



Mālama Honua: To Care for the Earth

— Virtual Project #4 —

• *MARINE DEBRIS & GLOBAL CHANGE* •



NAME: _____

GRADE: _____

SCHOOL: _____

TEACHER: _____



Don't forget to have the digital copy
of this project ready to go on your
computer.

You'll need it to click on all of the
links to the videos!

www.digitalbus.org

Mālama Honua: To Care for the Earth

— Marine Debris & Global Change —



PART 1: WELCOME



Aloha!
My name is Kumu Dav (he/him/his), welcome to our project about marine debris and global change! I have a bunch of cool information to share with you. Hopefully you're interested in learning a bit about how humans are changing the world, for better and for worse.

OK! So what are we going to do???



We're going to go over the different kinds of pollution, the problems they cause, and possible solutions to the issues. Our goal is that you'll be able to share all this information with your classmates, teacher, and family! When you complete everything, you'll even have the chance to win some cool prizes!

So what do... I have to do?



You'll watch some videos, look up facts and information on the internet, answer some questions, and come up with your own questions to ask me or your teacher!

Uh, ok. But how do I ask you questions?



At some point during this project I'll either come to your class or you'll get on a video call with me to ask all the questions you have! Your teacher will know how to contact me :)

What do you know about all this stuff anyway? Why should I do all this with you?



Good questions, I'm both a scientist and a teacher! I studied marine biology, environmental science, and education. And for my job here in Maui I make cool science projects for students all around the island. From kindergarten all the way to 12th grade. It's called The Digital Bus! If you want to see pictures, [CLICK HERE](#).

We do things like study anatomy, learn to use microscopes, figure out why the oceans are polluted, things like that. Some of our projects are in person, and others (like this one) are virtual. So you'll need a computer and the internet for this project.

I guess that sounds ok. I hope this isn't going to be boring.



If you ever think it's boring, tell me something you're really interested in and I'll try to relate it back to this project!

Ok, I'll give it a try!





Great! Let me explain a little bit about things you'll find in the lessons. I'll put links to online videos and facts right into our conversation.



Let's give it a try. Here is your first video:
[CLICK HERE](#)

Haha! What does that have to do with anything?!



Nothing, I just love bears! Ok, here are some more things you'll find throughout the lessons:

**YELLOW
BOX**

— RESOURCES —

In here you'll find links and information with additional resources for you to explore. Sometimes I'll ask you questions about this stuff. Sometimes I'll just put cool stuff in here.

**PURPLE
BOX**

— RESEARCH —

In here you'll find the directions for your little research project! I'll also put a list of materials you might need. You'll always have to share your research with your family!

**ORANGE
BOX**

— TANGENT —

In here you'll find information that is related to our conversation, but it covers a different topic. For example I might ask you to try some math about the topic we are learning about.

**PINK
BOX**

— VOCABULARY —

In here you'll find all the words you should look up and understand. Maybe you'll already know a bunch of them, but maybe some will be new. The words will also be in bold in the lesson.

Ok, this seems pretty easy so far!





During the lesson I'll ask you questions too. They will be in red letters. Like this:



What is your favorite food?



Mine is pizza. But I try not to eat too much of it; it's not very healthy!
Your answers can go in your blue bubble! Like this:

ANSWER:



Video 4.1



Sometimes my picture will have a pink frame. Click on the pink icon to see me explaining things in detail! I'll either be inside The Digital Bus or bringing you along a virtual field trip.
Go ahead, try it out!

Got it!



Before we start our lesson, do you have any questions for me?
Maybe you want to know more about me, or the Digital Bus, or more about what we're going to do?
I can't wait to hear from you!

Questions and things I want to talk about





- PART 2 - INTRODUCTION

This part includes:

- ✓ 11 Pages
- ✓ 5 Digital Bus Videos
- ✓ 9 Questions
- ✓ 3 Tangent
- ✓ 14 Vocabulary Words
- ✓ 2 Quizzes

DATE ASSIGNED: _____

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notes... drawings... thoughts... ideas...

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PART 2: INTRODUCTION



Hey again! Ready to begin!?
Can you please answer a few questions just to see what you already know about this topic?
It's not graded so don't worry if you aren't sure of the answers, you'll be able to try again later!

[CLICK HERE](#)

Let's start by finding out some basic information about the Earth and how humans are changing it.

[CLICK HERE](#)



Ok, here are some questions just to warm up our brains:



Approximately how old is the Earth? (Based on the "calendar" in the video)

ANSWER:



Can you explain what an epoch is?

ANSWER:





What is the name of the new proposed epoch?

ANSWER:



Can you list the 5 ways humans are leaving a permanent mark on the planet?

ANSWER:



We won't talk much more about the geologic times in this project, but it's important to know the extent of our impact to the Earth. We will, however, talk about some of those ways in which humans are leaving a permanent mark: especially the "new material" category

TANGENT: Science
Geology is the study of the Earth's history, its substances (rocks), and the forces that act upon it. Can you list the major Eras and Epochs of the Earth's geologic history and figure out where to place (1) The first living organism, (2) The dinosaurs, (3) When Maui was formed, (4) When the first human evolved.



Before we dig into the project, there is some background information that I'd like to ensure you know. First of all, some **geography**. I'm going to be referring to a lot of different places throughout the world, so it's important that you know where a few places are.

Geography, not to be confused with geology, is the study of the Earth's physical features, locations, and the distribution of human activity.
Oh, I'm Em-J by the way! I'll be chiming in once in a while to share facts or ask some questions!





On the following page you'll find a map of the world that you can use to answer the questions.



Ok, so first up: Hawai'i.
Can you circle and label Hawai'i on the map?



There are few other places that will be important to know. In a different color, can you label:

| | |
|-------------------|--------------|
| 1. USA (mainland) | 6. ASIA |
| 2. CHINA | 7. MEXICO |
| 3. JAPAN | 8. EUROPE |
| 4. PHILIPPINES | 9. INDONESIA |
| 5. AUSTRALIA | 10. AFRICA |



We'll also need to know the Oceans! Can you label:

1. The Pacific Ocean
2. The Atlantic Ocean
3. The Indian Ocean
4. The Arctic Ocean
5. The Southern Ocean



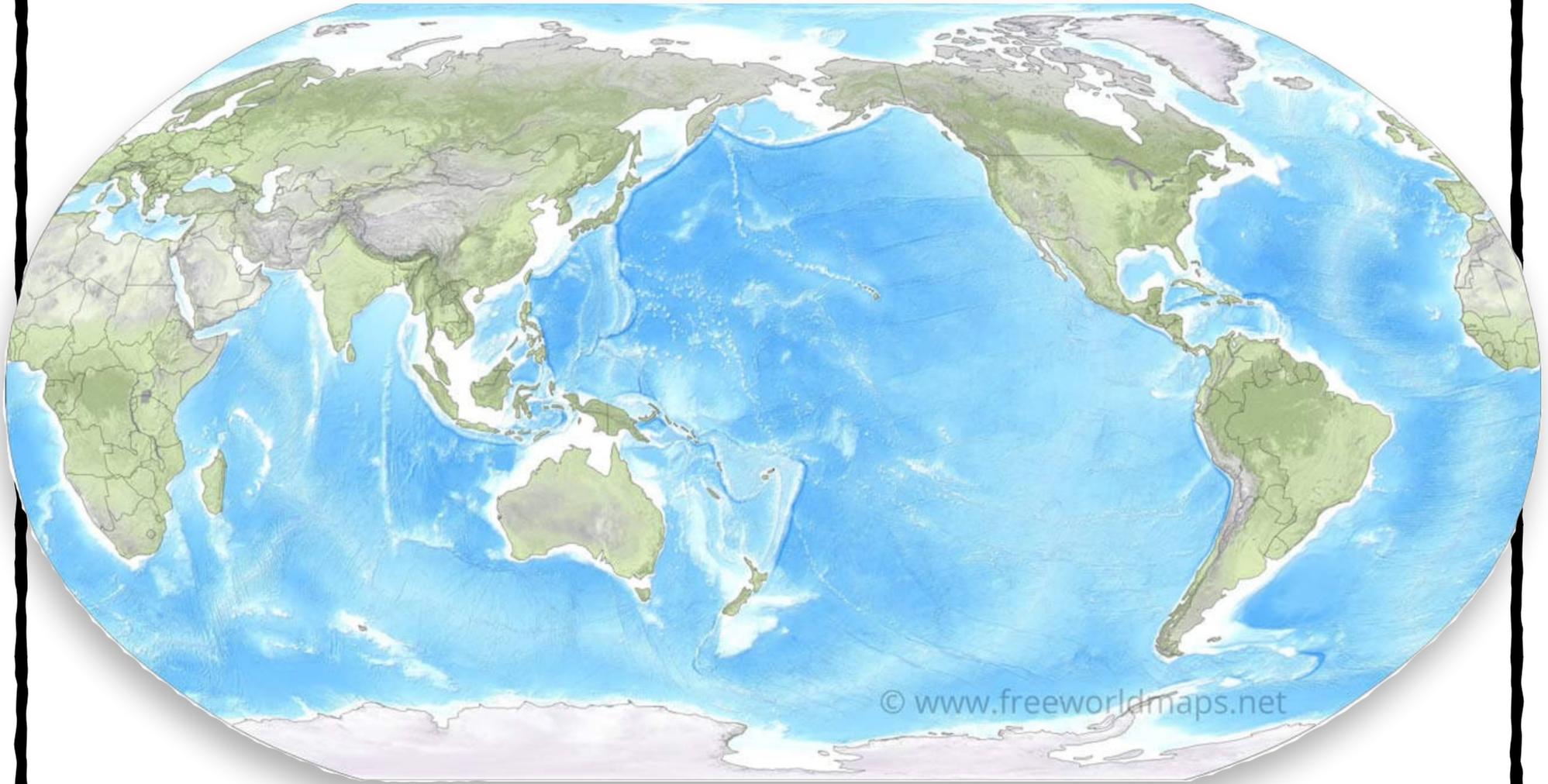
The final place I'd like you to label on the map is one location that is important to you. Maybe it's where you are from, where you grandparents are from, or even where your favorite sports team is located. Use any place that you feel a connection to!

You may have only learned about those first four oceans! That's because starting in 2021, the Southern Ocean is finally being recognized as the 5th main ocean! Scientists have long advocated for this, but international consensus was only agreed upon recently!
[CLICK HERE](#)

OK, sounds good!



MAP OF THE WORLD





All of these places will be important when we discuss where pollution is coming from and where it ends up traveling to.



Speaking of pollution, this is going to be the main part of this project. We are going to learn about different types of pollution (specifically marine debris) and how it impacts the Earth's **ecosystems** and human populations. Let's get into that now!

I'm ready!



In your own words, can you explain **What is pollution?**
(Don't give an example, give an explanation!)

ANSWER:



Video 4.2



Make sure you check out the video link to the left, to make sure you got your answer right!

TANGENT: Arts and Culture

One of my favorite movies is WALL-E. Have you seen it? If not, maybe you can find time to watch it and try to see how pollution is featured. Can you also try to find another movie, TV show, or book that has pollution as a theme?



So now we know that **pollution** is the introduction of harmful materials (also called **pollutants**) into the environment that have a negative effect on nature and ecosystems.



I'd like for you to think about some different kinds of pollution.

List all of the ones you can think of!

But wait! If you write down a plastic bottle, and a plastic cup, and a soda can... all of these examples are one type of pollution: Solid waste. Keep this in mind when answering the question.

ANSWER:



Did you find a bunch!?! Here is a list that covers the main different types of pollution:



Video 4.3



THE BIG THREE

1. **Solid Waste Pollution**: This is usually the first thing we think about when the word pollution comes up.
Example: Soda can on the ground.
[CLICK HERE](#)
2. **Air Pollution**: Any type of gas that ends up in the atmosphere.
Example: Smoke from a power plant.
[CLICK HERE](#)
3. **Water Pollution**: Anything harmful that will dissolve or be present in bodies of water.
Example: An oil spill in the ocean.
[CLICK HERE](#)



I gave you an example of each.
Can you find two more examples of each one?

Solid Waste Pollution

Air Pollution

Water Pollution



Video 4.4



Excellent! Did you notice that I called those types of pollution "The big three"? That means there are others:

THE OTHER ONES

1. **Soil Pollution**: Any type of harmful materials that are released in (or on) the soil.
Example: Pesticides on a plant.
[CLICK HERE](#)
2. **Radioactive Pollution**: The leftover materials (or accidentally released) from nuclear power plants, explosives, and experiments.
Example: Radiation from the Fukushima disaster.
[CLICK HERE](#)
3. **Light Pollution**: Any excess artificial light that may alter animal behavior.
Example: Baby turtles being attracted to hotel lights.
[CLICK HERE](#)
4. **Noise Pollution**: Any excess artificial noise that may alter animal behavior.
Example: Underwater explosions damaging the ears of dolphins.
[CLICK HERE](#)

WHAT IS REAL RESEARCH?

Once a scientist finishes their experiments, they will write up their findings. Other scientists will read it (peer review), and determine if it seems valid enough to be published. Only then will it be released to the public. This is real research. These are examples of real scientific journals from scientists working on pollution:

[Click Here](#)
[Click Here](#)
[Click Here](#)



We've looked at 7 different types of pollution, **can you explain which of these you would be most interested in learning more about?**
Explain why!

This one seems interesting to learn more about:

because...



Thanks for sharing. There is no right or wrong answer to that question!



Although we are separating these types of pollution to better understand them, it's important to remember that they are ALL CONNECTED!



For example, air pollution (eg. exhaust from cars) can create acid rain, which will then fall in the oceans and on the soil, creating both water pollution and soil pollution!

And the plastic trash (solid waste) that floats around the oceans will release harmful chemicals into the water (water pollution).



This is the main reason why this issue affects everyone! And why, in order to solve the pollution problems, we'll need every type of person to help. From the scientists studying animals or chemicals, to the builders installing solar panels and wind farms, to the teachers and students engaging in these topics in their classrooms.

So I'm just as important as the scientists for this issue?!



Absolutely!! As a student you can do your part. The most important of which is acknowledging the pollution issue and realizing that we humans must do something about it.



Video 4.5



The **interconnectivity** of this topic is the reason why humans are causing very big changes to the Earth. It's the reason why those scientists from the first video you watched are discussing the possible Anthropocene Epoch.

The Earth is changing. Quickly. And we humans are a major reason for how fast it's changing.

We call this **Global Change**.

The **climate** is changing
The soil **composition** is changing
The ocean's **acidity** is changing
The **weather patterns** are changing
The ocean **currents** are changing
The ecosystems are changing

If all of these are changing, then the way we live on this planet will also change.

We can either change voluntarily, by understanding how we fit into the ecosystems, or the changes will be forced upon us by nature—and humans will end up facing the consequences of our choices.

Here are some more resources about **Global Change**:

[Wikipedia definition](#)

[A more in depth look](#)

[An article](#)

[US government program all about figuring out Global Change](#)

Woah. That's a lot to take in... Can we just take it one step at a time?



YES!! That's exactly what I was going to say. The first step is just to understand some basics!



In this project we're going to look at one part of the big problem: Solid Waste. More specifically the solid waste that ends up in our oceans. We call this type of pollutant marine debris.



Video 4.6



We are going to cover three big questions:

1. *What is marine debris?*
2. *What harm is marine debris causing?*
3. *What are some solutions to this problem?*



All of this will be able to fit into the idea of interconnectivity: The Earth is changing because of many different factors that are connected.

Don't forget we as humans are interconnected with the Earth. Human and Earth are not separate from each other. We aren't above the ecosystems and environment. We are a part of it! Just like the tree, the shark, the soil, the ocean, us humans are a part of **Honua** (The Earth). We are a part of the **'Āina** (land). It's our only home.

It's our responsibility to Mālama (care for) our home.

To **Mālama Honua**, to take care of the Earth, is to take care of ourselves as well.

Our food comes from the land, our water from the rivers and lakes, the oxygen we breathe comes from photosynthesizing organisms all over the planet. We rely on nature for every single part of our existence!

TANGENT: 'Ike Hawai'i

One of the Polynesian Voyaging Society's slogan is also "Mālama Honua". With the Hōkūle'a as their main ambassador, they are caring for the planet in many different ways. Can you find out more about the mission of the Hōkūle'a and some ways in which they are contributing to the negative issues of "Global Change"?



So let's learn some stuff so that we can be the best stewards for our Hawaiian islands and for our Earth!

Let's Mālama Honua together.



Ok, that's it for now. You've gotten through the intro! You can use this page to write down any questions for me, or any thoughts you have!

Questions and things I want to talk about



VOCABULARY

Geography

Ecosystem

Pollution

Pollutants

Interconnectivity

Global change

Climate

Composition

Acidity

Weather patterns

Currents

Honua

'Āina

Mālama Honua

**REVIEW YOUR KNOWLEDGE WITH A
SHORT QUIZ ABOUT PART 2
[CLICK HERE](#)**

notes... drawings... thoughts... ideas...



- PART 3 -

MARINE DEBRIS AND PLASTICS

This part includes:

- ✓ 11 Pages
- ✓ 5 Digital Bus Videos
- ✓ 8 Questions
- ✓ 3 Tangent
- ✓ 12 Vocabulary Words
- ✓ 1 Research Project
- ✓ 1 Quiz

DATE ASSIGNED: _____

DATE DUE: _____

notes... drawings... thoughts... ideas...

Mālama Honua: To Care for the Earth

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PART 3: MARINE DEBRIS AND PLASTICS



Welcome back! In the last section we figured out what pollution is, introduced some of the different types, and learned how all of it is interconnected in affecting the health of the Earth.

And I figured out which type of pollution I find most interesting.



That's awesome! Let's put some of this new knowledge to work. We're going to focus on solid waste in this project, more specifically marine debris. Let's start by watching a quick video. [CLICK HERE](#)



I hope that video helped explain a little bit about what we are going to cover. Let's see if we can clarify a few things:



In your OWN words can you answer:
What is marine debris?

ANSWER:





Video 4.7



So, **marine debris** is any **solid waste** (litter) that ends up in the oceans. Check out some of these pictures:

Here are some pictures of various different kinds of marine debris:

[CLICK HERE](#) & [CLICK HERE](#)



Based on the photos, can you come up with a list of ten different things you recognized that ended up becoming marine debris?

ANSWER:



I want you to think about those ten things and try to figure out what they are made of (or mostly made of).

Marine Debris Item

Material (What is it made of?)

1

2

3

4

5

6

7

8

9

10



If we did this correctly, there should be one type of material that stands out. **What is the material that makes up most of the marine debris?**

ANSWER:



Well, it looks like we need to talk about this **plastic** stuff...



Look around you right now and answer:

1. How many human-made things within reaching distance are made of plastic (or have plastic parts)?
2. How many things don't have any plastic parts?
3. Can you calculate the percentage of things around you that have plastic?

ANSWER:



Did you count your clothing? Because unless you are wearing cotton or wool (or a few other less commons materials), your clothes might be made of plastic!

Hold up, t-shirts and underwear can be made of plastic??



Absolutely! Anytime something is made of **polyester**, or **nylon**, or **acrylic**, it's just different types of plastics.

For real?!





For real. Ok, so now we know that plastic makes up (or is a part of) many of the things we use. We need to figure out why that is.

TANGENT: Science

The word "plastic" comes from the Greek work "plastikos," meaning "capable of being shaped." Plastic is a synthetic (human-made) material that is composed of multiple carbon containing molecules that are linked together. When individual molecules are linked together, we call them polymers. If we take the plastic "polyester" as an example, it is made multiple ester molecules linked together: Poly- (the prefix mean "many"), and -ester (the suffix is the molecule name).

There are many different kinds of plastics, each with different properties (hard, soft, waterproof, heat resistant, etc...) Each have different molecular compositions, but they are all polymers. And nearly every plastic we use is created from oil. It's therefore important to realize that the production of plastic needs fossil fuels for the actual product and for the energy used to create it.

We aren't going to go over this in any more detail in this project, but if you are interested in learning more about the science of plastics, the process of creating plastic, and its energy consumption, check out these links:

[CLICK HERE](#) & [CLICK HERE](#) & [CLICK HERE](#)



Video 4.8



Plastics are undeniably an amazing material. You can make pretty much anything out of plastic: it can be **moldable** , very strong, heat and/or cold resistant, waterproof, can be **sterilized**, and maybe most of all: it's now cheap to produce.

It is safe to say that plastics have made the modern world possible. From parts of satellites and space suits, to synthetic heart transplants, to major components in telecommunication, and many more.



One that last longer than a few months is still in development but there are some people that have actually received a synthetic heart!! Do you know what the function of the heart is?



The visors and helmets of the space suits are made of plastics. Along with a bunch of other parts.



Those smartphones that are such a huge part of our lives have a lot of plastic parts, both inside and outside.





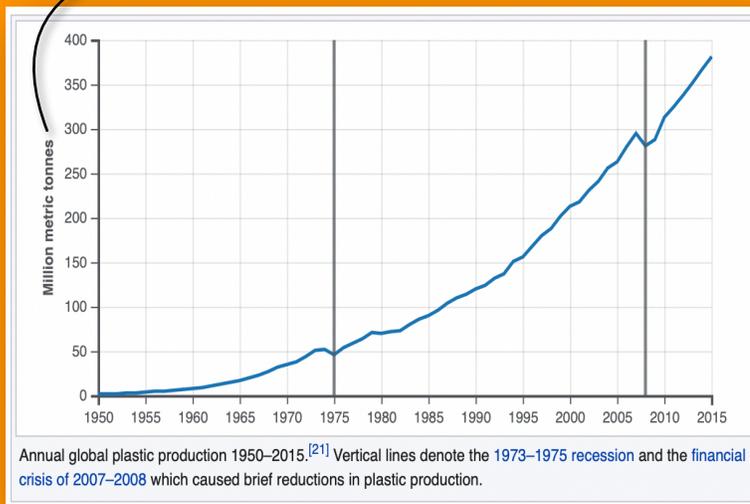
Although plastic was invented a little over 100 years ago in 1907, it wasn't until the 1950s and 1960s that plastic production really took off.

TANGENT: History

Let's go a little more in depth about the history of plastic. We are going to focus on the modern synthetic plastics here. Leo Baekeland, a Belgian chemist, is usually regarded as the inventor of the first fully synthetic plastic in 1907. He also coined the term "plastics." A lot of scientists contributed to the advancement of this material in the next decades, including some folks that won a Nobel Prize in chemistry for their work on polymers. Mass production started in the 1950s, and it has steadily increased ever since. Check out this graph, and click on the links for more resources.

[CLICK HERE](#) & [CLICK HERE](#) & [CLICK HERE](#)

The y-axis shows how many millions of tonnes of plastic are produced each year.



So modern plastic is really not that old at all! Some of your aunts or uncles might even remember when plastics were much less common.



Video F4.1



That gives me an idea for a little research project! I'm going to talk to someone that remembers the 1950s and 1960s, and ask them some questions. I'd like you to do the same! Check out what you need to do below:



1. For one hour (or until you fill up the page, you'll keep a list of every single HUMAN MADE thing you use. Write them down on the following page.
2. Answer the questions about to each item.
3. Find someone who was your age in the 1960s, and ask them what material the items you wrote down where made of back then.
4. Pick three items that are made of plastic today that used to be made of something different to share with your class.



Plastics are really useful, I think we can all agree here. It's also apparent that we use them way more than before. We can agree there too. Plastics seem to be great in every way!! But... just a second now...



There is something we haven't talk about yet. Although plastics are amazing in many ways, they aren't the perfect material. There are three big issues. **Do you know what they are?**

ANSWER:



Video 4.9



1. *Plastics require a lot of fossil fuels to make.*

To make one pound of plastic, it takes about 2-3 pounds of oil! Remember, oil is a fossil fuel and anytime we use it, we are creating some sort of pollution.

2. *Plastics can take up to 1000 years to **decompose**.*

Plastics are incredibly durable materials, which is great for a lot of reasons. But that also means that all of the plastic is thrown out (and it all gets thrown out, eventually) will stay around for up to 1000 years. We are going to focus on this issue for our project.

3. *Waste plastics can release **toxic** chemicals.*

Different plastics will leach out different chemicals over time. Some may not be that bad, but others can be toxic. And since plastic will not decompose for a very long time, they can be releasing chemicals for hundreds of years.

To decompose means for something to break down into the original **molecules** that it is made of. For example an apple will eventually break down (decompose) into carbon, oxygen, nitrogen, etc... And those molecules can be used by other life forms. This process will take about a month or two (for an apple).

Plastics will take up to 1000 years to decompose. In the mean time they will just break apart into small pieces of plastic. So even when they are too small for the human eye to see, it is still a piece of plastic. It has not decomposed.

Hmm, so for all the ways plastics help, there seems to be some problems too!





Every year humans produce about 500 million **tons** of plastic. About 200 millions tons are used only once and then thrown away: either for packaging material, plastic containers, food wrappers, or plastic water bottles.

These are called **single-use plastics**.



In addition to the 200 million tons that are used one time and then thrown away, there is about 100 million tons of old plastics from different industries that get throw away each year: like old plastic chairs, or the plastic in cars, or the plastics in construction materials or broken kid toys.

Pretty much every single thing that is made of plastic will one day become waste: The new Playstation you may want, that new car your grandpa got, the artificial heart we talked about earlier... They will all become old and broken and be thrown away only to continue their 1000 year life somewhere on the planet: most likely in a landfill or in the ocean.

TANGENT: Math

Let's graph! Graphs are a great way to visualize data and sets of numbers!

There are many different types of graphs, each with their own purpose based on the information we are trying to show. For this example we're going to learn the bar graph.

Here is some data about the amount of plastic produced for various industries in 2015.

[CLICK HERE](#) to learn how to create a bar graph, and use these data to make your own graph. Don't forget to include a title, labels, units, and colors!

| Industry | Total plastic production (in millions of tons) |
|-------------------|--|
| Packaging | 146 |
| Construction | 65 |
| Textiles | 47 |
| Consumer products | 42 |
| Transportation | 27 |
| Electronics | 18 |
| Machinery | 3 |
| Other industries | 59 |



The 200 million tons from single use plastics, in addition to the 100 million tons from old plastics totals about 300 million tons of plastic waste every year! And that number rises every year.



Most of that waste ends up in landfills, but over *8 million tons* of plastic ends up in the ocean... every year, and become marine debris!
[CLICK HERE](#) (this is the real science!)

Hold up. How much is 8 million tons anyway? And while we are at it, how much is 300 million tons?



Video 4.10



That is a GREAT question! Often times it's hard to fully visualize and wrap our heads around those big numbers.



If you wanted to count to 300 million, it would take you almost 10 years, non-stop!



There are about 300 million cars in the USA, each weighing about one ton. The world produces that amount of plastic waste each year!



The Empire State Building in New York City weighs about 300,000 tons. So we produce about the same amount of plastic waste as 1000 Empire State Buildings! Seriously, I did the math!



That can't be real...



It's an unimaginable amount of waste (and that's just plastic!)

So what does this mean for all the plastic we use in our daily lives?
Do we just have to stop using every single thing that's made of plastic?





Well, it's imperative to remember that plastic as a material isn't bad. We learned earlier how amazing it can be. The issue here is how **dependent** we have become on this material for nearly every part of our lives. Especially for things that we only use once, then throw away.



Here are some examples of different items made of plastics. **Can you connect them to the approximate length of time a person would use it?** (Multiple answers may be correct)



Outdoor chair



Reusable bottle



Fruit packaging



Water bottle



Pickup truck bed



Disposable tape dispenser



ONE USE



LESS THAN ONE YEAR



A FEW YEARS



UP TO 20 YEARS



A HUMAN LIFETIME



Let's review what we've covered so far:

1. Plastics are one of the most useful materials humans have ever created.
2. Plastics are being used today far more than just 50 years ago.
3. Over 500 million tons of plastic are made each year.
4. Over 300 million tons of plastic are thrown away each year.
5. Plastics can take up to 1000 years to decompose.
6. Waste plastics can give off toxins.
7. 8 million tons of plastic end up in the oceans every year.

So what happens to all of that plastic waste?





We'll answer your question in the next section. For now, I'd like you to write down any questions you have for me. It can be about stuff you don't understand, or anything else!

Questions and things I want to talk about



VOCABULARY

Marine debris

Solid waste

Plastic

Polyester

Nylon

Acrylic

Moldable

Sterilized

Decompose

Ton

Single-use plastic

Dependent

**REVIEW YOUR KNOWLEDGE WITH A
SHORT QUIZ ABOUT PART 3
[CLICK HERE](#)**

notes... drawings... thoughts... ideas...



- PART 4 -

EFFECTS OF MARINE DEBRIS

This part includes:

- ✓ **14** Pages
- ✓ **9** Digital Bus Videos
- ✓ **15** Questions
- ✓ **2** Tangent
- ✓ **1** Research Project
- ✓ **13** Vocabulary Words
- ✓ **1** Quiz

DATE ASSIGNED: _____

DATE DUE: _____

notes... drawings... thoughts... ideas...

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PART 4: EFFECTS OF MARINE DEBRIS



Aloha! Last time we answered the question: "What is marine debris?" Now we're going to focus on how marine debris is affecting the ocean ecosystems. Let's do this!

Sounds good! I'm ready!



We learned last time that about 8 million tons of plastic waste ends up in the ocean every year.



All of that plastic comes from different parts of the world. Although China produces the most amount of plastic, Americans throw away the most. It's easy to point fingers and blame others for problems, but we must remember that it's all **interconnected**.

Can you brainstorm how plastic production in China is directly related to plastic use (and waste) in the USA?

ANSWER:



Experts say that 10% of plastic that is produced worldwide each year will end up in the oceans at one point. [CLICK HERE](#)
By 2050, the weight of all the plastic debris in the ocean will be more than all of the fish! [CLICK HERE](#)



Video 4.11



Take a look at this scientific journal that we saw last time. ([CLICK HERE](#)) I know, it's pretty complicated! Don't forget, this is the real research that the scientists did. This is how scientists share their results with the world, no matter what type of science they do!

Within Table 1, find the USA.

How many kilograms of plastic does the average American throw away each day (ppd means person per day)?

Can you find something of approximately the same weight?



ANSWER:



Americans throw out the most amount of plastic, it's true. And a lot of our plastic waste is actually shipped back to Asia, which adds to the total amount of waste they produce. (We'll talk more about this later).



Check out these three different ways plastic waste can become marine debris:

1. It can be tossed directly into the ocean (either on purpose or by accident)
2. It can be tossed on land and end up in the ocean (either by rivers, wind, or humans)
3. It can be put into **landfills** that poorly contain the waste. (Also called mismanaged landfills)



Not cool guys!



This is the most common way waste become marine debris.



It's important to remember that even when we throw something "away" (in a trash can, or landfill) there is no "away". We are simply putting our trash in a different location.



Here on Maui, trash goes to the landfill in Pu'unēnē. As you can see from this video ([CLICK HERE](#)) and pictures, some of that trash will still end up being blown into the ocean.



These are plastics bags from the Maui landfill that were blown onto the trees. Think about how many didn't get stuck in the trees and made their way into the ocean...



What do you think could be some solutions to prevent this from happening?

ANSWER:



Once plastic does find its way into the oceans, the **currents** will take over. They will then send the marine debris all around the world.

Plastic that was throw out in Japan can end up in California, and plastic that was thrown out in Europe could even end up in Australia!

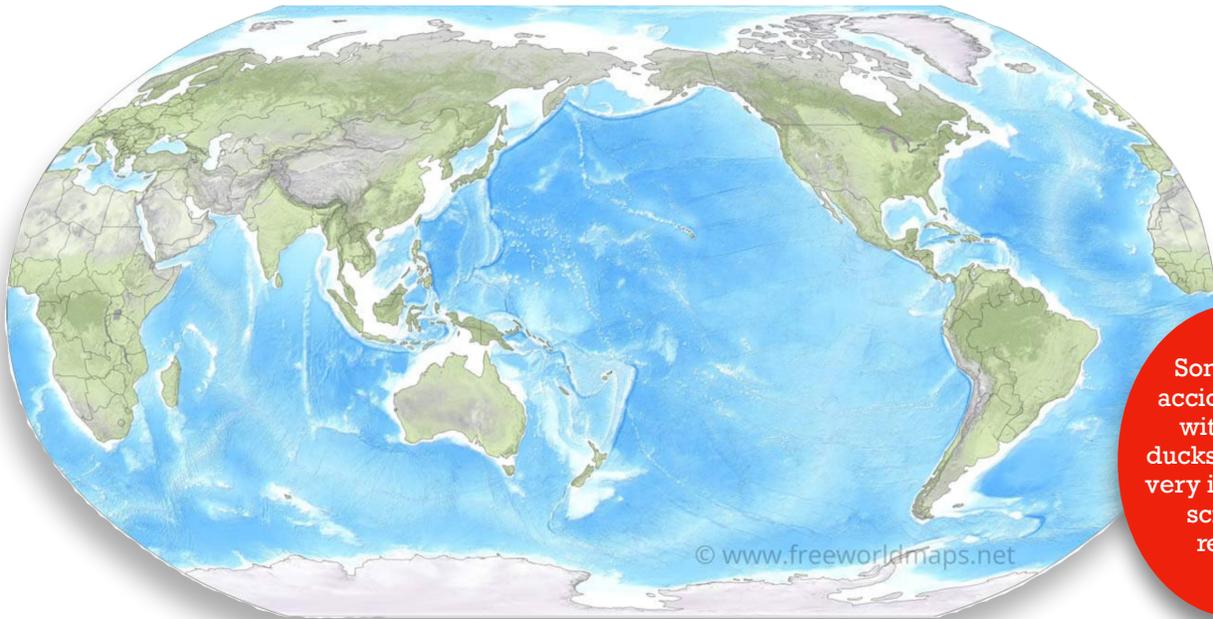


Here is a very crazy story:
In 1992 during a storm, a ship lost a container that had 29 thousand rubber ducks! This gave scientists a unique opportunity to track where they would end up. 30 years later, some are still washing up all around the world!

[CLICK HERE](#)

Can you draw the journey of the ducks on this map?

What are currents anyway?
[CLICK HERE](#)



Sometimes accidents like with these ducks can yield very interesting scientific results!



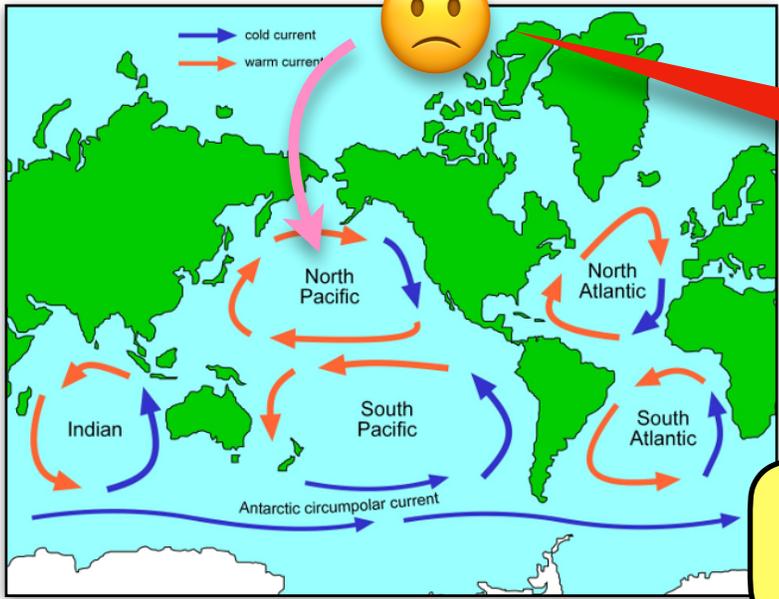
Although the rubber ducks did become marine debris themselves, the silver lining is that it confirmed some scientific models about the ocean currents! [CLICK HERE](#)



Video 4.13



We now know that there are special ocean currents called **gyres**, which are large systems of circulating currents. Marine debris can get stuck in these gyres forming huge **garbage patches**. [CLICK HERE](#)



This is where the North Pacific Garbage Patch is, and since Hawai'i is in the North Pacific, it's one of the reasons we find tons of marine debris on our beaches from the countries that border the North Pacific Ocean.

Can you name at least three of the countries that boarder the North Pacific?

Let's go a little deeper and try to understand more about currents. [CLICK HERE](#)



So currents are circulating millions and millions of tons of marine debris in the oceans... and millions of more tons of debris have sunk to the bottom of the ocean. [CLICK HERE](#)

Check out this resource ([CLICK HERE](#)) and answer the following question:

What are three negative effects of marine debris?

ANSWER:



Video F4.2



Maybe you got the answers, maybe not, no worries! Here is a list of the harmful effects this marine debris can cause:

1. Wildlife **entanglement** ([CLICK HERE](#))
2. **Ingestion** (eating) ([CLICK HERE](#))
3. **Habitat** damage ([CLICK HERE](#))
4. Toxic chemical release ([CLICK HERE](#))
5. **Non-native species** transport ([CLICK HERE](#))
6. Vessel damage ([CLICK HERE](#))
7. Economic loss ([CLICK HERE](#))
8. Human health issues ([CLICK HERE](#))

Let's chat with an expert to get some more info!

I know this can all be super sad and seem like it's just too big of a problem, but don't lose hope! We'll discuss solutions in the next section!

Woah... marine debris causes all those problems?!



Yup!! After you've explored some of those links, can you try to answer these questions?



What is an example of a habitat that is damaged by marine debris?

ANSWER:



Can you name two species that have been transported by marine debris?
Why could this be bad?

ANSWER:



Explain how marine debris can have negative health consequences on humans.

ANSWER:



Although all of these issues are of equal importance, I'd like to focus on two of them for our project: Entanglements and Ingestion.
In your own words, explain "entanglement" and explain "ingestion" and give an example of each.

Entanglement:



Ingestion:



Let's start with entanglements. Many different animals can get stuck and entangled in marine debris. The biggest culprits are the discarded fishing nets, fishing line, and plastic bags.
[CLICK HERE](#)



Humans have been using nets and fishing line for thousands of years, so **why do you think this has become a problem only recently?**

ANSWER:



We discussed earlier that many things are made of plastic that used to be made of different materials. This applies to nets and fishing line too!



Look at this picture of an entangled whale. If it got stuck in a cotton net, **why do you think it would have had a better chance at getting free?**



During the lifetime of our Kupuna, most fishing line and nets went from being made from silk, hemp, cotton, and other plants, to nylon (plastic) today.



ANSWER:



TANGENT: 'Ike Hawai'i
 Fishing is one of the most important resources for Hawaiians. Check out some examples of different traditional Hawaiian fishing techniques! Did you catch what the Hawaiians used for fishing rope and line before switching over to cotton? [CLICK HERE](#) & [CLICK HERE](#)



Video F4.3



Let's chat with Ed Lyman for a bit! Part of his job is to find entangled whales here in Maui and to try and cut them free. It's incredible and can be very dangerous.

What is one thing you'll remember about the work Ed Lyman does?

Check out this video of Ed hard at work before watching the interview! [CLICK HERE](#)



ANSWER:



In addition to whales, many other animals get entangled in our discarded waste.

[CLICK HERE](#)



Let's move our attention to the problems marine debris can cause when it is ingested (eaten).



Many animals will eat plastic either by accident, because there are little creatures living on it, or because the plastic is so tiny that it's now part of their food source.

Can you match the animal with the type of food and plastic they may ingest?

(might be more than one)



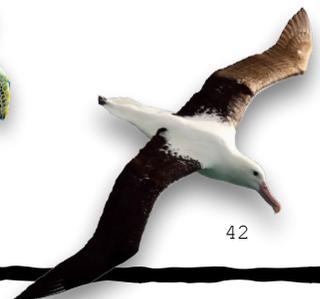
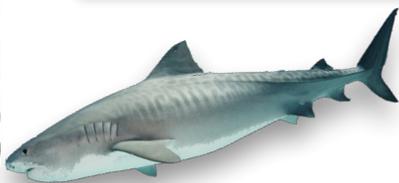
Macro-plastics



Small plastics



Micro-plastics



Click on the pictures for more information.



Video 4.14



Micro-plastics or microscopic sized plastics, are causing quite a stir right now. We're finding out some shocking conclusions about how bad these can be. Not only for wild animals, but for our health as well, going so far as altering human DNA! [CLICK HERE](#). Micro-plastics have even been found in rain. [CLICK HERE](#) and [CLICK HERE](#). And in the lungs of people! [CLICK HERE](#). I'm not going to go in too much detail here, but below is a bunch of information about the topic. If you have time, you should look into it.

Micro-plastic resources

[CLICK HERE](#) & [CLICK HERE](#)



Each of those animals on the previous page are worth studying further; I'd like to focus on birds. More specifically the Mōlī (in Hawaiian), or **Albatross** (in English). [CLICK HERE](#)



Can you list some unique characteristics of birds? (What makes a bird... a bird?)

ANSWER:



The Mōlī is an incredible bird! It's the bird with the longest wingspan of any bird. Some can have up to a 12 feet (3 meters) span! Find a tape measure and figure how long that is! [CLICK HERE](#)

TANGENT: Math (and History)

Units are very important. It's the only way to be able to understand what measurements we are discussing. If say something is "12 long", you wouldn't know how long it is until I add the unit. In this case, 12 feet.

There are many different types of units. In the USA we use the Imperial system: feet, inches, miles, pounds, etc... But nearly all other countries and all scientists (even in the USA) will use the metric system: meters, kilometers, kilograms, liters, etc... Check this out these links to understand the differences, and to see why the metric system may actually make way more sense! [CLICK HERE](#) & [CLICK HERE](#)

There are seriously birds that have wings that big!?



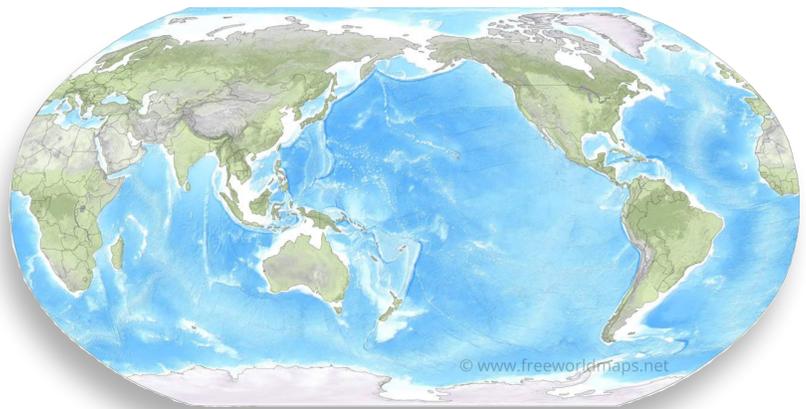
Totally! They use those huge wings to fly incredible distances. I'm talking about thousands and thousands of miles to go search for food. Remember this map of the world? Many Mōlī have been tracked flying from Hawai'i all the way to Alaska and back to Hawai'i!

[CLICK HERE](#) for information about these birds.



Find Hawai'i and Alaska on the map, draw a line, and try to calculate how many miles my round trip journey takes!

ANSWER:



These birds do something else that is very interesting and very important in regards to our project (and kind of gross).

Young Mōlī before fledging (leaving the nest) and adults, will **regurgitate** all of the undigestible material in their stomach. It will come up looking like a thick brown tube. [CLICK HERE](#)

Uhhh, that looks like a piece of poop.



You're totally right! But it's important to remember that it isn't! Poop is all the material that is left over AFTER it passes through the entire digestive system. This has only gone to the stomach and back up.

Still looks super gross



Here are some scientific journals of real experiments conducted by the expert biologists who are studying the Albatross. It's just for you to see, it can get pretty complicated!

[CLICK HERE](#)

[CLICK HERE](#)

[CLICK HERE](#)

I agree, but often time biologists can learn a lot of important information from the gross stuff that animals threw up or pooped out. This is no exception!

This thing that the Albatross will regurgitate is called a **bolus**. Let's rewind to see what has to happen before the bird produces a bolus:

From the time it was hatched as a little chick until it's ready to leave the nest, mama bird fed its chick by regurgitating different things it had eaten on its food searches. [CLICK HERE](#)

It's mostly fish and squid. However, mama bird will also end up eating a lot of plastic pieces. Either by accident or thinking it was actually food.

They will then transfer all of this to the baby bird: Fish, squid, and plastic pieces.

Little by little fish bones, squid beaks, and plastics accumulate in its stomach. At some point there is so much there that it has to get rid of it, so it will start coughing and eventually produce a bolus!



Before you watch a video on all of this, I have a question for you:

What do you think the scientists (and us) can learn from studying and observing these boluses?

ANSWER:





Let's watch a video to make sure all of this information is nice and clear.
[CLICK HERE](#)



Without looking back, can you explain in your own words:
What is a bolus?

ANSWER:



It's shocking to think that the birds that were able to produce a bolus were the lucky ones: they got most of the plastic out of their bodies.
Thousands and thousands of baby Mōlī aren't so lucky. Either the plastic bits are sharp and puncture their organs, or the plastics get stuck while trying to regurgitate, or the bird stop eating because their stomach is full of plastic. Sadly if this happens, they won't survive.
[CLICK HERE](#)

CAREFUL!
The video to the right shows some very sad clips of dying and dead birds. Only watch if you are prepared for it.



Video F4.4



Let's chat with someone who has had first hand experience with the albatross in the Northwest Hawaiian Island. Page 49 has a few questions I'd like for you to answer about this interview.

Ok, sounds good!



Video 4.15



I have another video for you. I have a real albatross bolus that I'd like to show you! We're going to get a first hand view at what is inside!

A real one?! This sounds like it's going to be gross.



Not that gross at all! Continue answering the questions on page 49 after you've watched the video!



Time for another research project. Now that I've shown you a bunch of animals, I'd like for you to pick ONE that is affected by marine debris and collect some facts about it!

Research Time!

1. From all the recourses I shared with you, pick one marine animal that you'd like to focus on.
2. Find some facts and information about the animal (where it lives, its diet, size, reproduction, etc...).
3. Figure out how marine debris is affecting it (what kind of debris, where it's happening the most, etc...).
4. Figure out if it's negatively affected by other kinds of pollution (go back to the introduction of this project to remind yourself of the different pollutions).
5. Take all of your research and put in on a big cardboard, paper, or digital presentation to share with your class, family, or me!

Learning about all of this can be very hard sometimes, especially when seeing all the dying and suffering animals.



Video 4.16



I know a lot of this information can be very sad, emotional, and even depressing. The goal here is not to feel guilty about what humans are doing. The goal is to learn, so we can be productive.

It's easy to become overwhelmed by how big this problem is and even feel helpless. But every little thing we do can make a difference. What I shared in this section is important, but the solutions and decisions we come up with are even more important!

This makes me so sad, and angry... and... I don't even know what to think. The problem just seems so huge.



So what do we do about all of this? That'll be for the next section. For now, I'd like you to write down any questions you have for me!

Questions and things I want to talk about



VOCABULARY

Interconnected

Landfill

Currents

Gyres

Garbage patch

Entanglement

Ingestion

Habitat

Non-native
species

Micro-plastics

Albatross
(Mōlī)

Regurgitate

Bolus

**REVIEW YOUR KNOWLEDGE WITH A
SHORT QUIZ ABOUT PART 4
[CLICK HERE](#)**

Albatross (Mōlī) Questions: INTERVIEW

1. What island did Zach work on? (Can you go find it on a map??!)

2. What is causing the albatross to be unable to run and take off flying?

3. What was an example of marine debris that Zach found inside a bolus?

Albatross (Mōlī) Questions: BOLUS

1. Observe the intact bolus from the video and describe it in detail.

2. Observe the dissected bolus from the video and describe its contents in detail.

3. Count the number of prey items, and the number of non-prey (debris) items.

TOTAL PREY ITEMS

TOTAL NON-PREY ITEMS

4. Calculate the percentage of prey items to non-prey items.

5. If we dissected a bolus from 100 years ago, explain what the differences may be to the one we dissected today.

notes... drawings... thoughts... ideas...



- PART 5 -

MOVING FORWARD WITH SOLUTIONS

This part includes:

- ✓ **16** Pages
- ✓ **9** Digital Bus Videos
- ✓ **17** Questions
- ✓ **3** Tangent
- ✓ **2** Research Project
- ✓ **12** Vocabulary Words
- ✓ **1** Quiz

DATE ASSIGNED: _____

DATE DUE: _____

notes... drawings... thoughts... ideas...

Mālama Honua: To Care for the Earth

— Marine Debris & Global Change—



PART 5: MOVING FORWARD WITH SOLUTIONS



Video 4.17



Hi again, in the last section we talked about all of the negative effects of marine debris. Now it's time to figure out what must be done.

Solutions here I come!



Video F4.5



I think the most important thing to start off with is this:

It will take a lot of work. From everyone. These problems will not be solved over night. It will take time and patience. The longer we wait to start on solutions, the bigger the problem will become.

Let's talk with a college student and chat about why she decided to focus her education on these issues.



Before I share information with you and we discuss what folks are doing to help this issue, **are there already some solutions to the marine debris problem that you can come up with?** Nothing is too far fetched or silly!!

ANSWER:





I have a few questions!

1. Why can't we just burn all the waste/debris/plastics?

2. Why can't we just put it in a rocket and send it off to space?

3. Why can't we just burry it all underground?



Those are actually some really good questions, can you answer those? To start off our discussion about solutions, let's think about this:



Let's say humans successfully pick up all of the marine debris on beaches and everywhere in the oceans. **Can you explain why this is only one part of the solution?**

ANSWER:



I like using an analogy here: If you need to clean up the water from a leaky faucet, you HAVE TO TURN OFF THE WATER! Or else, you'll be cleaning up forever!



Conclusion: As long as we humans are using and throwing away more waste (especially plastic) than we can clean up, this problem will keep getting worse and worse.



Finally! It sounds like there is a solution here!! I think I know what it could be. Do you?

So the goal is to throw away less!



In its simplest term, yes!

So we just need to recycle!! Problem solved!



Video 4.18



Hold on a second! Not quite... **Recycling** is good (when it's done right), but it is NOT as good as we have come to believe.



Recycling does help in many ways and it's always better to recycle plastic than to throw away in the trash. But a lot of the things we think are being recycled don't end up being recycled at all. And even if it is recycled, we can't forget that the process takes a lot of energy. ([CLICK HERE](#) for an in-depth look at recycling problems)

What do you mean it doesn't end up being recycled?



Well, let's pretend you just finished drinking water from a plastic single use bottle. You decide to put the bottle in the recycling instead of the trash. Good job!
This bottle will then go on to the county recycling center. Here in Hawai'i we don't have the machines that can process the plastic and turn it into new plastic, so... Hawai'i will ship and sell its recycling off island!

People are going to buy our old plastic bottles?!



Yup!

Can you think of some reasons why people would buy old plastic bottles (and other trash)?

ANSWER:



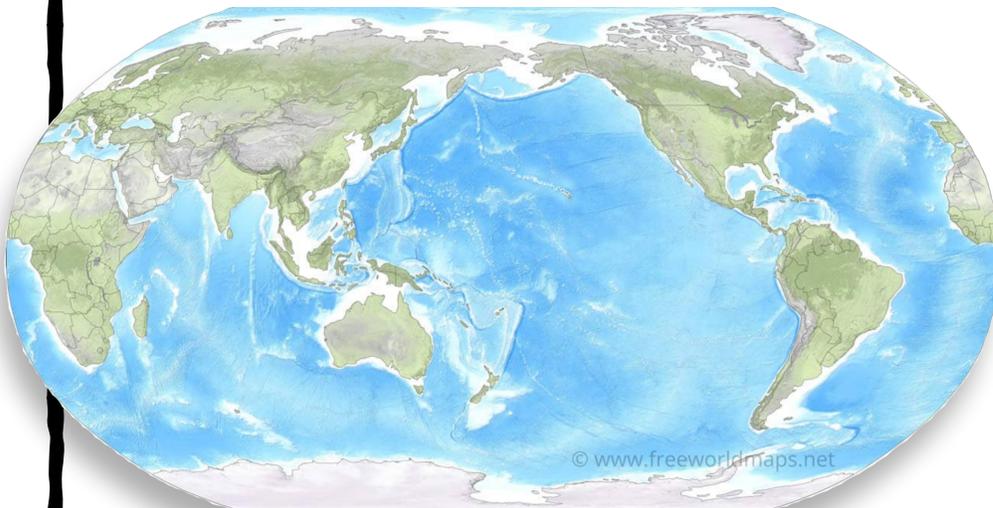
So now your **discarded** water bottle will be shipped to whomever purchased it: Either another state or, most likely, another country.

Since countries like the USA and those in Europe produce so much waste (and recyclables), there is too much for it to all be processed within their countries, most of it is sold to other countries.

[CLICK HERE](#)



At this point, the plastic bottle is now on a big ship (that uses a lot of fuel) from Hawai'i to some other place in the world.



Here is our world map again. Can you figure out your plastic water bottle's journey from Hawai'i to Indonesia? And what if a student in England discards a bottle, what might its journey be?



China was the primary buyer of plastic until 2018 when they put strict rules on what types of plastic were allowed in their country. This meant the US and others started selling to other countries, most of which do not have enough space or the **infrastructure** to process it. Therefore, a lot of the recyclables ends up getting burned or are left in huge, unmanaged piles that can become marine debris.

Wait. BURNED?! We just said that's not a solution!!!



It's not a good solution at all. It creates tons and tons of air pollution. But it's still being done in the USA and all around the world.



Can you see now how this is a global problem? Although we see a lot of plastic pollution originating from Asian countries, a pretty big portion of that plastic can actually be waste shipped over there from Europe and the USA.



Of course some of the recyclables are effectively recycled and turned into something new. However, we must realize that this process takes an enormous amount of energy: The plastic needs to be collected, transported (sometimes thousands of miles), cleaned, chopped up, melted, then formed into new products.

For many companies, it's just not worth it and it's just cheaper for them to make new plastic, even if that means adding to the global waste problem.

TANGENT: Math

Let's graph! Yes, again! In a previous section you practiced making a bar graph, this time we'll try a line graph. [CLICK HERE](#) for the data about how much plastic was produced each year starting in the year 1950. The graph will give you a good visual to understand how much more plastic the world currently produces.

[CLICK HERE](#) to learn how to create a line graph. Don't forget to include a title, labels, units, and colors!



Even if recycling goes smoothly, plastic can only be recycled a few times before the material loses integrity and strength and can no longer be used. And don't forget: Most of the energy needed comes from power plants that are producing lots of air pollution.



Believe it or not, there is still a lot of uncertainty about what happens to all the recyclables from Hawai'i once they are sold around the world. [CLICK HERE](#)

So should I just not recycle??!



You absolutely should! I think we should go check out how recycling actually works so we can understand the other options that may be even better than recycling.



Video F4.6



Answer these questions about the video!

What place did we visit?

What is the mission of this organization?

Name the steps and machines needed for this operation.

What are some challenges to this process?

What is one thing you'll remember about this visit?



Although there are better options than recycling, it **MUST** be a part of the solution. It's pretty cool to it in action right here in Maui!

It gives me hope that awesome people are working hard to find solutions!



We can confidently say that recycling is better than throwing away. But, all this information shows us that recycling shouldn't be the ultimate goal. Something else should be our goal.

Do you know what that could be?

ANSWER:



Let's listen to Jack Johnson's famous song, maybe that will help you get the answer if you didn't already get it!

[CLICK HERE](#)



Better than recycling is **reusing**! This means, instead buying/using things with the intent of throwing it away or recycling it, we buy/use things with the intent of reusing them.



Whenever you reuse something instead of buying something new, you are effectively **reducing** how much new material is being used.



The most common example is the water bottle! If we use a reusable bottle instead of single use bottles, we are effectively reducing our use of plastic.

This seems like it would be really difficult!



To do it for everything, yes it would be! But that doesn't have to be the goal right away. If everyone reused and reduced twice as much as they already do, it would make a big difference!

Can you give me an example of something that is doable? Other than the water bottle example?





Video 4.19



Sure! Let's take a T-shirt for example: A friend of mine has a T-shirt that I really love, but they don't want it anymore. They've only worn it a few times, so it's in great condition. Instead of throwing it away, they give it (or sell it) to me!

So I've now re-used something by getting a used shirt instead of a new one. Let's say I wear it so much that there are now holes in it. It's now appropriate to recycle the shirt. And if I absolutely can not recycle it, the last option is throwing it away.



Can you think of other examples to reuse?

Maybe one that you already do, or some that you'd be willing to try:

ANSWER:



Video 4.20



This entire process actually has a name! This is called the **waste hierarchy**.



Right now, most of the world uses the "Landfill" and "Recover" levels, which is why the marine debris problem (among others) is so big.

Can you help spread the word that the "Recycle" level isn't our ultimate goal? Let's try to get more people to understand what the "Reuse" and "Reduce" levels are really about!

With your help, I know we'll be to achieve amazing results!



If we really want to enact change, you and I (the consumers) must demand change! The best way to do that is by trying our best to not use items that will go directly into the landfill after one use. Especially if it's plastic. [CLICK HERE](#)



Time for another little research project!



1. On an average day, list five single use plastics that you [or your family, friends, etc...] used then recycled or threw away.
2. Explain how each item made the task it was used for more convenient for you (or whomever used it).
3. Figure out what it would have to be replaced with in order to shift the task from single use plastic to something reusable.
4. Talk with your teacher or parents to determine what the difficulties, changes, or extra work this would create.
5. If possible, pick one of the five to try to replace with a reusable option for one day.
6. Discuss your findings with your class, your family, and with me!



So why don't we just reuse and reduce everything...

Hopefully that little research project shed some light on the reasons why it can be tough to stop using single use plastics.



It's very convenient to be able to buy things in single use containers and packaging: There is no mess and it's safely packaged.

Honestly, sometimes I end up reaching for them too in the store. So, in short, we (you and I, and the big companies, and the governments, and everyone) may have to sacrifice some convenience in order to make a difference.

[CLICK HERE](#)

Don't feel guilty about not being about to do everything all at once. Don't stress about it! Do your best, and make conscious choices to improve things, even if it's little by little.



And so the question is: Is it worth it?? Is the convenience of single use plastics, packaging, etc... worth the damage it is causing to us and to the planet?



I'd like to you brainstorm and discuss with your class why some people would say: "no, single use plastics are not worth the harm they cause" and why some people would say: "yes, single use plastics are worth the convenience even if it's bad for the planet".

And maybe even more importantly, why so many people end up doing this:

Agreeing that the convenience is NOT worth it, but still end up using single use plastics a lot.



ANSWER:



We should never judge or make someone feel bad for using single use plastics: Maybe they haven't been taught about the problems, or maybe they don't know what alternatives exist. It's up to us to be empowered to share our knowledge, and try our best at getting these messages across to others in a productive way.



Video 4.21



Something that is helping us move away from single use synthetic plastics are the inventions and implementation of plant-based plastics, like **biodegradable** food containers. Although these are a lot better, they come with their own set of problems too, however. [CLICK HERE](#) & [CLICK HERE](#)

Synthetic plastics are still the cheapest options (for now), and many people and businesses may not be able to afford alternatives. So it's important to be aware of all these limitations when discussing this issue.



We've established that the biggest solution is to reduce the amount of plastics (and other materials) we use. This will ultimately reduce the amount of trash thrown out, thereby reducing the amount of debris that ends up in the oceans.

If we, as a population, can reduce our plastic waste, it will be a great advancement.

But now we're left with the other part of the problem. How do we clean up the oceans of marine debris? **Any ideas?**

ANSWER:



Video F4.7



Let's look at some efforts that are happening around the world!

We'll start here in Hawai'i and chat with Lauren Blickley of Surfrider Foundation!



Lauren and the team at Surfrider are doing amazing work, and they aren't the only ones! Something that takes place often and that everyone can do are **beach cleanups**! We helped in a beach cleanup in a previous video! Are beach cleanups going to solve the entire problem? No... but they are absolutely a part of the solution.

There are a bunch of different ways to get involved in local cleanups. [CLICK HERE](#) and [CLICK HERE](#)

But you can also do this on your own! You be the leader! Organize some friends and family to join you at a beach to help pick up marine debris!

There are organizations on Maui that will provide you with all the supplies you need to lead your own beach clean up!

— FOR FREE —

[CLICK HERE](#)
and
[CLICK HERE](#)



That sounds like something I could lead! Maybe I could even share it on my social media (if I do that kind of thing).



When you lead your clean up, make sure you use an app like this one to share all the data from your event with the scientists! [CLICK HERE](#)



There are also groups of people that work together to clean up entire islands! Every month the folks at Kaho'olawe Island Reserve Commission (KIRC) travel to **Kaho'olawe** and do huge clean ups!
[CLICK HERE](#)

TANGENT: 'Ike Hawai'i & History
 Kaho'olawe is one of the main Hawaiian Islands. It's part of Maui Nui. For many decades now, there has been no permanent human population. It is actually illegal to go to the island unless you are with one of the restoration groups or cultural groups. Can you find out why is it forbidden to go to the island, and more importantly, why Kaho'olawe is so important to the Hawaiian people?
[CLICK HERE](#) & [CLICK HERE](#) & [CLICK HERE](#)



When people work together, they can achieve amazing things! Check out this guy from India, and the efforts he led. [CLICK HERE](#)
 Or these YouTube guys that came together for this cause. [CLICK HERE](#)



This guy, [CLICK HERE](#), came up with his idea while in middle school! People didn't take him seriously at first, but he carried on and founded one of the leading ocean clean-up organizations!
[CLICK HERE](#) and [CLICK HERE](#)



Scientists and engineers are constantly inventing incredible new technologies to help clean up the oceans! Here are just a few:



Mr. Trash Wheel
 (Baltimore, MD)
[CLICK HERE](#)



The Interceptor
 (Multiple locations worldwide)
[CLICK HERE](#)

No idea is too silly or far fetched to be considered! If you have an idea, research it, figure out how it could work but also why it might not work. Share your idea with friends and look at the pros and cons and decide if it's worth exploring further.
 You got this!



Those are just two examples. There are a lot of different organizations that have been developing innovative ways to collect plastic waste from the **waterways**. Here are a few more:

[CLICK HERE](#) & [CLICK HERE](#)

For a complete list of all the different ones, look on page 6 to 9 of this article. [CLICK HERE](#)



Time for another research project! Let's see what you can invent to help collect small plastics in a beach cleanup.

Research Time!

1. You'll need to brainstorm what type of plastic you'll encounter at your local beach.
2. Using equipment that is easily available, devise a tool that will help you collect small pieces of marine debris from the beach.
3. Remember that you only want to collect marine debris, not rocks or other natural materials.
4. Take you time to build and test your tool.
5. If possible take your tool to the beach and test it out!
6. Share your invention with your classmates and family, and don't be afraid to ask them for suggestions! Remember, we'll all have to work together to solve this problem.



Hopefully you'll be able to participate in a beach clean up to test out your inventions!

Yeah, me too! Crossing my fingers that we can all do a field trip together!



Great! Ok, so we have some amazing technology being developed and we know what we can do as individuals. There is one more piece to the puzzle of solutions: **Industries** and **governments**.



Some are already taking a lead on this! Hopefully other governments and big companies will get onboard soon!

In order for all of these solutions to work, everyone must work together:

The big companies (and industries) of the world also have to start focusing on ways to reuse, reduce and implement alternatives to single use plastics, just like you and I. [CLICK HERE](#)

And it's also up to the governments of the world (at international, national, and regional levels), to put measures into place to ensure certain plastic usage are enforced and regulated, as well as having adequate means of disposal and recycling.



Here on Maui, the local government made the decision in 2011 to ban plastic grocery bags. [CLICK HERE](#) Can you figure out what new law went into effect March 1, 2022 here in Maui?

ANSWER:



Until just a few years ago, a lot of cosmetics had micro-plastic beads as an ingredient. That has now been banned by governments in the USA and many European countries. [CLICK HERE](#)



Video 4.22



Companies are also making progress. For example, there is a company that makes water filters that decided to make sure all their packaging is biodegradable!



So it's totally possible to move away from single use plastic in packaging! For now it's more expensive to produce, but as demand increases, the price will decrease!

Other companies are the ones inventing these new biodegradable **alternatives** to plastic packaging using plants or even mushrooms! [CLICK HERE](#) (YouTube required to watch)

Some companies are promoting trading old unused clothes for other used clothes instead of buying new. [CLICK HERE](#)



It seems like many people, companies, and some governments seem to be on the right track, which is great!

But there is a lot more work that needs to be done. People may not agree what the best ways are to solve these problems, but there are some things we can definitely all agree on.

Can you come up with a few things about marine debris (and other pollution) that everyone could agree on?

ANSWER:



TANGENT: Reading and Writing

How could you share this information to students that are much younger than you? Stories are one of the best way to communicate an idea or information! Using all the information you've learned in this project, can you write a fun short story about marine debris and some of its complications? Maybe your story is from the perspective of an animal we talked about, or from a piece of plastic, or maybe it's something entirely different!

If you like drawing, include those! Maybe you can work on it with a friend, and hopefully you can share your story with a student (or a friend or relative) that is younger than you!



Video 4.23



- Throughout this section we discussed many different solutions to the marine debris issue:
1. Reducing our waste production.
 2. Removing debris from the oceans, waterways, and beaches.
 3. Inventing new, alternatives to synthetic plastics.
 4. Ensuring big companies and governments are doing their part.

All of these solutions to the marine debris problem are also solutions to other problems, climate change being one of them! For example, by reducing our consumption of plastic, we'd also be reducing the amount of oil is used, thereby reducing atmospheric pollution. So it's a win win!

So many of these solutions are totally in my power, awesome!





That's it for now! We'll cover some final thoughts in the conclusion section. In the mean time, do you have any questions for me?

Questions and things I want to talk about



VOCABULARY

- Recycling
- Discarded
- Infrastructure
- Reusing
- Reducing
- Waste hierarchy
- Beach cleanup
- Biodegradable
- Waterways
- Industries
- Governments
- Alternatives

**REVIEW YOUR KNOWLEDGE WITH A
SHORT QUIZ ABOUT PART 5
[CLICK HERE](#)**



- PART 6 - CONCLUSION

This part includes:

- ✓ **10** Pages
- ✓ **2** Digital Bus Videos
- ✓ **22** Questions
- ✓ **51** Vocabulary Words (from all parts)
- ✓ **1** Quiz

DATE ASSIGNED: _____

DATE DUE: _____

notes... drawings... thoughts... ideas...

Mālama Honua: To Care for the Earth

— Marine Debris & Global Change—



PART 6: CONCLUSION



Congratulations! You have completed all the lessons. Now it's time to wrap it up with a little conclusion and make sure you remember some of this information. Here is a great little video that reviews a lot of the information we covered.

[CLICK HERE](#)

I got it! No problem!



Before you start this conclusion, you should look back at all your lessons and your research, and check out the vocabulary lists on the next page. I'm going to ask you a bunch of stuff.

You can use this space for some notes you might have, concepts you are having trouble with, or questions you still have.

NOTES



VOCABULARY

Geography
Ecosystem
Pollution
Pollutants
Interconnectivity
Global change
Climate
Composition
Acidity
Weather patterns
Currents
Honua
`Āina
Mālama Honua

VOCABULARY

Marine debris
Solid waste
Plastic
Polyester
Nylon
Acrylic
Moldable
Sterilized
Decompose
Ton
Single-use plastic
Dependent

VOCABULARY

Interconnected
Landfill
Currents
Gyres
Garbage patch
Entanglement
Ingestion
Habitat
Non-native species
Micro-plastics
Albatross (Mōlī)
Regurgitate
Bolus

VOCABULARY

Recycling
Discarded
Infrastructure
Reusing
Reducing
Waste hierarchy
Beach cleanup
Biodegradable
Waterways
Industries
Governments
Alternatives



From this long list of vocabulary, pick one term that you didn't know before this project and write a sentence using it!

ANSWER:





In your own words, explain pollution.

ANSWER:



List five different types of pollution.

ANSWER:



In your own words, explain global change (in the context of this project).

ANSWER:



Explain some benefits of plastic.

ANSWER:





Explain why plastics are now used more than any other material.

ANSWER:



What are three sources of plastic that most commonly turn into marine debris?

ANSWER:



How much plastic is produced every year? And how much turns into waste? (approximately)

ANSWER:



Will a wooden box decompose faster or slower than a plastic box? Explain why.

ANSWER:





How is the plastic waste problem in Asia directed related to the amount of waste produced in the USA and Europe?

ANSWER:



What waste management system contributes the most to the marine debris issue?

ANSWER:



What are the big circulating ocean currents that trap tons of marine debris called?

ANSWER:



Give an example of an animal that could be at risk of entanglement and of ingesting marine debris.

ANSWER:





People that eat large quantities of oysters, clams, and mussels are at a higher risk of eating lots of micro plastics. Explain why.

ANSWER:



If we compared a bolus from a Mōlī chick from 100 years ago to one from today, what differences would you expect?

ANSWER:



Rank these in order from most preferable to least: Rubbish, Reusing, Recycling, Reducing

ANSWER:



What is one solution to the marine debris issue that is already being implemented that you remember discussing?

ANSWER:





Explain the different steps that could happen to this water bottle once EM-J tosses it into the recycling.



1. Tossed into the recycling bin

2.

3.

I'll use a reusable bottle next time!

5b. Recycled into a new product

5b.

5a.

4.



On the diagram above, write the words "TAKES ENERGY" at every step that takes some kind of machine to complete the task.



Of all the single use plastics that are used every year, **how much of it actually gets recycled?**

ANSWER:



Now that we've discussed this issue in depth, I'll ask you this question again: **What is the one solution that you think would best tackle the marine debris issue?**

ANSWER:





You know, we hear a lot from the experts about why this issue is so important. But what about other people? I thought it would be interesting to ask some people, who are not scientists in the field, why this issue is important to them.

In the next video Dav talks story with Tavana Mcmoore, a musician. Check out this awesome song he wrote before watching the interview! [CLICK HERE](#)



Video F4.7



These people all live in Hawai'i, hold various different professions, and they all think the marine debris issue is important. Let's hear what they have to say.



Now it's your turn! There is no right or wrong answer here:

Is the issue of marine debris one that is important to you? If so, can you please explain why?

ANSWER:



Thanks for sharing!
We know that in order to solve this problem, it will take effort and commitment from everyone, everywhere. **If you agree, are you ready to make a pledge and to share how you will do you part?**



The next page is blank. Use it to draw, write, color, anything... This is YOUR PLEDGE!! Be creative, think, take you time.

**Everything you can do will help.
YOU make a difference!**

MAHALO NUI LOA
for your pledge!

Take a pic of you holding up your pledge
and share with your class, family,
friends and Kumu Dav!



My Pledge



Thanks for sharing!



It's time to wrap it up! Remember those five questions you answered at the start of this project? Now that you've learned about these issues, you can try those questions again!
[CLICK HERE](#)
It'll show you the correct answers this time after you're all done!



Video 4.24



Congrats, you are done! Great job. I hope you learned something new and had fun joining me on this project. If you've completed everything, your teacher will have a little something to give you from me!



Woohoo!
Thanks for letting me tag along, see you next time!!

Hope to see you soon
for another Digital Bus
project!
A Hui Hou,
Dav



The mission of The Digital Bus is to encourage interest in science and technology among the underrepresented student populations in grades K-12. Currently operated by The Maui Economic Development Board (MEDB), a non-profit 501(c)3, The Digital Bus program serves as part of the organization's educational outreach goal to expand the next generation of leaders and scientists capable of developing and supporting critical technologies for the future. We offer a state of the art mobile learning platform, field-based science projects, and interactive virtual lessons to K-12 students that incorporate technology & culture.

This hardcopy workbook is designed to be used in tandem with the digital version, which allows access to video and resource links.

Please feel to contact us with any questions:

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