

Student Name: _____

Summer 2020 Science Notebook

Project Save the Oceans: Design a Device That Cleans Our Oceans



I did ALL of my work:

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- ☐ Ask a Ton of Questions (pg. 5)
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Design Challenges

You're going to make something amazing and you're going to start on it today. It's going to be something that has never existed before in the history of humanity.

You know how you typically turn in an assignment to your teacher and then you get it back and, well, that's pretty much it. This is different. When you return to school we are going to show off your brilliant design and build a 3D model of your design; you're going to create something people will see!

The Launch Process

Look all around you. Seriously. Glance around your home. You are surrounded by things that people created. Not only did they create these things but they also designed them. The fancy term for this is **design thinking**. It's the term professionals use. You're going to use the LAUNCH Process. It's a modified version of the design thinking cycle that artists and engineers use in the real world. Here's how it works:

Look, Listen, and Learn

Ask a Ton of Questions

Understand the Problem or Process

Navigate the Ideas

-----When we return to school:

Create a Prototype (3D Model)

Highlight What's Working and Fix What's Failing

Ready to Launch!

Look, Listen, and Learn

THE BIG QUESTION: Where do you think your trash goes after it is discarded? (Individual)

THE BIG QUESTION: Interview a family member or two. Where do they think trash goes after it is discarded? What different ideas did your family member have about where trash ultimately ends up?



Look, Listen, and Learn

Watch the video (<https://tinyurl.com/y97jbqm2>) and listen closely to the challenge. No technology? No problem. The transcript is below:

The numbers are staggering: There are 5.25 trillion pieces of plastic debris in the ocean. Of that mass, 269,000 tons float on the surface, while some four billion plastic microfibers per square kilometer litter the deep sea. How can we begin to solve this problem without harming marine life in the process? You are an engineer who also happens to have a love for marine biology. You're ready to take on the challenge of this massive problem. To move forward with this project, you have decided to build a prototype of a machine or device that can help solve the ocean trash problems.

Be sure to think about all the scenarios needed to fulfill this mission:

1. If you were to create a device to remove trash from the ocean would you want to focus on the surface trash or the trash that is found deep within our oceans?

2. How is your solution going to impact marine life? Is there a way to make sure your device removes trash in a non-harmful way?

Ask A Ton of Questions

Inquiry

What are three (or more!) questions you have about plastic in our ocean?

What are three (or more!) questions you have about solutions that already exist for this problem?



Understand the Problem or Process

Let's learn more about what plastic really is and where it ends up when it is thrown away!

Video: <https://tinyurl.com/gvykxeh>

Reading:

The Plastic Predicament

Try to get through a day without using plastic. For that matter, try to go just one hour without it. From food and drink packages to cell phones and toothbrushes, plastic is nearly impossible to avoid. You can't even turn on a light without flicking a plastic switch.



A seagull is entangled in a plastic six-pack ring.

Plastic doesn't exist in nature. It's created from chemicals. Mass production of plastic started in the 1940s. Since then, it has become supremely popular—and for good reason. Plastic is lightweight, cheap, and convenient. It also lasts for a very long time. That can be good—you don't want your laptop to fall apart as you type—but it can be bad too.

Plastic can remain in the environment for hundreds or even thousands of years. It piles up, filling garbage dumps and polluting the land and the ocean. Each year, more than 300 million tons of new plastic are manufactured worldwide. Clearly, we have a plastic problem.

Trash Soup

Natural products such as food, paper, and wood are biodegradable [big-oh-di-GRAY-duh-buhl]; they're broken down by bacteria and are absorbed by the environment. Plastic, on the other hand, is photodegradable. Light from the sun causes it to break into smaller pieces over time. It never degrades completely, however. It often winds up littering the land and the ocean.

In the Pacific Ocean, plastic waste has collected in a swirling "soup" of trash called the Great Pacific Garbage Patch. It's huge—four times as big as Texas! It's just one example of an ocean garbage patch. Plastic pollutes all the world's seas. The United Nations Environment Programme estimates that plastic kills 100,000 marine mammals and turtles and 1 million seabirds every year. Some become tangled in plastic debris, while others die after eating plastic trash that they can't digest. Scientists estimate that 80 percent of the ocean's plastic started out on land.



Now the good news: you can help by tossing plastic into the recycling bin instead of the trash. A measly 28 percent of plastic bottles were recycled in 2009, according to the U.S. Environmental Protection Agency. You can help drive that number up.

Sea of Trash

The Great Pacific Garbage Patch is two areas of floating garbage in the Pacific Ocean. Each one is twice the size of the state of Texas. They lie within the North Pacific Subtropical Gyre, a ring of currents that turns clockwise in the ocean.

Reduce, Reuse

Still, recycling won't solve our plastic predicament by itself. Not all types of plastic can be recycled. And those that can may not be recycled in the way you'd expect. Plastic water and soft-drink bottles—some of the most commonly used plastics in the United States—are hardly ever turned into new bottles. Instead, they're recycled into carpet, furniture, and fleece clothing. When those products wear out, they often can't be recycled a second time.

So what can you do? One of the best ways to tackle the problem is to reduce the amount of plastic you use. Carry reusable water containers instead of single-use plastic bottles. Bring your lunch in recyclable aluminum foil instead of a plastic sandwich bag. Ask your family to carry reusable tote bags to the grocery store. Every little bit helps.

Plastic will probably always be part of our lives. But by making smart choices, we can keep it from burying us.

What are two ways you can reduce the amount of plastic you use? Support your answer with evidence from the text.

To help solve the problem of plastic waste, why is it important not only to recycle plastic, but also to reduce the amount of plastic you use?

Understand the Problem or Process Part 2

Research with graphic organizer

Using online resources and/or the provided readings (attached at the end) do some research on what inventions already exist to clean up the oceans. What role do humans play on the Earth's oceans? What is the impact of trash? What inventions already exist to fix this problem?

Humans and Earth Oceans	Impact of Trash	Pre-existing Inventions

Research Resources

Pre-existing inventions websites:

- <https://theoceancleanup.com>
- <https://tinyurl.com/y4op5bam>
- <https://tinyurl.com/yxou2a2y>
- <https://tinyurl.com/y8gaca53>

Readings:

Inventions Literally Saving Our Oceans

February 22, 2019

1. The world's first ocean clean up system

One young man took it upon himself to invent the world's first oceanic cleanup system. The novel device has been described as a "giant Pac-Man" because it literally gobbles up plastic and debris as it travels.

It is now headed for the Great Pacific garbage patch where an estimated **1.8 trillion** pieces of plastic debris have accumulated. We wish it luck and can not wait to see our oceans cleaned up!

Source: *The Ocean Cleanup*

2. The Seabin Project

The Seabin Project has an interesting story as it began with an inventor working in plastic production. When he realized how unnecessary and wasteful the products he was making were he took another path.

Today, we have these literal sea bins that collect sea garbage wherever they are placed. They even collect oil and fuels. Now, we are impressed!



3. The WasteShark

Designed by Richard Hardiman of RanMarine and already in use in the Port of Rotterdam, Waste Shark is a small robotic device that 'swims' close to the shore catching rubbish before it can make its way out to sea. Available in both Slim and Fatboy versions, each device has a mouth that extends a foot below the water and

can catch up to 1,100 pounds of waste before returning to land to be emptied. The Port of Rotterdam Authority's Port Waste Catch programme trialled the product back in 2016, as did Dubai Marina. Most recently, a WasteShark was launched in March 2019 by WWF and Sky at Ilfracombe Harbour in Devon, UK.

4. Marina Trash Skimmer

Similar to the Seabin, the Marina Trash Skimmer has been specifically designed for use in harbours and marinas to help reduce plastic pollution in ports and high marine traffic areas. The Skimmer is a stationary unit that should be strategically placed at a specific problem site or deployed as a network of units to protect and clean a larger marine space or ecosystem. Working with the ocean's natural currents, tides and winds, skimmers work around the clock to collect trash and oil sheen into one easy-to-access location for quick removal and disposal. With a nearly indestructible shell holding industrial-grade components, the skimmer has been designed exclusively for the removal of trash and pollutants at a commercial scale.



5. A robot that can identify and capture microplastics in the ocean

This invention was designed by Anna Du, a 6th grader that became a finalist in the Discovery Education 3M Young Scientist Challenge. Her robot is a remotely operated vehicle (RAV) that employs infrared light to detect and hunt microplastics.

It's composed of 2 different systems, a navigation system that guides it through water, and a detection system that uses a high-resolution infrared camera to find the plastic.

Check out her project here: <https://tinyurl.com/y77adh73>

Navigate the Ideas

An Initial Sketch:

Create a labeled sketch of what your ocean trash machine will look like. It could be a 3-D sketch or a plan. Focus on the specific features. Be creative. Take some risks.