



LESSON PLANS

LESSON #3: MICROPLASTIC SOLUTIONS

3RD > 5TH
GRADE

LEARNING OUTCOMES

Complete a pre-assessment T/F quiz.

Watch 2 short videos giving them important factual information about the problem of plastics in the ocean.

Collaborate in groups through a STEAM challenge to build inventions to clear the plastics in the water.

Analyze the pros and cons of each invention made.

Reflect on pre-assessment T/F and correct wrong answers.

TIME REQUIRED FOR LESSON: 1 eighty minute period or 2 forty minute periods

BIG IDEA

Students will gain an understanding of the complex problem of micro plastics in the ocean and how it affects the marine food web.

BACKGROUND

Phytoplankton are an essential organism in our world's aquatic ecosystems as they are the foundation of ocean and freshwater webs of life. Micro-plastics are flooding into our watersheds and oceans at alarming rates. In some areas of the ocean, there are more micro-plastics than there are phytoplankton. Fish mistake the micro-plastics for phytoplankton, eating them and introducing plastic pollution at the base of the aquatic food web. Larger and larger fish and mammals are being found with alarming amounts of plastic in their digestive tracks as more plastic finds its way into our waterways.

One of the most challenging parts of trying to clean up micro-plastics is its size. Larger pieces of plastic break down into tiny particles over time from exposure to sun, water and air. These particles float in the great oceanic currents known as gyres and get trapped in giant patches of garbage and waste, some estimated to be the size of Texas.

Level 1 of the Oceanic Scales puzzle game app is dedicated to cleaning up plastic and oil based waste from our oceans.

ESSENTIAL QUESTIONS

How does human use of plastics affect the marine food web?

What are micro plastics?

How do micro plastics affect the health of phytoplankton?

MATERIALS/SOURCES

- T/F quiz
- Plastic info videos- https://www.youtube.com/watch?v=qVoFeELi_vQ
- https://www.youtube.com/watch?v=dA0_xGH87n8
- Contraption pros/cons paper
- Materials- Aluminum or plastic pans (size can vary but ideally 13X9)
- Pitcher of water for each group
- Tiny pieces of plastics divided into groups- allow a few helping students to pull items out of recycling (plastic bottles, food wrappers etc.) and cut up
- Tiny pieces of living debris-to represent living sea creatures- allow a few helping students to pick up items for outside (leaves, grass etc.) and cut up
- Variety of materials to build with such as: twist ties, rubber bands, fabric, yarn, paper clips, index cards, tape

ACTIVITIES

ENGAGE

Students will begin by taking a short T/F quiz as a preview to the information they will be learning. It is highly encouraged for the teacher to read aloud each question to encourage vocabulary connections. Then, students will watch 2 short videos educating them about the problem of plastics in our oceans.

DISCUSS/EXPLORE

Hand out invention pros/cons paper and explain to students that they have been chosen as a superhuman by the Phytoheroes to find solutions to remove the micro plastics from the ocean. They must design at least 3 different invention prototypes to test that will remove the plastic, but not kill the living organisms. They cannot use their hands to get the plastic out of the water! Show students what materials they have available to them (such as twist ties, rubber bands, fabric, yarn, paper clips, index cards, tape) and how to proceed into groups (preferably 3) and gather their materials. For easiest transition, have pans ready with water, plastics and living organisms already out and ready at stations so students can just focus on gathering their materials to build contraptions and collaborating. Give groups a certain amount of time (around 15 minutes) to build their contraptions to remove the plastics, but not the living matter, from the water. Have them collect the plastic pieces to compare results.

SHARE/EVALUATE/REFLECT

After the 15 minute challenge, allow groups 5-10 minutes to complete the invention pro/cons paper and then give time for a 5 minute gallery walk for groups to share ideas and results. Come back together as a class to reflect on what a huge and challenging problem humans have made for marine life and how we are also affected by it. Students can re-evaluate their T/F quiz in the post-assessment column. Allow students to also reflect on the most responsible way to clean up the experiment (i.e. don't let them dump the plastic pieces down the drain!)

EXTENSIONS

There are infinite directions to go from here. Students could:

- Turn the challenge into a competitive game between groups.
- Design their most successful contraption in a program such as [Google Sketch Up](#) or [123D Sculpt +](#) and then 3D print a model of it.

CONNECTIONS TO STANDARDS

3rd Grade:

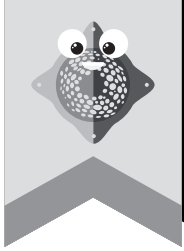
- NGSS. 3-PS2-2 Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- NGSS. 3-ESS3-1 Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- CCSS.ELA-LITERACY.W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- CCSS.ELA-LITERACY.SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

4th Grade:

- NGSS. 4-ESS3-2 Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
- NGSS.4-PS3-4 Most scientists and engineers work in teams.
- CCSS.ELA-LITERACY.W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- CCSS.ELA-LITERACY.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.SL.4.1.C Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

5th Grade:

- NGSS. 3-5-ETS1-2 Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.
- CCSS.ELA-LITERACY.W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- CCSS.ELA-LITERACY.SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.SL.5.1.D Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.



MICROPLASTIC SOLUTIONS

NAME



TAKE A GUESS AT THESE PLASTIC FACTS - TRUE OR FALSE?

- It is estimated that 8 million (8,000,000) tons of plastic waste enters the ocean each year.
- Plastic bottles get weakened by sunlight and torn apart by wind and waves into little bits of micro plastic.
- Plastic confetti is something that every birthday party needs.
- Microplastics can be found in pretty much every ocean around the world.
- Plastic tricks ocean creatures into thinking it's food.
- Every piece of plastic ever made still exists.
- The Pacific Trash Vortex is a new roller coaster at Coney Island in New York.
- 90% of all trash is plastic.
- The amount of plastic we dump into our oceans each year could stretch halfway to Mars.
- Plastic is the perfect material because it's cheap, durable and versatile.
- Phytoplankton make shelters from all the microplastics in the water.
- It is easy to find a solution to clean up the plastic in the ocean.
- WRITE YOUR OWN:

T or F
(true or false)



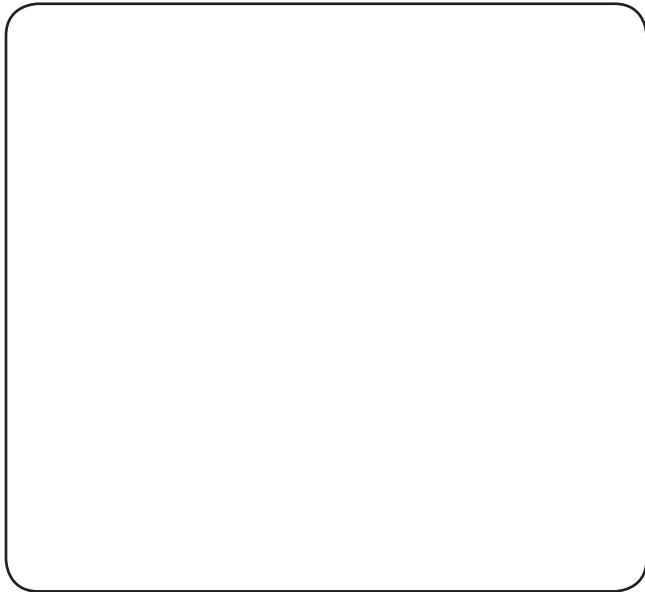
HOW DO YOU THINK PHYTOPLANKTON ARE AFFECTED BY PLASTIC?



PLASTIC REMOVER CHALLENGE

You have been chosen as a superhuman by the Phytoheroes to find a solution to remove the micro plastics from the ocean. You must design an invention that will remove the plastic but not kill the living organisms. Be creative and reflective! You must come up with at least 3 different prototypes to test.

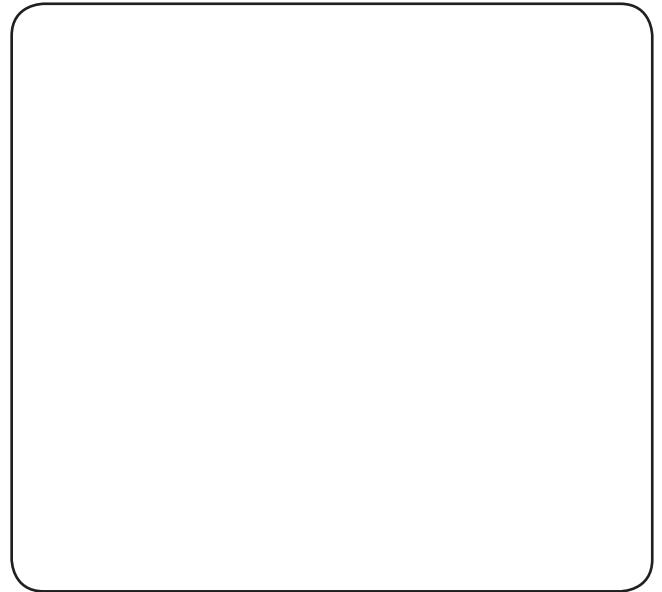
You are limited to the following materials:



Labeled Sketch of Invention #1:

Pros

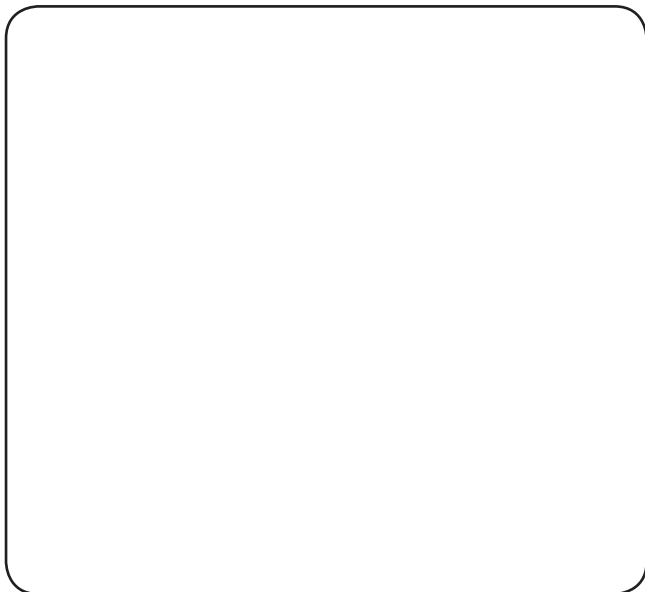
Cons:



Labeled Sketch of Invention #2:

Pros

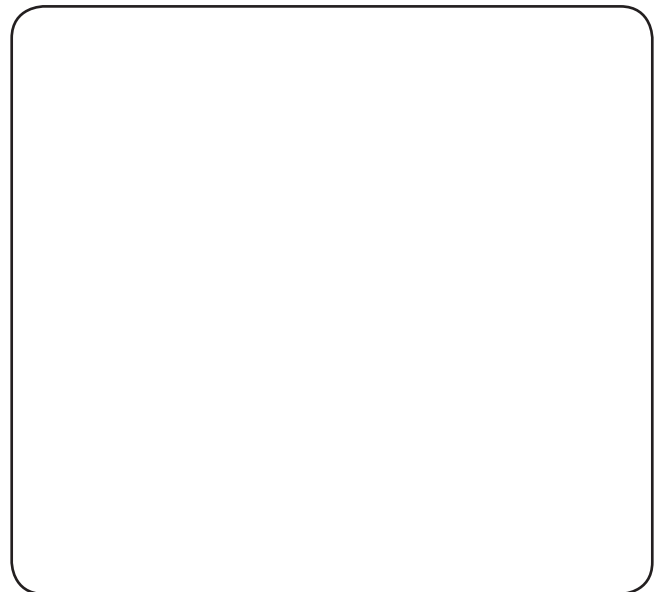
Cons:



Labeled Sketch of Invention #3:

Pros

Cons:



Labeled Sketch of Invention #4:

Pros

Cons: