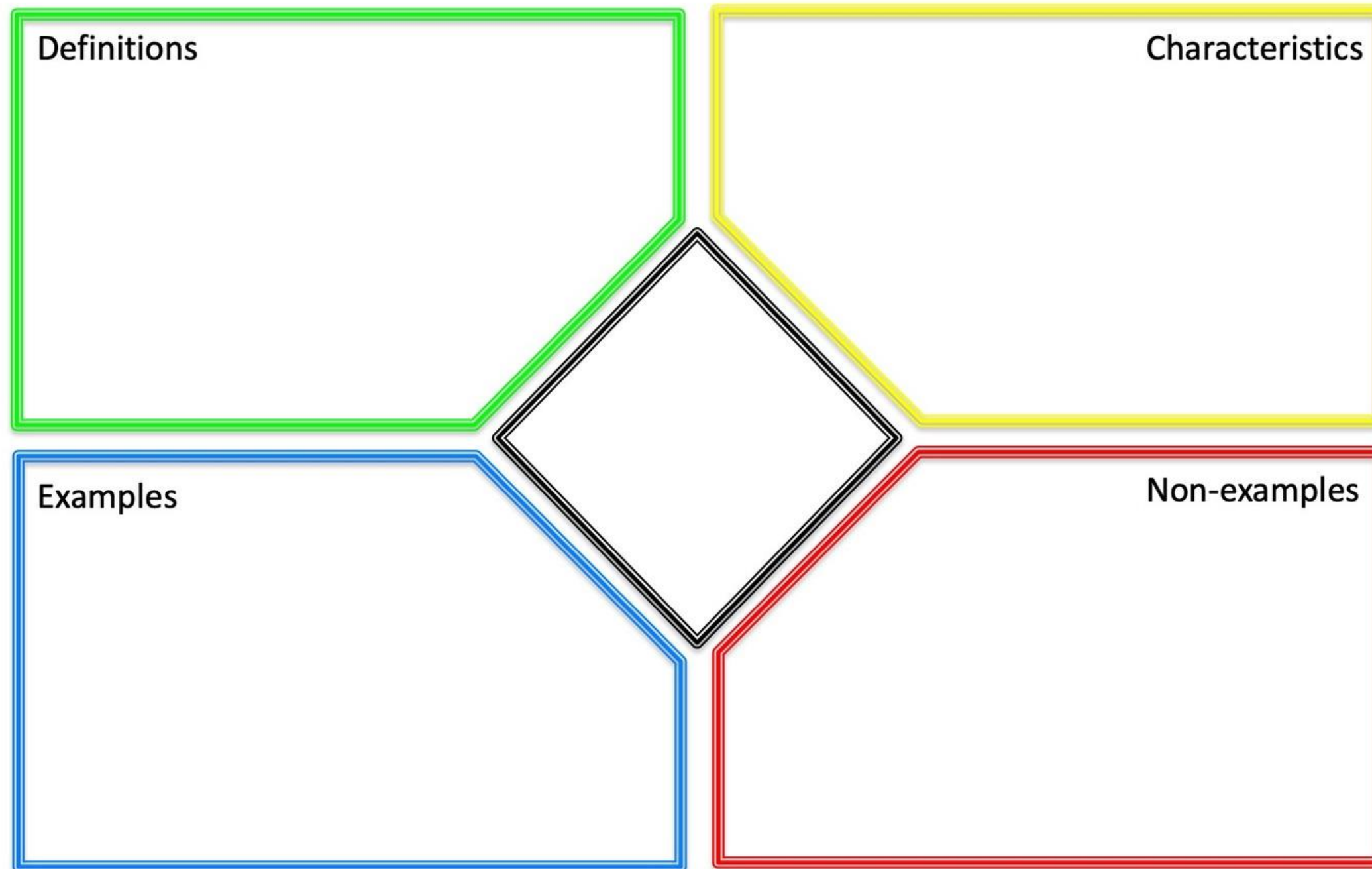
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

Complete a Frayer Model with your group using your assigned word and fill in the graphic organizer. We will share some as a class.

## Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.





# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Vocabulary Words

**aquatic:** anything related to, living in, or found in water



Image credit: Canva

**consumer:** an organism that obtains energy by feeding on other organisms or organic matter

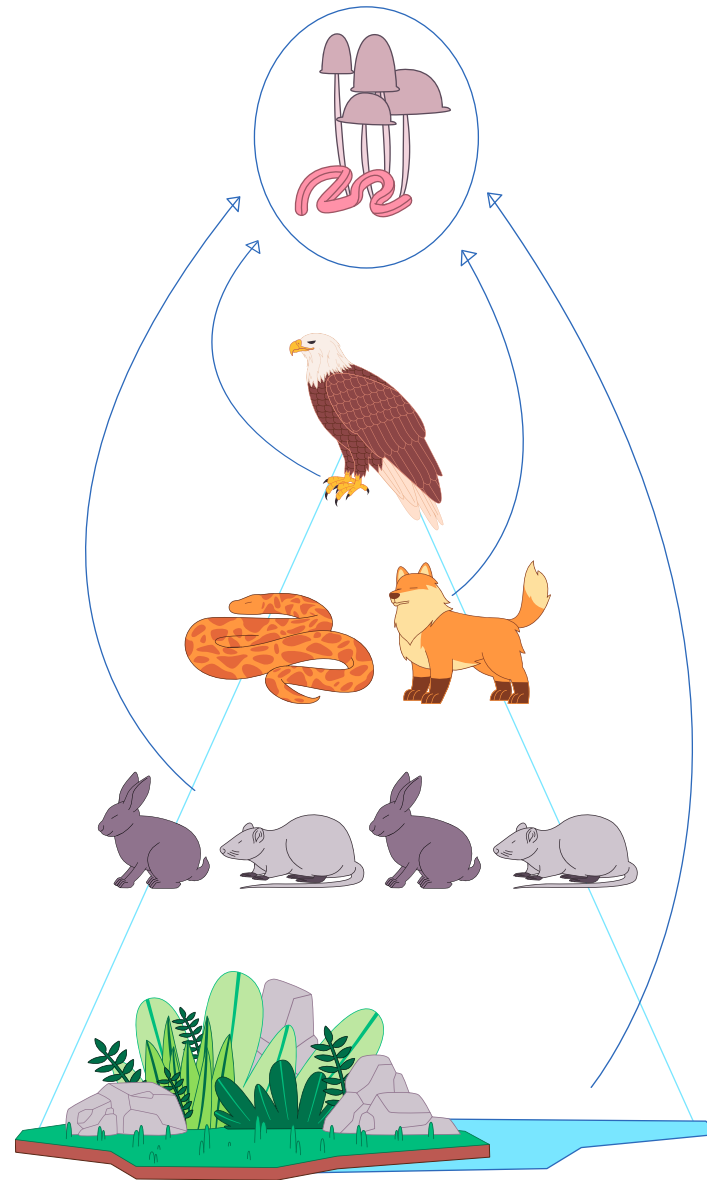


Image credit: Canva

**decomposer:** an organism that breaks down dead plants and animals, as well as waste products, and releases nutrients back into the environment



Image credit: Canva



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Vocabulary Words

**ecosystem:** a community of living organisms (plants, animals, and microbes) interacting with each other and their physical environment



Image credit: Canva

**food web:** interconnected food chains within an ecosystem, showing the flow of energy and nutrients between different organisms

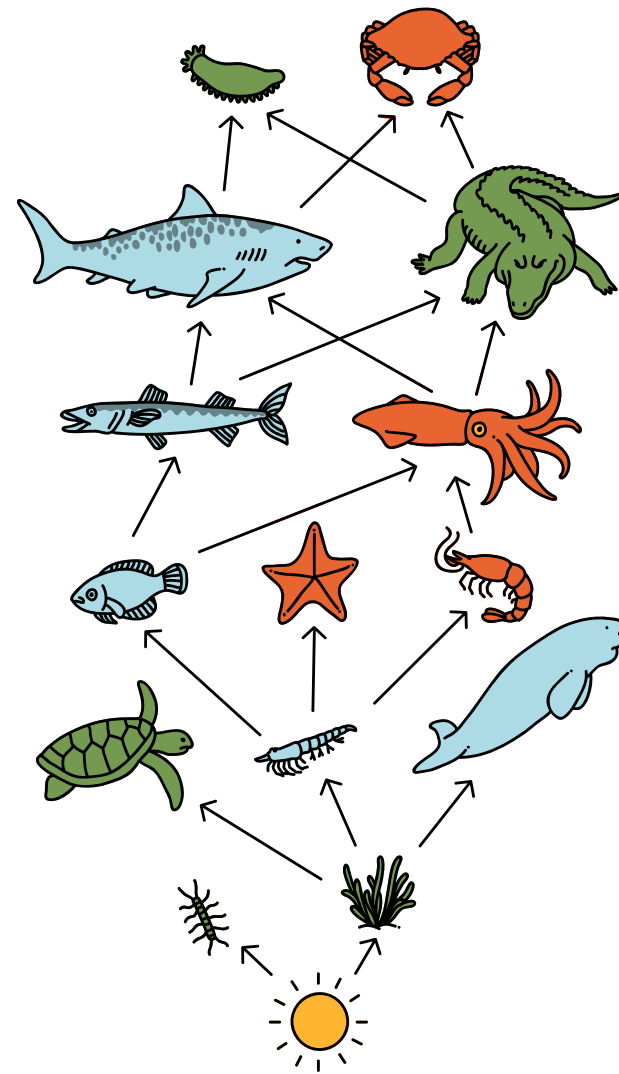


Image credit: Canva

**global ocean:** the interconnected system of all Earth's saltwater bodies

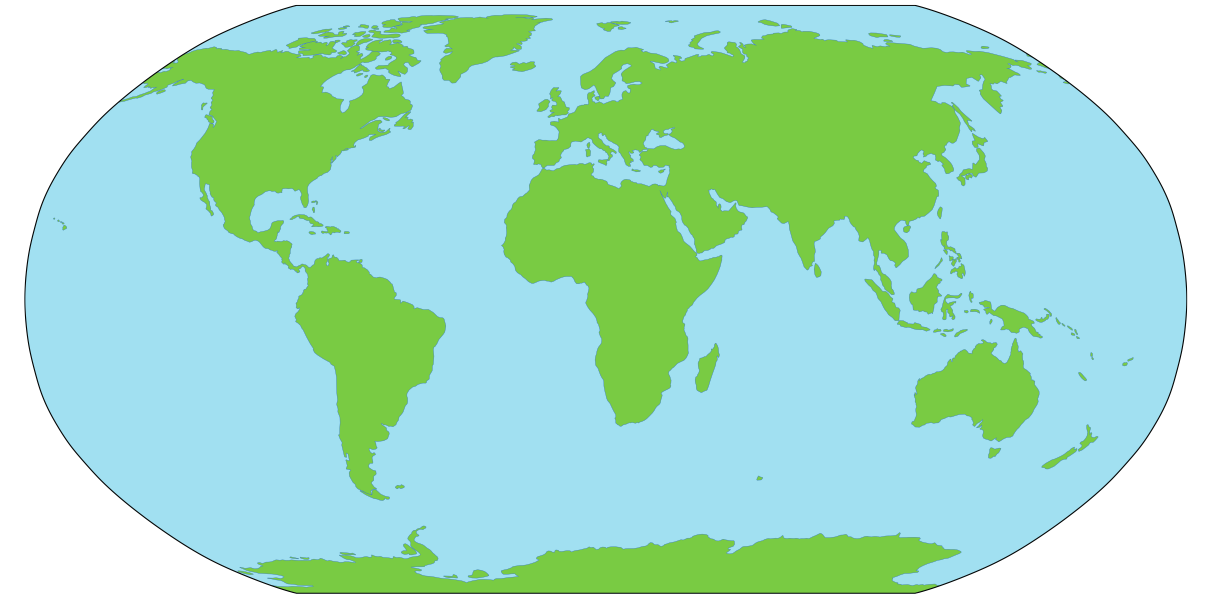


Image credit: Canva



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Vocabulary Words

**microscopic:** object that is extremely small, and usually can be seen only through a microscope

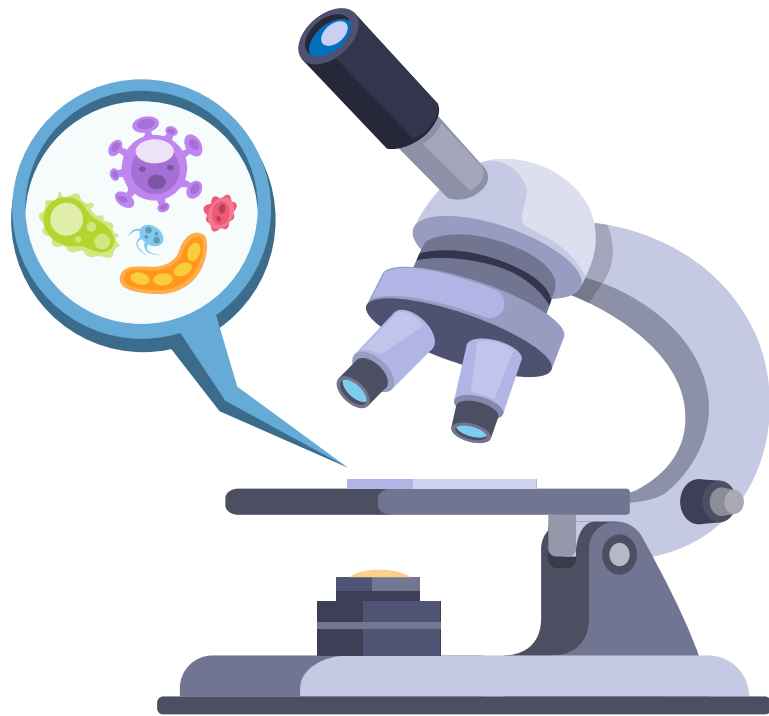


Image credit: Canva

**organism:** any living thing made of cells, that needs food, water, and air to survive; and can grow, reproduce, and respond to their surroundings

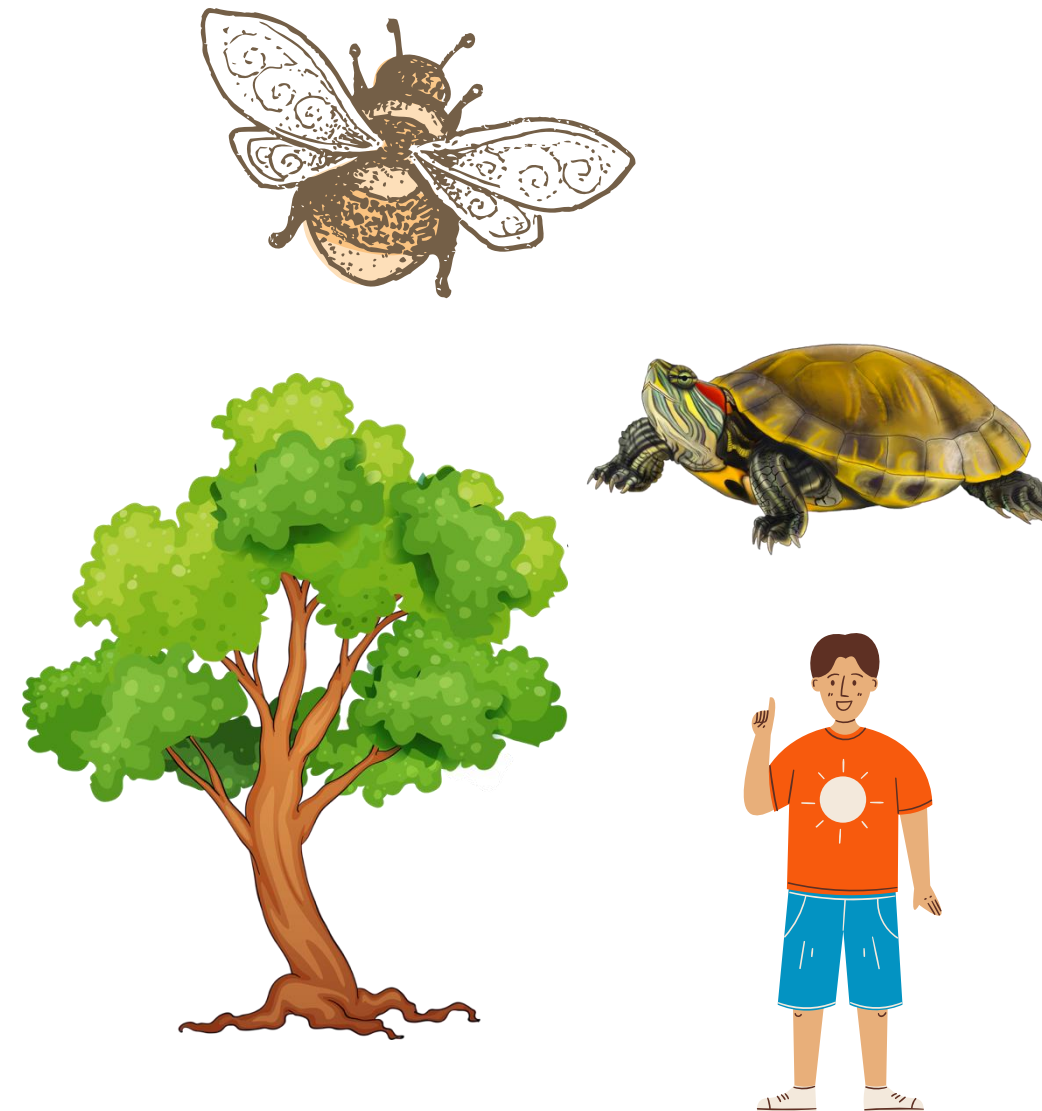


Image credit: Canva

**oxygen:** a gas found in air that some organisms need to live (represented by O<sub>2</sub>)

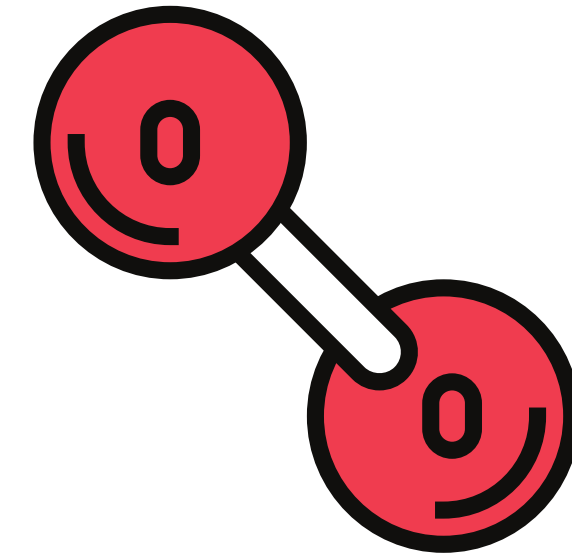


Image credit: Canva



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Explain

## Vocabulary Words

**photosynthesis:** is the process in green plants and certain other organisms that uses energy from sunlight to make food (a sugar called glucose) from water and carbon dioxide

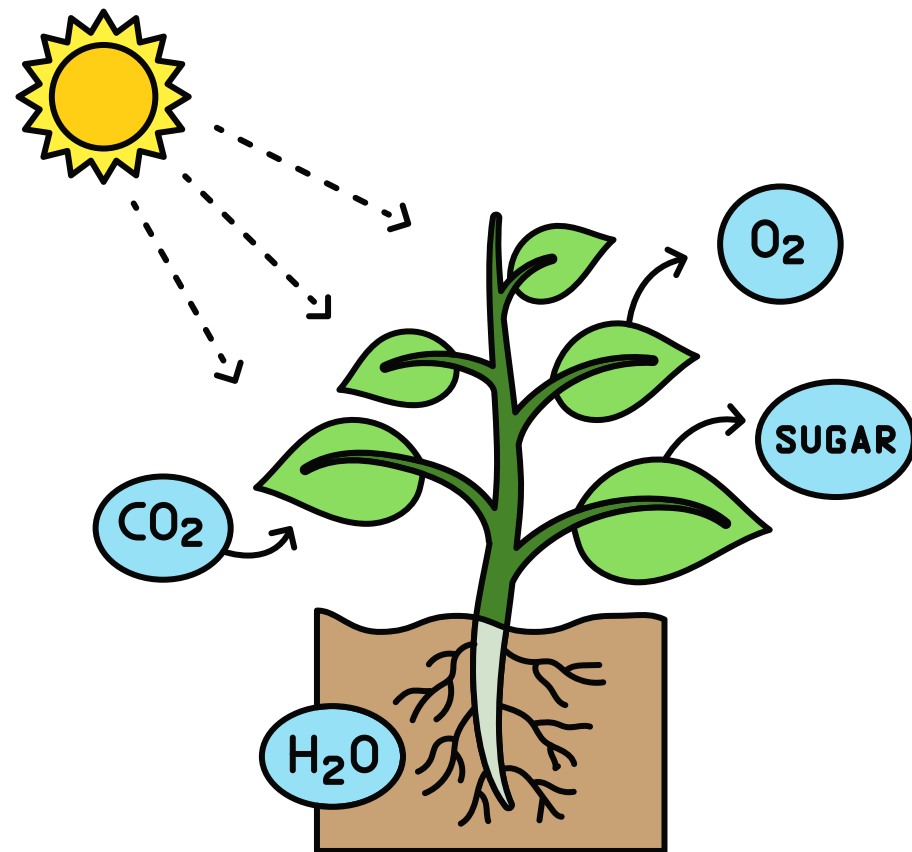


Image credit: Canva

**phytoplankton:** mostly microscopic, plant-like organisms found in aquatic environments



Image credit: Canva

**producer:** an organism that makes its own food, usually using energy from the sun

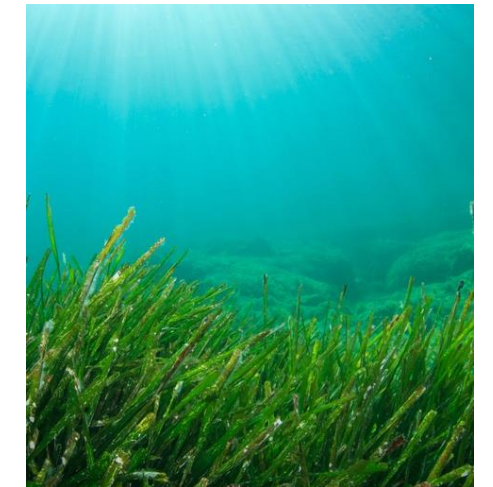


Image credit: Canva

**survive:** to remain alive or to continue to thrive and prosper

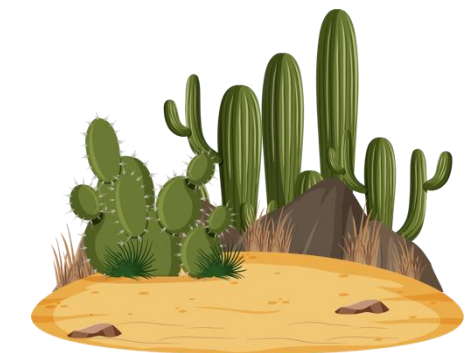


Image credit: Canva



# NASA Spotlight Interactive Lesson: Do we need Phytoplankton?

Evaluate

## Identify Misconception

What is a common misconception people have about phytoplankton? Why do they have this misconception?

## NASA Spotlight Videos

Carefully re-watch the NASA Spotlight videos about phytoplankton.

### Spotlite: Where can you find phytoplankton?



NASA Spotlight: Where is Phytoplankton?

Link - <https://science.nasa.gov/eclips/videos/where-can-you-find-phytoplankton/>



# NASA Spotlight Interactive Lesson: Do we need Phytoplankton?



## Vocabulary Review

Use the new vocabulary to answer the prompt. Add drawings or images to support your response.

Imagine you've just been shrunk down to the size of a phytoplankton and dropped into the Plankton Observation Jar you made!

- What do you see around you in your new tiny habitat?
- What challenges do you face as phytoplankton?
- How do you get what you need to survive?
- What other living things do you meet in your habitat? Are they helpful or harmful?
- If a NASA satellite flew over your jar from space, what might it notice about your environment?

A large rectangular area with horizontal dashed lines for writing a response.



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Evaluate

## Pretest & Posttest



**1. The picture shows some examples of phytoplankton. What are phytoplankton?**

- A. Tiny rocks in the water
- B. Mostly microscopic ocean plants that make oxygen
- C. Small fish that eat plants
- D. Sediments at the bottom of an aquatic environment

**2. Where do phytoplankton live?**

- A. On land
- B. At the bottom of a body of water
- C. Floating near the surface of a body of water
- D. Only in oceans

**3. What do all phytoplankton need to live and grow?**

- A. Moonlight and nutrients
- B. Darkness and carbon dioxide
- C. Sunlight, water, and nutrients
- D. Sunlight and salt

**4. How do phytoplankton make their food?**

- A. By photosynthesis, using sunlight
- B. By taking in saltwater
- C. By eating other organisms
- D. By releasing wastes

**5. What gas do phytoplankton produce that we breathe?**

- A. Carbon dioxide
- B. Nitrogen
- C. Helium
- D. Oxygen



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Evaluate

## Pretest & Posttest

6. Why are phytoplankton important?

- A. They make the ocean blue
- B. They help boats float
- C. They give oxygen and food to aquatic animals
- D. They are important decomposers in the food web

7. What animals eat phytoplankton?

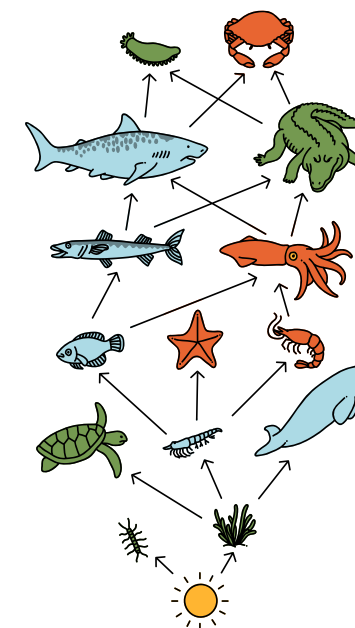
- A. Algae
- B. Zooplankton
- C. Only penguins
- D. Most land animals

8. Why are phytoplankton found near the surface of the water?

- A. They need air
- B. They need to stay warm
- C. To get sunlight
- D. Because zooplankton are only found at the surface

9. What does NASA use to study phytoplankton?

- A. Telescopes
- B. Submarines
- C. Satellites
- D. Rockets



10. Study this food web. What might happen if there were no phytoplankton?

- A. Nothing would change
- B. The ocean would be red
- C. There would not be enough food and oxygen to support aquatic animals
- D. There would be less carbon dioxide in the water



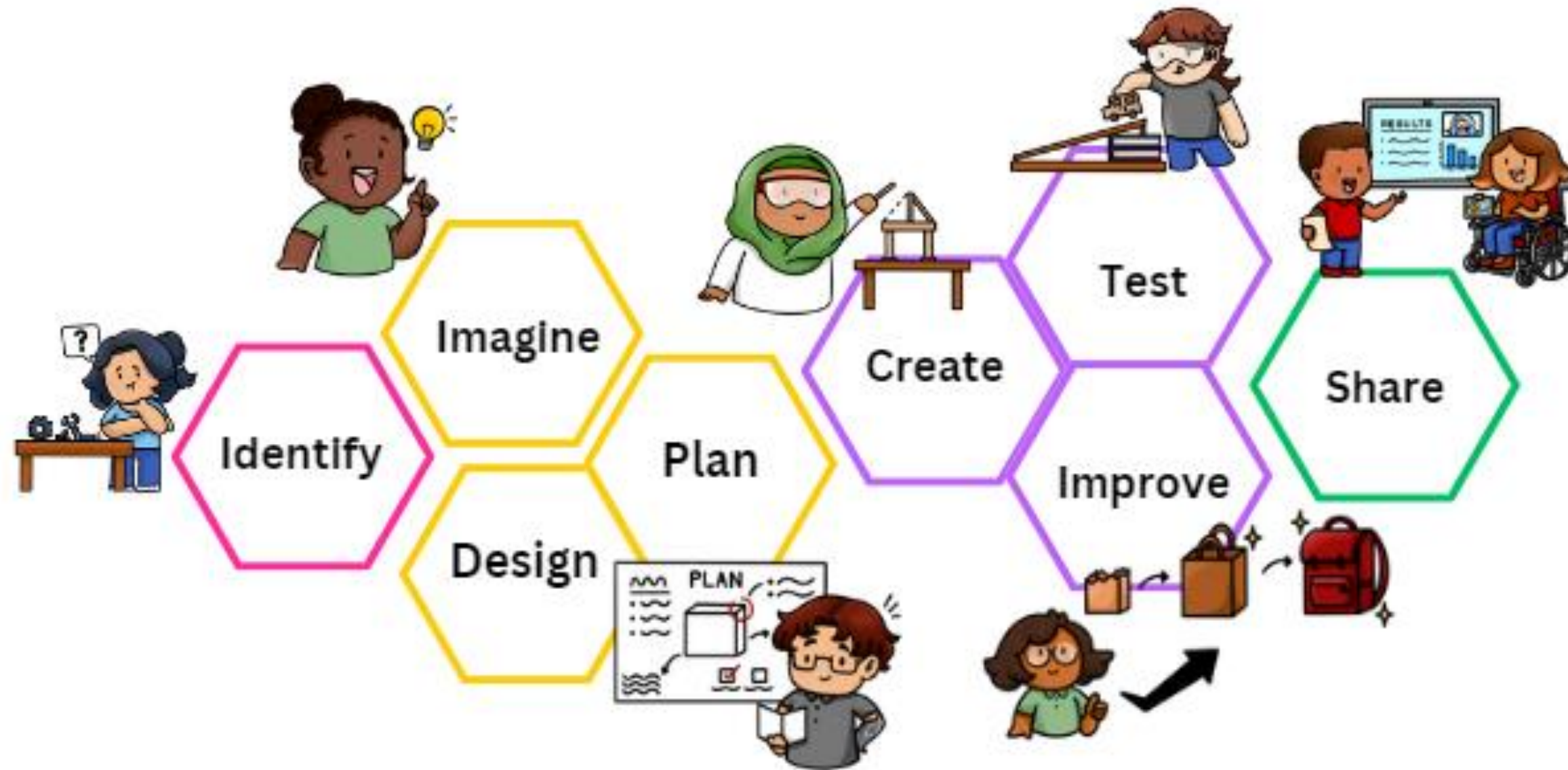
# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Extend

## NASA Connection

### Engineering Design Challenge

Use your new knowledge to design a model of a phytoplankton that has neutral buoyancy. That means it does not sink and it does not rise.



[Use this link to download a copy of the engineering design packet to complete this challenge.](#)



# NASA Spotlight Interactive Lesson: Who Needs Phytoplankton?

Extend

## Engineering Challenge

### Wonderful Wanderers

Adapted from Deep C Consortium's The Great Plankton Race- <https://education.gulfresearchinitiative.org/wp-content/uploads/2015/09/LP-The-Great-Plankton-Race.pdf>

The word plankton comes from the Greek word planktos, which means “wandering.” Plankton are tiny living things that drift in the water. They do not swim like fish. Some plankton drift their whole lives. These are called holoplankton. Other plankton drift only when they are young. When they mature, they can either swim or live on the ocean floor. These are called meroplankton. Baby sea stars, octopuses, and sea urchins are examples of meroplankton.

To avoid sinking, plankton must stay afloat in the water. This is called neutral buoyancy. Buoyancy means the force that helps things float in water or air. If plankton have neutral buoyancy, they don't sink or rise — they just drift.

### Engineering Design Challenge:

Your mission is to design and build a model plankton that is neutrally buoyant and can float in the water without sinking or rising.

Use what you know about shape, size, and materials to create a plankton model that floats just below the water's surface for at least 30 seconds.

### Materials for construction:

- toothpicks
- feathers
- sponges
- beads
- straws
- metal washers
- milk caps

### Materials for testing station:

- clear aquariums, storage containers, or buckets (5-10 gallons) filled with water
- stopwatch with a second hand

