

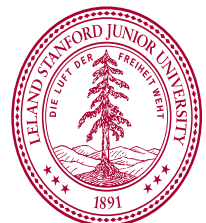
UNIT 4

Using Engineering & Technology to Sustain Our World

How are humans harming Earth, plants,
and animals, and what can we do about it?

SCALE

Stanford Center for Assessment,
Learning & Equity



8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Culminating Project

Unit Essential Question: *How are humans harming Earth, plants, and animals and what can we do about it?*

Challenge

Human overpopulation may be a huge problem, but it is not hopeless. Throughout this unit, you will learn about technologies we might be able to use to help monitor or lessen the effects of human overpopulation and excess resource consumption. As a group, you will choose one of three solutions to research: solar energy, ocean wave energy, or satellite image monitoring. Based on your research, your group will create a scientific poster to present arguments and counterarguments at a Resource Conservation Conference. After evaluating each other's ideas at the conference, you will individually write a letter to an environmental non-profit organization, recommending which solution they should put their funding towards and explaining why.

Group Project Criteria for Success

Your poster presentation should:

- Define the problem Earth faces, by describing the multiple cause-and-effect relationships involved
- Describe your solution
 - Explain how it works, in terms of waves and energy
 - Diagram how it works, showing and labeling characteristics of the type of wave used
- Present arguments and counterarguments that support and refute the solution
 - What do people say about the benefits of this solution?
 - What do people say about the limitations or disadvantages of this solution?
 - How can you respond to each of these counterarguments?
- Practice good oral presentation skills, such as:
 - Clear voice
 - Consistent eye contact
 - Reference to visual aids (on your poster)
 - Equitable speaking time between team members
 - Logical organization



<http://thienissues.blogspot.com/2014/08/you-are-not-alone.html>

Individual Project Criteria for Success

Your letter to the environmental non-profit organization should:

- Define the problem Earth faces
 - What are the criteria of success in solving the problem?
 - What are the constraints that could limit solutions?

- Construct an argument to convince the reader why this problem matters
 - What is harming Earth?
 - Describe the multiple cause-and-effect relationships at work.
 - How can you use natural selection to explain and predict why these changes to environment also affect organisms? Support with evidence and reasoning to describe this relationship between environment and traits.

- Describe the three solutions presented at the Resource Conservation Conference:
 - Ocean Waves Energy: draw and compare at least two mathematical wave models to explain how the characteristics of different ocean waves might affect the energy that can be transferred from the ocean wave to the energy-capture devices.
 - Solar Energy: draw a model to explain all the different wave interactions involved in solar radiation in order to explain how light waves from the sun can be used for energy in solar panel technology.
 - Use labels to identify the different types of wave interactions.
 - Use captions to describe the properties of the clouds, the air, and the solar panels, which affect how the wave behaves.
 - Satellite Image Monitoring: Make a claim for what type of signals has the best structure to communicate satellite images. Combine information from the texts, videos, and pictures in Task 5 to explain why.

- Evaluate the three solutions and recommend one solution to be funded. In your evaluation, include:
 - Why the solution you chose should be funded over the others.
 - How well the solution you chose meets the criteria and constraints of the problem.

Letter Peer Review Feedback

Complete after you have a full first draft of your letter to the environmental non-profit organization.

Letter Owner's Name	
Letter Reviewer's Name	

Review the following sections of the Letter:

- Define the problem Earth faces
 - What are the criteria of success in solving the problem?
 - What are the constraints that could limit solutions?
 - Positive Comment:
 - Constructive Comment:

- Construct an argument to convince the reader why this problem matters
 - What is harming Earth?
 - Describe the multiple cause-and-effect relationships at work.
 - How can you use natural selection to explain and predict why these changes to environment also affect organisms? Support with evidence and reasoning to describe this relationship between environment and traits.
 - Positive Comment:
 - Constructive Comment:

- Describe the three solutions presented at the Resource Conservation Conference:
 - Ocean Waves Energy: draw and compare at least two mathematical wave models to explain how the characteristics of different ocean waves might affect the energy that can be transferred from the ocean wave to the energy-capture devices.
 - Solar Energy: draw a model to explain all the different wave interactions involved in solar radiation in order to explain how light waves from the sun can be used for energy in solar panel technology.
 - Use labels to identify the different types of wave interactions.
 - Use captions to describe the properties of the clouds, the air, and the solar panels, which affect how the wave behaves.
 - Satellite Image Monitoring: Make a claim for what type of signals has the best structure to communicate satellite images. Combine information from the texts, videos, and pictures in Task 5 to explain why.

- Positive Comment:

- Constructive Comment:

- Evaluate the three solutions and recommend one solution to be funded. In your evaluation, include:
 - Why the solution you chose should be funded over the others.
 - How well the solution you chose meets the criteria and constraints of the problem.

- Positive Comment:

- Constructive Comment:

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

3-Dimensional Individual Project Rubric

Overview: The following rubrics can be used to assess the individual project: a letter to an environmental non-profit organization. Each rubric is aligned to one section of the *Individual Project Criteria for Success*, located on your Culminating Project Student Instructions. Use these rubrics to see if you are doing your best work on your individual project.

Rubric 1: Student defines the problem Earth faces and identifies criteria and constraints to solving this problem

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately or incompletely defines the problem Earth faces and/or identifies irrelevant criteria and constraints.	Student accurately, but generally defines the problem Earth faces and identifies relevant criteria OR constraint(s).	Student accurately and completely defines the problem Earth faces and identifies a relevant criterion and constraint.	Student accurately and completely defines the problem Earth faces and identifies multiple relevant criteria and constraints to solving this problem.

Rubric 2: Student explains what is harming Earth, identifying causes and explaining the chain of cause-and-effect reasoning.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately explains what is harming Earth.	Student accurately explains what is harming Earth, identifying one cause and explaining a partial chain of cause-and-effect reasoning.	Student accurately explains what is harming Earth, identifying multiple causes and explaining a partial chain of cause-and-effect reasoning.	Student accurately explains what is harming Earth, identifying multiple causes and explaining the complete chain of cause-and-effect reasoning.

Rubric 3: Student explains and predicts why recent environmental changes will affect organisms, using evidence and the cause-and-effect relationship of natural selection to support their explanation.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately explains and predicts why recent environmental changes will affect organisms.	Student generally explains and predicts why recent environmental changes will affect organisms, using no evidence AND/OR no cause-and-effect relationship of natural selection to support their explanation.	Student partially explains and predicts why recent environmental changes will affect organisms, using evidence and part of the cause-and-effect relationship of natural selection to support their explanation.	Student accurately explains and predicts why recent environmental changes will affect organisms, using evidence and the complete cause-and-effect relationship of natural selection to support their explanation.

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3-Dimensional Individual Project Rubric

Rubric 4: Student explains how the characteristic(s) of ocean waves affect the energy that can be transferred, using mathematical wave models.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately explains how the characteristic(s) of ocean waves affect the energy that can be transferred and/or uses inaccurate mathematical wave models.	Student accurately explains how the characteristic(s) of ocean waves affect the energy that can be transferred, but only uses one mathematical wave model.	Student accurately explains how the characteristic(s) of ocean waves affect the energy that can be transferred, using partial but accurate mathematical wave models.	Student accurately explains how the characteristic(s) of ocean waves affect the energy that can be transferred, using complete and accurate mathematical wave models.

Rubric 5: Student develops a model of solar radiation and solar energy harvest to describe how the properties of different matter result in the reflection, absorption, and transmission of light waves.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student develops an inaccurate or irrelevant model.	Student develops an incomplete model of solar radiation and solar energy harvest to incompletely describe how the properties of different matter result in the reflection, absorption, and transmission of light waves.	Student develops a partial model of solar radiation and solar energy harvest to partially describe how the properties of different matter result in the reflection, absorption, and transmission of light waves.	Student develops a complete model of solar radiation and solar energy harvest to accurately describe how the properties of different matter result in the reflection, absorption, and transmission of light waves.

Rubric 6: Student identifies what type of signals has the best structure to communicate satellite images, explaining why by integrating information from text, media, and visuals.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately identifies what type of signals has the best structure to communicate satellite images AND/OR does not explain why.	Student accurately identifies what type of signals has the best structure to communicate satellite images, generally explaining why but using no explicit information from text, media, and visuals.	Student accurately identifies what type of signals has the best structure to communicate satellite images, partially explaining why by using specific information from text, media, and/or visuals.	Student accurately identifies what type of signals has the best structure to communicate satellite images, completely explaining why by integrating specific information from text, media, and visuals.

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

3-Dimensional Individual Project Rubric



Rubric 7: Student recommends one solution to be funded and explains why this is a better solution in terms of criteria and constraints.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student recommends an irrelevant solution to be funded.	Student recommends one relevant solution to be funded and explains why this is a better solution but not in terms of criteria and constraints.	Student recommends one relevant solution to be funded and explains why this is a better solution in terms of criteria or constraints.	Student recommends one relevant solution to be funded and explains why this is a better solution in terms of criteria and constraints.

**8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World
Project Organizer**

Unit Essential Question: *How are humans harming Earth, plants, and animals and what can we do about it?*

You are presenting a poster at a Resource Conservation Conference that showcases one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. After each task, you will return to the table below to organize what you learn as you go through the unit. By the end of the five tasks, you will have all this information to use for your culminating project. For each activity, be sure to include answers to the **ALL** the questions provided.

<p>Lift-Off Task: Growing Human Impact</p>	<p>Humans are having more of a negative impact on Earth in recent years. Based on the cartoon and your prior knowledge, why do you think that is?</p>
<p>Task 1: Human Population and Resource Consumption</p>	<p>Now that you have a better idea of the problem we are facing, answer the following questions:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Diagram the problem as a cause-and-effect flowchart. <input type="checkbox"/> What are the criteria of success in solving this problem? <input type="checkbox"/> What are the constraints in solving this problem? <input type="checkbox"/> Look at the flowchart you created: Where do you think is the most feasible place for humans to intervene in this process?

**8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World
Project Organizer**



<p>Task 2: Effects of Environmental Change on Biodiversity</p>	<p>Today we learned that not only is Earth being harmed, these changes to Earth’s environment are also affecting organisms. Now that you know how this is happening:</p> <ul style="list-style-type: none"> <input type="checkbox"/> How can you use cause-and-effect reasoning and the process of <u>natural selection</u> to better define the problem? <ul style="list-style-type: none"> ○ Add to the problem you outlined after Task 1. <input type="checkbox"/> Are there any other criteria and constraints you would like to add considering what you have learned in this task?
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**8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World
Project Organizer**

<p>Task 3: Waves and Energy</p>	<p>One way we might mitigate (reduce) the effects of resource consumption on Earth is to use sources of energy that are more plentiful and cause less environmental degradation. For example, electricity can be generated from ocean waves.</p> <ul style="list-style-type: none"><input type="checkbox"/> Based on what you learned today, draw a model of an ocean wave, using labels.<input type="checkbox"/> How is the structure of an ocean wave related to the amount of energy it has?<input type="checkbox"/> How might these ideas about waves and their energy help how us use ocean waves as an energy source?
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**8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World
Project Organizer**



<p>Task 4: Wave Interactions</p>	<p>Another way we can conserve resources is to use solar (sun) energy for electricity. When light rays from the sun shine down on Earth, some of the light is reflected by the atmosphere and clouds, while others transmit down to Earth to be reflected or absorbed. Solar panels can absorb these light waves and the energy from the light waves creates electricity.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Use what you learned about the ways that light waves get reflected, absorbed, and transmitted to draw a model of how solar radiation and solar panels work. <input type="checkbox"/> What are the properties of clouds, air, and solar cells that cause waves to reflect, transmit or absorb? <input type="checkbox"/> Explain how we can use light waves as a way to reduce our impact on the earth.
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**8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World
Project Organizer**



<p>Task 5: Using Waves to Communicate Information</p>	<p>Besides alternative energy sources, there are other ways we can use waves to monitor resource consumption or mitigate (reduce) the effects on Earth.</p> <ul style="list-style-type: none"> <input type="checkbox"/> What technology did you learn about in this task that can be used to monitor resource consumption or mitigate the effects on Earth? <input type="checkbox"/> Can you think of any other ways that waves can communicate information to help mitigate effects on Earth? <input type="checkbox"/> Are analog or digital waves a better option for this solution? Why? Explain using knowledge of their structure and function.
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8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Lift-Off Task: Growing Human Impact

Unit Essential Question: *How are humans harming Earth, plants, and animals and what can we do about it?*

In past science classes, you have learned that every ecosystem has a carrying capacity, or a maximum number of organisms that it can support without degrading the environment. The Earth, as a whole, is no different. Despite what we think, it cannot support an infinite number of human beings. At present, human overpopulation is one of the most pressing environmental issues Earth faces.



<http://thienissues.blogspot.com/2014/08/you-are-not-alone.html>

Part A: The cartoon above is a commentary on human overpopulation. Analyze the cartoon and individually record any questions that you have about human overpopulation.

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Lift-Off Task: Growing Human Impact**

Part B: As a group,

- Discuss what questions each member wrote on his or her list.
- On a large piece of poster paper:
 - Write the phrase “Human Overpopulation” in the middle of your poster and draw a circle around it.
 - Around the circle, record the questions that were similar across your group members.
 - Draw lines to link together questions that relate to each other.
 - Draft possible answers to the questions, using your prior knowledge. Connect these to the questions on your poster.
- Post your group poster on the wall.
- Walk around and look at each groups’ ideas.

Part C: As a whole class,

- Construct a class concept map with the phenomenon in the middle: “Human Overpopulation.”
 - Decide which key questions you want to have on the concept map.
 - Draw lines with arrows between two key questions to show that there is a relationship.
 - Make as many connections as you can between the questions on the concept map.
- It’s important for everyone to share their ideas and it’s okay if you don’t agree.
- You will revise and add new questions and information to this concept map as you learn more about human overpopulation.

Unit Essential Question: *How are humans harming Earth, plants, and animals and what can we do about it?*

Connecting to the Culminating Project

You are presenting a poster at a Resource Conservation Conference that showcases one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. Humans are having more of a negative impact on Earth in recent years. Based on the cartoon and your prior knowledge, why do you think that is?

This should be completed individually in your Project Organizer.

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Lift-Off Task: Growing Human Impact

Unit Essential Question: *How are humans harming Earth, plants, and animals and what can we do about it?*

Reflection

Individually reflect on the Lift-Off Task, using the questions provided:

1. At the beginning of this task, you made a list of all the questions you have about human overpopulation. Look back at your list: think about the questions your peers asked that you did not initially write down. How are their questions different from the ones you originally asked?

2. In this unit, we will be focusing on four crosscutting concepts:
 - **Patterns:** by using graphs and charts to identify patterns in data
 - **Cause and Effect:** by seeing how phenomena may have more than one cause, and using cause-and-effect relationships to predict phenomena
 - **Energy and Matter:** by observing that the transfer of energy can be tracked as it flows through a system
 - **Structure and Function:** by noticing how an object's structure can be designed to serve particular functionsLooking at your class concept map, give an example of how one of these crosscutting concepts came up in today's task.

3. Now that you understand what project you'll be working on over the course of this unit, what else do you need to know? What additional questions do you have?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 1: Human Population and Resource Consumption

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Engage

In the Lift-Off task, you generated questions about human overpopulation and made a hypothesis of why this might be happening more and more in recent years. Today you will dig into that question of how and why humans are having such a negative effect on Earth.

By using natural resources, like wood, fossil fuels, freshwater, and minerals, every human is having an effect on the environment, but some humans are having more of an effect than others. One way scientists are able to compare resource consumption by different people is to calculate their **carbon footprint**. Your carbon footprint is the sum of all the carbon dioxide you put into the atmosphere by doing all the things you do in a year. This helps paint a picture of how many resources you are consuming or using up.



<https://www.theecoambassador.com/WhatisaCarbonFootprint.html>

Let's calculate our own carbon footprint!

Individually, locate the carbon calculator online by

typing in "Trees For Life Kids Carbon Calculator" in your internet search browser or visiting

<https://www.treesforlife.org.au/kids-carbon-calculator>. Record your data in the table below:

Your Total Carbon Dioxide Emissions, also known as your Carbon Footprint (in 1 year)	
Average Carbon Footprint for an Adult (in 1 year)	
Activity That Added Most to Your Carbon Footprint	
One Way You Can Reduce Your Carbon Footprint	

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 1: Human Population and Resource Consumption

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explore

Using Mathematical and Computational Reasoning: Calculating our own carbon footprint is helpful for us to be aware of how much we are consuming. But scientists also need a bigger picture of how resource consumption compares on a global scale. The data set below shows the populations of different regions in 2012, as well as the amount of carbon dioxide each region emits in that year. In pairs, calculate the **per-capita** (per person) emission of carbon dioxide for that region. In other words, calculate how much carbon dioxide the average person emits in that region in 2012.

Region or Country	Population in 2012 (# of people)	Total CO ₂ Emitted in 2012 (tons)	Show Your Math!	Per-Capita Emission of CO ₂ (tons/person/year)
Africa	1,100 million	1,200 million	1,200 million/1,100 million =	1.1 tons
Asia	4,300 million	14,000 million		_____
East Europe	300 million	2,700 million		_____
West Europe	190 million	1,700 million		_____
South America	400 million	1,200 million		_____
Middle East	230 million	2,000 million		_____
North America	350 million	5,800 million		_____

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 1: Human Population and Resource Consumption

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explain

Now that you have calculated the per-capita carbon footprint for each region, you are able to compare them. Create a color gradient in the boxes on the right-hand side to represent low to high rates of consumption. As a group, use your calculations above to decide how each region should be shaded based on their per-capita emissions. Then shade each region on the map below accordingly. This image can be used to help you identify the **Patterns** in the data.

High
Low

Wikicommons

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Task 1: Human Population and Resource Consumption**

1. Look at your shaded map. Which regions have the highest average per-capita carbon dioxide emissions (or highest natural resource consumption)?
 - a. Why do you think these regions have higher per-capita carbon dioxide emissions? (Hint: Think about what activities are done there or natural resources that are common there).

2. **Cause and Effect:** Look back at the original data table. In general, how does population size (number of people) relate to the amount of carbon dioxide emitted?
 - a. Since 2012, the global population has increased from 7.1 billion people to 7.6 billion people. How do you think this increase in population affects the amount of carbon dioxide emissions emitted and natural resources consumed globally?

3. This data was collected in 2012. How do you think per-capita (per person) carbon dioxide emissions may have changed since then? Why do you think it has changed?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 1: Human Population and Resource Consumption

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Elaborate

You have seen how human consumption of natural resources can vary by region. You also know that if the number of humans increases over time, then natural resource consumption also increases. But how does this actually affect Earth systems? Individually read the article provided by your teacher and then work with a partner to organize the information you learned in the table below.

Cause: What are humans doing and why?	Effect: What is the effect on natural systems?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 1: Human Population and Resource Consumption

Engaging in Argument From Evidence: You see a story on the news that claims that human overpopulation is the only thing having an impact on Earth and the impact is minor. Individually, construct a written argument that supports or refutes this claim. In your argument, use the **mathematical representation** data above, evidence from the article, and **cause-and-effect** reasoning.

<p>Original Claim (The News Story)</p>	
<p>Your Claim</p>	
<p>Evidence and Cause-and-Effect Reasoning</p>	

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Task 1: Human Population and Resource Consumption**

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Evaluate: Connecting to the Culminating Project

You are presenting a poster at a Resource Conservation Conference that showcases one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. **Defining Problems:** Now that you have a better idea of the problem we are facing, answer the following questions:

- ✓ Diagram the problem as a cause-and-effect flowchart.
- ✓ What are the criteria of success in solving this problem?
- ✓ What are the constraints in solving this problem?
- ✓ Look at the flowchart you created: Where do you think is the most feasible place for humans to intervene in this process?

This should be completed individually in your Project Organizer.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Reflection

Individually reflect on Task 1, using the questions provided:

1. At the beginning of this task, you were asked to calculate your own carbon footprint. After learning what you have today, what kinds of impacts do you think your carbon footprint is having on Earth?

2. In this task, we focused on two crosscutting concepts:
 - **Cause and Effect:** by seeing how phenomena may have more than one cause, and using cause-and-effect relationships to predict phenomena
 - **Patterns:** by using graphs and charts to identify patterns in dataWhere did you see examples of **Cause and Effect** or **Patterns** in this task?

3. Now that you have learned more about human overpopulation, what questions do you still have?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 2: Effects of Environmental Change on Biodiversity

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explore

In Unit 3, you saw one example of how a human-caused environmental change can affect organisms (Remember the rabbits in the snow versus the dirt?). However, there are many more examples of how human consumption of natural resources is affecting plants and animals around the world. In groups, visit the research stations set up by your teacher to learn about different plants and animals recently affected by human actions. Discuss the guiding questions on the station card with your group and then record information in the chart below:

Station	Use Cause and Effect to describe how humans are negatively affecting the organism(s).	Explain why using your knowledge of natural selection .
1: Effect of Habitat Loss on Forest Species		
2: Effect of Hunting On Elephants		
3. Effect of Habitat Degradation on Hudson River Fish		
4: Effect of Habitat Change on Kit Fox		

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 2: Effects of Environmental Change on Biodiversity



5: Effect of Climate Change on The California Pika		
6: Effect of Climate Change on Many Organisms		

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explain

Constructing Explanations: Individually, write a paragraph to answer the following question: What is the relationship between human-caused changes to the environment and populations of organisms in those environments? Write a claim supported with evidence from the stations and scientific reasoning related to natural selection.

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 2: Effects of Environmental Change on Biodiversity

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Elaborate

As you observed, the process of natural selection can explain why we are seeing drastic changes in various populations of organisms. But what happens when populations can't adapt quickly enough? **Cause and Effect:** Individually, make a prediction based on your understanding of the cause-and-effect relationship between environment and trait: what happens when an environmental change is too extreme for the population of organisms to adapt?

As a class, watch the following video to help you answer this question:

<https://www.youtube.com/watch?v=2mIT0HeVLv4>. In pairs, discuss the video and answer the questions below to draw conclusions about what you've learned over the course of this task.

1. What happens when organisms can't adapt quickly enough to these environmental changes? Use an example from the video.
2. The video named three major human-driven causes for animals going extinct. What are these causes? Based on the stations, could you add any more?
3. If humans continue to change environments at this rate, what do you think the future will look like for plants and animals around the world?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 2: Effects of Environmental Change on Biodiversity

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Evaluate: Connecting to the Culminating Project

You are presenting a poster at a Resource Conservation Conference to show one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. Today we learned that not only is Earth being harmed, these changes to Earth's environment are also affecting organisms. Now that you know how this is happening:

- How can you use cause-and-effect and the process of natural selection to better define the problem?
 - **Defining Problems:** Add to the problem you outlined after Task 1.
- Are there any other criteria and constraints you would like to add considering what you have learned in this task?

This should be completed individually in your Project Organizer.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Reflection

Individually reflect on Task 2, using the questions provided:

1. At the beginning of this task, you were asked to use your knowledge of natural selection to make a prediction about how resource consumption might affect biodiversity on Earth. Look back at your prediction: after collecting all the evidence today, how would you change your prediction or add to your reasoning? Use evidence from the task to justify your response and record below.

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Task 2: Effects of Environmental Change on Biodiversity**

2. In this task, we focused on one crosscutting concept:
- **Cause and Effect:** by seeing how phenomena may have more than one cause, and using cause-and-effect relationships to predict phenomena.

Where did you see examples of **Cause and Effect** in this task?

3. Now that you have learned more specifics about impacts to Earth's systems, what questions do you still have?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 3: Waves and Energy

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Engage

Now that you have a clear and comprehensive picture of the problem Earth is facing, it's time to move towards potential solutions. One of the largest reasons we are negatively impacting Earth is to get the energy we need for our daily activities, such as driving cars, turning on the lights in our houses, using stoves and fire pits to cook our food, etc. Obtaining these energy sources—natural gas, oil, coal, wood—destroys and pollutes habitats. Using these energy sources contributes to climate change, which does more damage to Earth systems and biodiversity.

What if we could get our energy from other sources—such as waves?

If you've ever been in an ocean, river, or lake, you may have felt the energy of the waves as they move or splash you. Can we use waves to find more sustainable and less damaging energy sources? First, we need to learn about waves.



Instructions: As a group, use the following materials to explore one kind of wave—water waves:

- Plastic Basin
- Water
- Several different size blocks
- Cork or other floating materials

<https://pixabay.com/en/wave-atlantic-pacific-ocean-huge-1913559/>

Pour water into the basin until it is about 1/3 full. Then move blocks around in the water to generate different sizes and shapes of waves.

1. What are some characteristics of waves that you observed? In other words, how does a wave behave, look, sound, or change?

2. At this point, how would you define “wave”?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 3: Waves and Energy



Add cork or other floating materials to your water-filled basin. Again, move the blocks around in the water and generate different sizes and shapes of waves.

3. **Energy and Matter:** What new characteristics did you notice about waves by observing a floating object?

As a class, discuss characteristics of waves and come to a consensus. Record below:

Class Definition for Wave	Characteristics of Waves

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

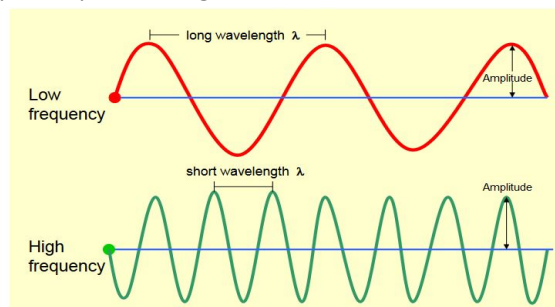
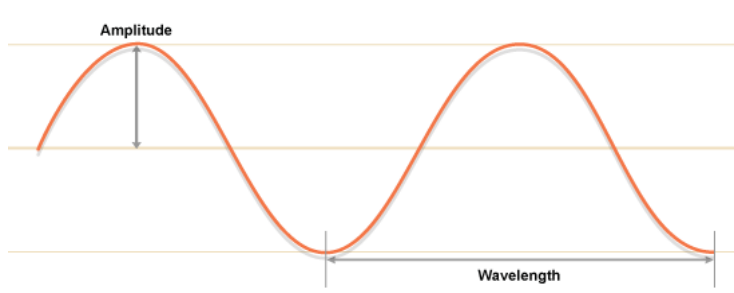
Explore

You observed several characteristics of waves in your experiments. Scientists have specific words to describe these characteristics. Read each definition and examine each word shown in the two graphs below. We will use these words as we create models to better understand waves.

Amplitude: Distance between starting height and highest (or lowest) point of a wave

Wavelength: The distance between identical points on consecutive waves

Frequency: The number of full wavelengths that pass a point in a given time interval



http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/radiation/anintroductiontowavesrev2.shtml

http://www.zamandayolculuk.com/html-3/electromagnetic_wave.htm

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Task 3: Waves and Energy



Learning about wave characteristics, like the ones above, helps us to understand how much energy different waves have—this will be essential if we want to use waves as an energy source. One great way to explore waves and their energy is to use a computer simulation that takes real-life data and allows you to manipulate it in a simulated environment. As a group, visit the PhET simulation, Wave on a String (http://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html). In this simulation, you will explore the question: **Do you think a small wave or a large wave has more energy?**

1. First, make a prediction to this question here:

2. Open the simulation and adjust the following settings:
 - “Slow motion” (center bottom)
 - “Rulers” (right bottom)
 - “Manual” (top left)
 - “Fixed End” (top right)
 - Do not adjust “Damping” or “Tension”

3. Experiment with moving the wrench up and down in whatever ways you would like.

4. Test 1: Move the wrench up and down 1 cm at a constant rate (try counting “1 one thousand up, two one thousand down”, etc.). Observe the amplitude of the wave. Then predict the amount of energy you think the wave has based on how it appears as it travels to the end of the screen. Record data in table below.

5. Test 2 and 3: Select two different wrench distances and repeat the process from Test 1. Record data in table below.

Using Mathematical and Computational Reasoning:

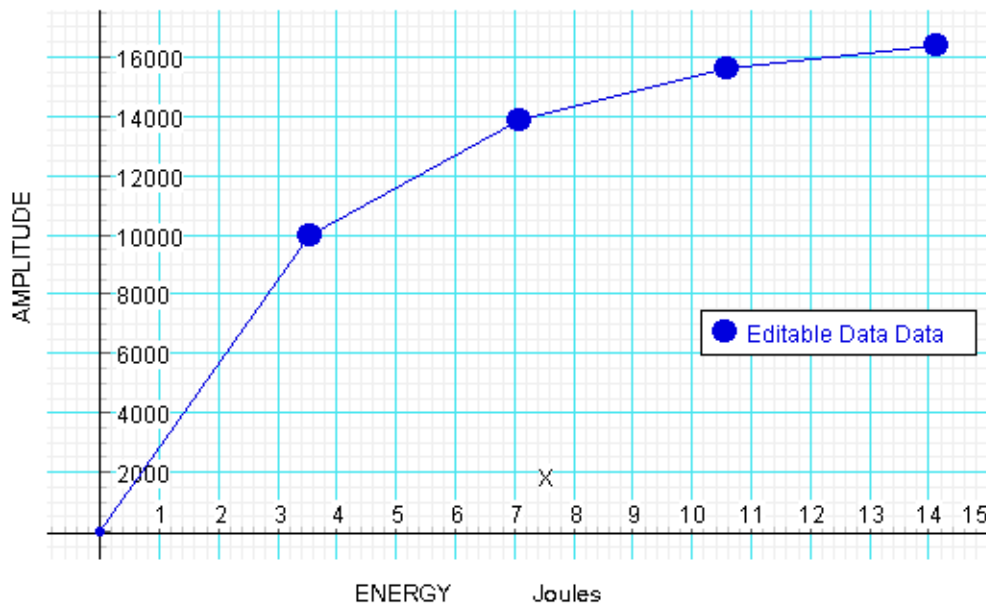
Test	Wrench Distance	Amplitude of Wave	Relative amount of energy I think this represents
1	1 cm		
2			
3			

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Task 3: Waves and Energy

6. Now take a look at the graph below, which shows the amplitude of waves from an earthquake compared to the amount of energy the earthquakes have.

GRAPH OF AMPLITUDE Vs ENERGY



<http://www.indiana.edu/~pepp/curriculum/1999/portle/portle.html>

Use the graph to identify **patterns**: What is the relationship between amplitude and energy?

- What is on the x-axis? The y-axis?
- How would you describe the slope of the line?
- What does this tell you about the relationship between amplitude and energy?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 3: Waves and Energy

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explain

Developing Models: Now that you have experimented with waves and their energy, you can make a model to better showcase characteristics of waves.

1. With a partner, draw a picture on the next page of a cross-section (side view) of one of the water waves you generated in the Engage. In your model, include the following:
 - Use words to explain what is happening to the water wave and other objects.
 - Use arrows and words to label all objects in the model.
 - Label the amplitude, frequency, and wavelength of your wave.
 - **Energy and Matter:**
 - Use words to explain how you know the wave is transferring energy.
 - Use words and/or pictures to compare your wave to other waves generated in the Engage, including the difference in energy.

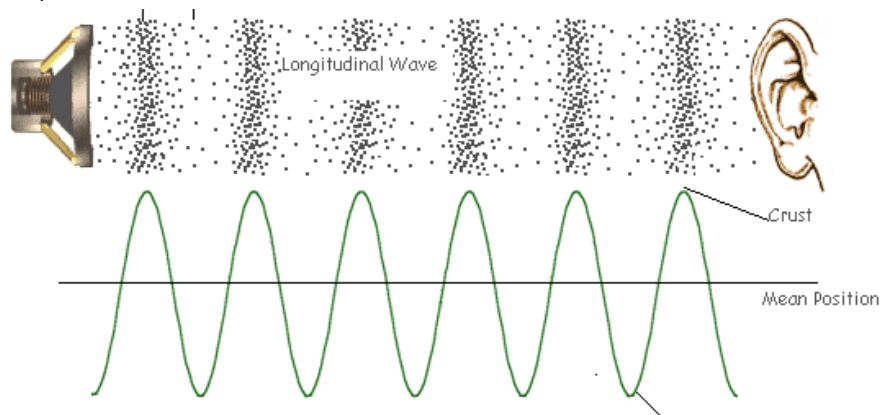
8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 3: Waves and Energy

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Elaborate

As you have seen, waves can travel through matter such as water. Another example of waves, **sound waves**, can travel through air. When you talk into a microphone, sound waves travel from your vocal cords through the air to the microphone. When you whisper a secret into someone’s ear, the sound waves travel from your vocal cords through the air until they reach the other person’s eardrum. Just like water waves travel by water molecules colliding and passing along their energy, sound waves travel by air molecules colliding and passing along their energy (see image below).



<http://studyonline.zohosites.com/Sound-Waves.html>

Unlike waves in the water, however, sound waves are invisible! If we want to learn more about sound waves, we need to be able to see them. In this activity, you will use an app on your device called “Oscillo” or “Oscilloscope”. When you speak into the microphone of your device, the oscilloscope will generate a visible wave on the screen. This allows you to observe the three characteristics of your sound waves (amplitude, wavelength, and frequency) on your device.

1. With a partner:

Try to make a wave with:	Drawing: What does this wave look like?	Record: What did you do to make this wave?
A high amplitude		

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Task 3: Waves and Energy



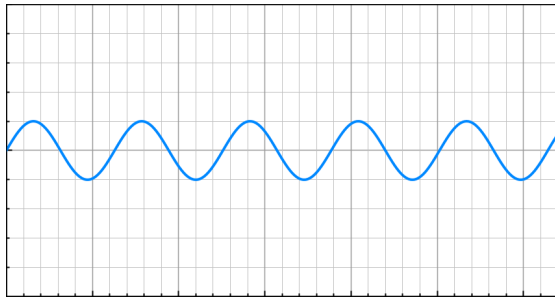
A low amplitude		
A long wavelength		
A short wavelength		
A high frequency (many waves)		
A low frequency (very few waves)		

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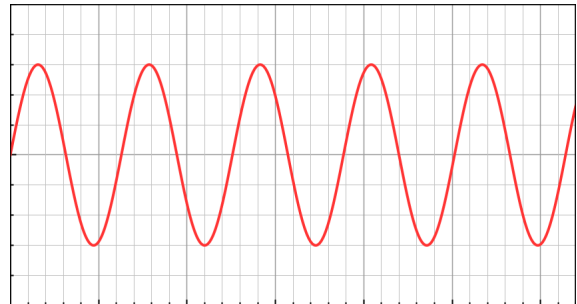
Task 3: Waves and Energy

2. Use your oscilloscope to analyze the pair of graphs below:

Graph 1



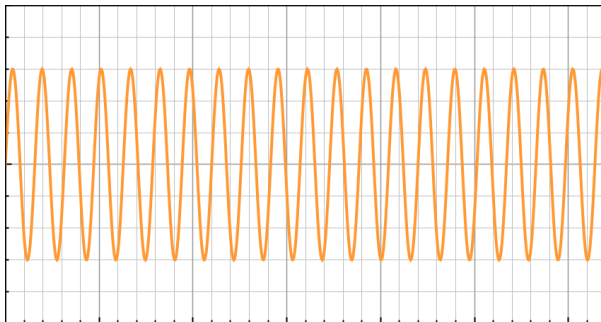
Graph 2



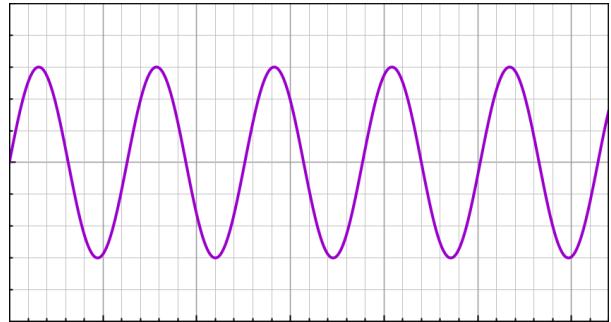
a. **Energy and Matter:** What is the difference in frequency, amplitude, wavelength, and energy?

b. What is the difference in the two sounds made by these graphs?

Graph 3



Graph 4



a. **Energy and Matter:** What is the difference in frequency, amplitude, wavelength, and energy?

a. What is the difference in the two sounds made by these graphs?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 3: Waves and Energy

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Evaluate: Connecting to the Culminating Project

You are presenting a poster at a Resource Conservation Conference that showcases one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. One way we might mitigate (reduce) the effects of resource consumption on Earth is to use sources of energy that are more plentiful and cause less environmental degradation. For example, electricity can be generated from ocean waves.

- Based on what you learned today, draw a model of an ocean wave, using labels.
- How is the structure of an ocean wave related to the amount of energy it has?
- How do these ideas about waves and their energy influence how we might use ocean waves as an energy source?

This should be completed individually in your Project Organizer.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Reflection

Individually reflect on Task 3, using the questions provided:

1. At the beginning of this task, you were asked to define a wave and identify characteristics of waves. Look back at your definition and characteristics: after collecting all the evidence today, how could you add to these or revise these?

2. In this task, we focused on two crosscutting concepts:
 - **Patterns:** by using graphs and charts to identify patterns in data
 - **Energy and Matter:** by observing that the transfer of energy can be tracked as it flows through a system

Where did you see examples of **Patterns** and **Energy and Matter** in this task?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Task 3: Waves and Energy**

-
3. Now that you've learned that waves can generate energy without as much impact on the environment, what questions do you still have?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 4: Wave Interactions

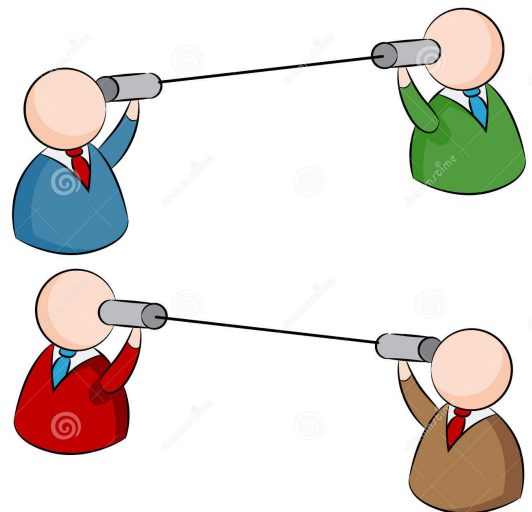
Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Engage

In the last task, you observed water and sound waves, which are known as mechanical waves. You learned that these mechanical waves can be used to generate energy, but they require some “matter” to travel through, such as water or air. There is another type of wave that is able to travel without any matter. These are light waves, also known as electromagnetic waves. We saw that water waves carry energy that we can use, so perhaps light waves also have energy that we can use to reduce our impact on the environment! Let’s first use what we already know about waves to explore sound and light waves.

Light is similar to sound in that it travels as waves from one location to another. Light waves are also similar to sound waves in that they can be affected by different materials. Since we have already experienced sound waves, let’s use sound waves to test out this idea.

1. With a partner, follow the instructions below to make a string telephone.
 - a. Use a pencil to poke a small hole in the center of the base of each paper cup that is just barely big enough to fit the string through.
 - b. Draw the ends of the string through each of the cups’ holes and tie a knot to each end to anchor it into place within the cup.
2. Stand 10 feet apart from your partner. First try whispering a word to your partner without using the string telephone. Could you hear your partner’s word?
3. Now try this again using your string telephone (hold with string taut). Could you hear your partner’s word?
4. Does sound travel better through air or through the string? Why do you think so? (Hint: return to the diagram in the Task 3 Elaborate).



<https://www.dreamstime.com/stock-illustration-tin-can-communication-image-two-people-communicating-use-cans-string-image51499838>

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 4: Wave Interactions

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explore

You have investigated whether sound waves travel better through air vs. a string. In your group, investigate how both sound waves and light waves behave with a range of different materials besides just string.

Part 1: Sound Waves

1. Place the oscilloscope app near your or your partners ear. Observe the sound wave that travels through the original string telephone you made in the Engage.
 - a. Draw the wave below, making sure to show and describe its amplitude.

- b. Describe the sound you can hear through your original string telephone.

2. Now use different materials provided by your teacher to re-engineer your telephone so that it can minimize, maximize, or even change the sound. Use the oscilloscope app again to measure the sound waves as they interact with each of the materials. Record data in the table below.

Material Used and How It Was Used	What effect did the material have on the wave? <ul style="list-style-type: none"> • Draw the oscilloscope wave • Make sure to show and describe amplitude 	What effect did the material have on the sound?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 4: Wave Interactions



3. Which materials made the sound louder? Which materials made the sound quieter?

a. **Structure and Function:** What is different about these materials that some made the sound louder and others made the sound quieter?

4. **Energy and Matter:** You used the oscilloscope to measure sound waves as they passed through different materials. Look at your wave drawings from your table:

a. What happened to the sound wave when the sound became quieter?

b. What happened to the sound wave when the sound became louder?

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Task 4: Wave Interactions

Part 2: Light Waves

We heard and thought about how sound waves behave when they interact with different materials. Let’s think about what happens to light waves when they encounter materials in their path. Will we see the same results? Does light behave like sound?

List A	List B	List C	List D
Glass jar with water Plastic wrap Light colored tissue paper	Mirror Aluminum foil	Wax paper Notebook paper Your cheek	Cardboard Your leg Dark colored tissue paper

1. In groups, pick one material from each list above and send the Materials Manager to get one flashlight and the four selected materials. Test what happens when you shine light through each material and write your observations in the data table below.

Material Tested	Observation What happened to the light from the flashlight when you put the material in the light’s path?	Quick Response Circle the description that <u>most</u> closely matches what happened.
		1. light reflected (bounced) off it 2. no light went through to the other side (light was absorbed) 3. light transmitted (went through) the material
		1. light reflected (bounced) off it 2. no light went through to the other side (light was absorbed) 3. light transmitted (went through) the material
		1. light reflected (bounced) off it 2. no light went through to the other side (light was absorbed) 3. light transmitted (went through) the material
		1. light reflected (bounced) off it 2. no light went through to the other side (light was absorbed) 3. light transmitted (went through) the material

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 4: Wave Interactions

1. Which materials didn't allow any light to pass through? Which materials let light through? Which materials made the light to bounce off?
 - a. **Structure and Function:** What is similar or different about the properties of these materials that makes light behave differently?

2. **Energy and Matter:** What do you think happened to the amplitude of the light wave when only some of it transmitted through a material? How does this relate to the amount of light you see through the material?

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explain

We observed that when light and sound waves encounter different materials they can behave in different ways. This is called a wave interaction. We also learned some of the terms used to describe these different behaviors. You now have a chance to practice using the new terms to explain how and why these behaviors occur.

1. Individually read the Light Waves article and Sound Waves article. As you read, annotate the article using whatever method you are most comfortable with.

2. **Developing Models:** With your group, create a poster model to describe the wave interaction you are assigned by your teacher. In your model, make sure to include:
 - A title that identifies the type of wave and the type of interaction
 - **Structure and Function:** A diagram showing the wave and what happens when it interacts with a material
 - An explanation of whether the sound wave is absorbed, reflected, or transmitted
 - An explanation of the effect on light or sound
 - A description of the properties of this material that cause the wave to behave in this way.
 - Any relevant vocabulary

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Task 4: Wave Interactions

3. Visit the posters of other groups in a gallery walk and record your observations (drawings and words) of the different types of wave interactions below:

<p>A sound wave travelling through only air between the sound source and an oscilloscope</p>	<p>A sound wave with a wall between the sound source and an oscilloscope</p>
<p>A light wave bouncing off a mirror</p>	<p>A light wave hitting a thick piece of cardboard</p>
<p>A light wave shining through a window</p>	<p>Additional Notes</p>

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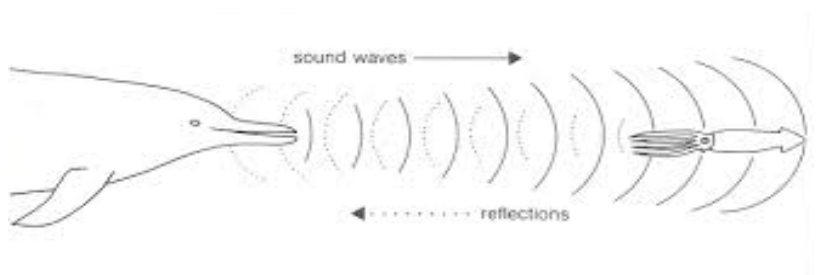
Task 4: Wave Interactions

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Elaborate

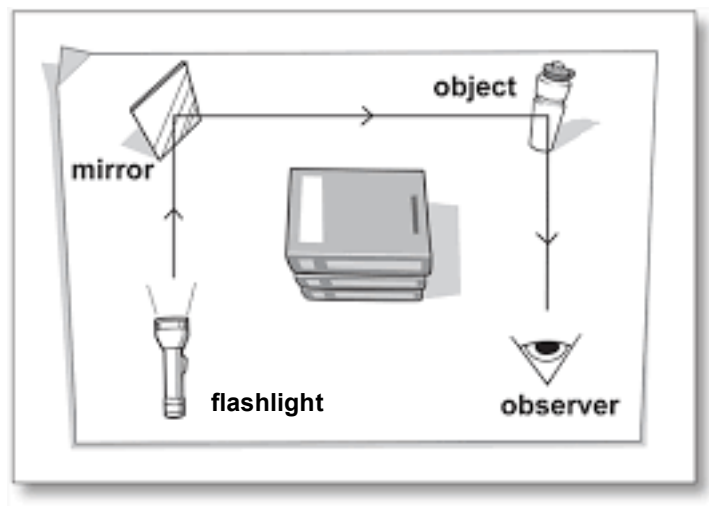
Now that you know how light waves and sounds waves behave, let’s apply this knowledge to some new scenarios to see what you have learned. Individually respond to the following questions:

1. **Energy and Matter:** Dolphins often hunt for food by using high frequency clicking sounds. Suppose a dolphin sends a click into a bed of kelp (seaweed) that absorbs much of the sound and reflects only a little. Decide whether the reflected signal will be quieter than the original outgoing signal? Explain why you think this is.



<http://www.angelfire.com/tn3/reneemahony/echolocation.html>

2. In the setup below, an observer sees an object with the help of a flashlight (torch) and mirror.



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Task 4: Wave Interactions

- a. Is the light wave absorbed, reflected, or transmitted by the mirror?
- b. **Structure and Function:** You do not know what material the object is:
- If the object is made of clear (transparent) glass, will the light wave be absorbed, reflected, or transmitted by the object?

 - If the object is made of shiny metal, will the light wave be absorbed, reflected, or transmitted by the object?
- c. Will the observer be able to see the light from the torch? For each scenario, explain why.
- If the object were made of clear (transparent) glass:

 - If the object were made of shiny metal:
- d. If the light from the torch does reach the observer's eye, will the light be as bright as if it was shined directly into the eye? Why or why not?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 4: Wave Interactions

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Evaluate: Connecting to the Culminating Project

You are presenting a poster at a Resource Conservation Conference that showcases one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. Another way we can conserve resources is to use solar (sun) energy for electricity. When light rays from the sun shine down on Earth, some of the light is reflected by the atmosphere and clouds, while others transmit down to Earth to be reflected or absorbed. Solar panels can absorb these light waves and the energy from the light waves creates electricity.

- Use what you learned about the ways that light waves get **reflected, absorbed, and transmitted** to draw a model of how solar radiation and solar panels work.
- What are the properties of clouds, air, and solar cells that cause waves to reflect, transmit or absorb?
- Explain how we can use light waves as a way to reduce our impact on the earth.

This should be completed individually in your Project Organizer.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Reflection

Individually reflect on Task 4, using the questions provided:

1. At the beginning of this task, you experimented with a string telephone. Look back at your explanation of why sound travels better through the string than the air: after learning everything you have through this task, how could you add to or revise this explanation?

2. In this task, we focused on two crosscutting concepts:
 - **Structure and Function:** by noticing how an object’s structure can be designed to serve particular functions
 - **Energy and Matter:** by observing that the transfer of energy can be tracked as it flows through a system

Where did you see examples of **Structure and Function** and **Energy and Matter** in this task?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Task 4: Wave Interactions**

-
3. Now that you have learned more about how waves behave and could be used to generate electricity, what questions do you still have?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 5: Using Waves to Communicate Information

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Engage

So far, we have learned that waves transfer energy; this means water waves and light waves might be good options for alternative forms of energy that place less strain on Earth's systems. However, this is not the only way waves might help you with the problem you are facing in your culminating project. Take a look at the images to the right, which were taken from satellites in space to show images of the Aral Sea in 1986 vs. 2007. Can you see a difference?

Waves are used to communicate these images, so humans around the world can also see the difference. But how does this technology work and how would images like these help us reduce the ways humans harm Earth?

Today you will learn about two ways waves can communicate information—using analog waves or digital waves. It will be your job to decide which is a better option for communication of information about resource consumption, like these images.



https://www.youtube.com/watch?time_continue=147&v=MNQ9z_Eb-Jc

1. With your partner, discuss the following question: How do you think our voices compare to digital recordings?

Let's investigate it!

2. Speaking: Can you make two sounds that are exactly the same using only your voice?
 - Say the word "digital" to your partner. Wait a moment and repeat the word. Did the two words sound the same?
 - Now say the word "digital" into the oscilloscope ("Oscillo") on your device. Repeat the word into your device. Did the sound waves you produced look exactly the same?
3. Recording: Can you make two sounds that are exactly the same using a digital recording?
 - Use a device to record yourself saying the word "digital".
 - Playback the recording and discuss some observations of the sound you heard with your partner. How does the recording compare with your voice?
 - Playback the recording into your oscilloscope several times. Does the sound wave look exactly the same each time?

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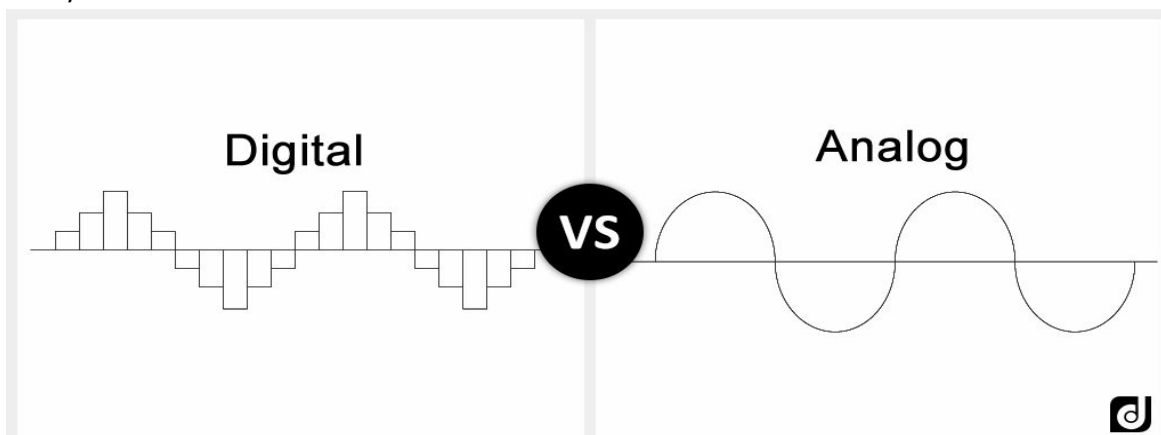
Task 5: Using Waves to Communicate Information

4. Compare Analog and Digital: Your voice represents an analog wave and the recording represents a digital wave.
- Which type of sound (analog or digital) was easiest to copy exactly?
 - Why do you think it might be important that a wave be able to be repeated exactly the same each time? (Hint: Think about the satellite image pictures on the first page).
 - Which type of sound (analog or digital) do you think is best for people who are far apart? Close together? Why?

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explore

Obtaining, Evaluating, and Communicating Information: Now that you have experienced examples of analog and digital waves, it's time to compare them in more depth. This will inform your decision in the end on whether to use analog or digital waves to communicate information on resource consumption. Below is a picture of what digital and analog waves look like. Keep this **structure** in mind as you learn more about digital and analog waves in this activity.



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Task 5: Using Waves to Communicate Information

1. Observe the examples of analog and digital waves provided by your teacher and record patterns you see in the chart below.

	What is similar about them?	What is different about them?
Pairs of Photographs		
Recordings of a Song		

2. Now watch a video about analog waves and digital waves as a class and record any information you think is important in the chart below. As you watch, pay attention to how each wave’s **structure** affects its **function**.

Analog	Digital
Questions you have	

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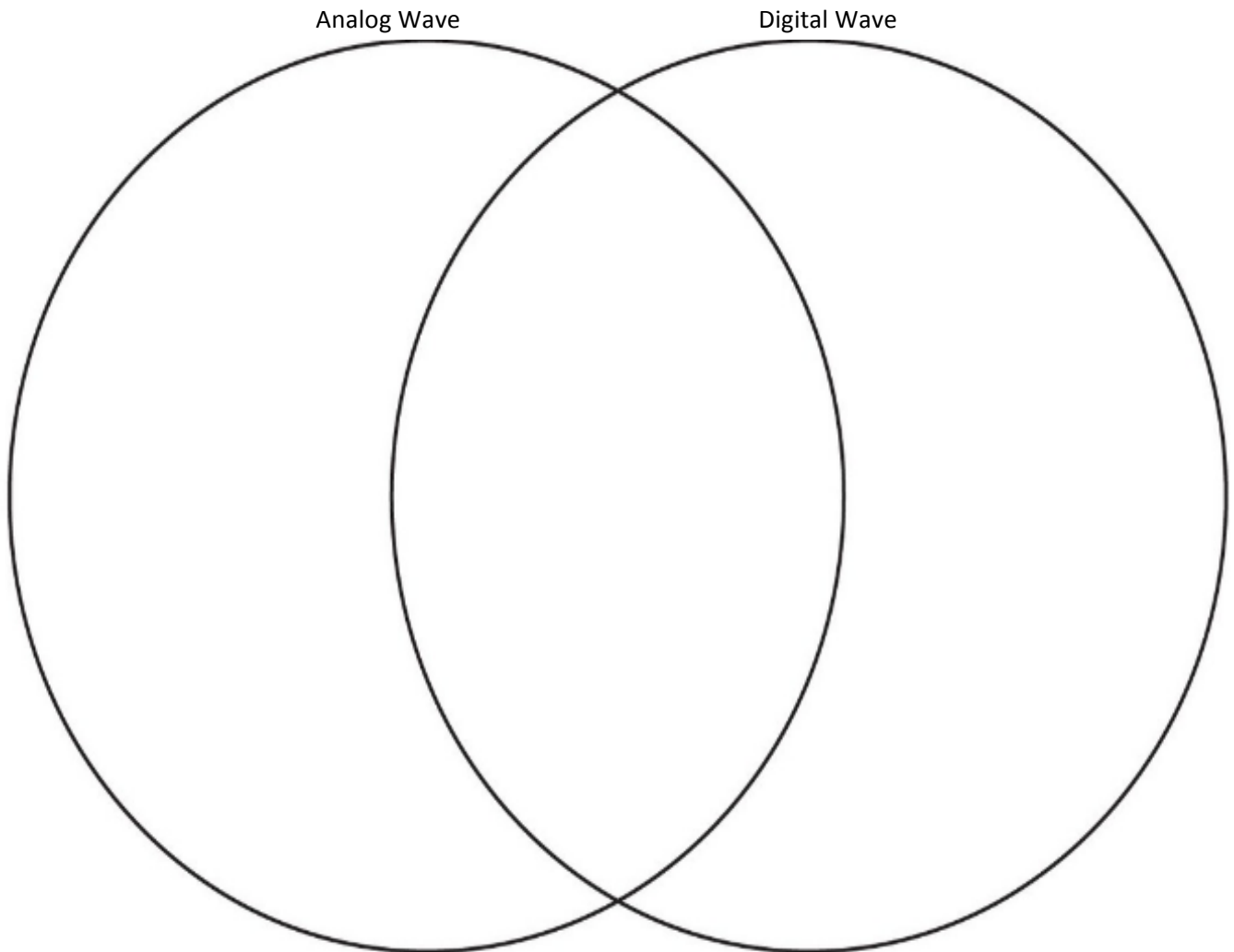
Task 5: Using Waves to Communicate Information

- To give you more information, individually read about analog waves and digital waves in an article provided by your teacher. As you read, annotate the article with whatever strategy you feel most comfortable with.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Explain

- To prepare you to make a decision on which type of wave is a better option for communicating information about resource consumption globally, complete the Venn diagram below in pairs. As you add information from the pictures, song recordings, video, and article, label where each piece of information came from in parentheses.



8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 5: Using Waves to Communicate Information

2. **Engaging in Argument From Evidence:** Now it's time to choose your wave: analog or digital. Which wave is a more reliable way to communicate information about excess resource consumption, like satellite images, to people around the world? Why? Individually write a recommendation, using evidence from the Engage and Explore and scientific reasoning to support your choice.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Elaborate

As a class, watch the following video to see more satellite images of how human activities are affecting Earth: https://www.youtube.com/watch?time_continue=147&v=MNQ9z_Eb-Jc. The way this technology works is that satellites in space collect radiation reflected from Earth. Different surfaces and objects can be identified by the way they react to radiation. This means that in any images taken, roads, trees, water, and land will look different. By looking at these satellite images taken over time, we can monitor the change in Earth's features. In groups, discuss and answer the questions below:

1. If comparing images of the same area over time is what helps us monitor resource consumption, do you think it would be best to use analog or digital waves? Why?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World

Task 5: Using Waves to Communicate Information

2. Why do you think using waves in this way might help mitigate (lessen) human impacts on Earth?

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Evaluate: Connecting to the Culminating Project

You are presenting a poster at a Resource Conservation Conference that showcases one solution to help monitor or lessen the effects of human overpopulation and excess resource consumption. Besides alternative energy sources, there are other ways we can use waves to monitor resource consumption or mitigate (reduce) the effects on Earth.

- What technology did you learn about in this task that can be used to monitor resource consumption or mitigate the effects on Earth?
- Can you think of any other ways that waves can communicate information to help mitigate effects on Earth?
- Are analog or digital waves a better option for these solutions? Why? Explain using knowledge of their **structure and function**.

This should be completed individually in your Project Organizer.

Unit Essential Question: *How are humans harming Earth, plants, and animals, and what can we do about it?*

Reflection

Individually reflect on Task 5, using the questions provided:

1. At the beginning of this task, you experienced and compared analog vs. digital waves for the first time. Look back at your conclusions (Question 4 of the Engage): after gathering all the information in this task, how would you add to or revise your conclusions?

8th Grade Science Unit 4: Using Engineering and Technology to Sustain Our World**Task 5: Using Waves to Communicate Information**

2. In this task, we focused on the following crosscutting concept:
- **Structure and Function:** by noticing how an object’s structure can be designed to serve particular functions

Where did you see examples of **Structure and Function** in this task?

3. Now that you have learned about another technology involving waves and will soon be moving on to your culminating project, what questions do you still have?