Using Engineering and Technology to Sustain Our World

Unit 4

This slide deck is intended to help guide you and your students through the sequence of this unit. While you may choose to use these slides as a helpful tool to prompt and facilitate students, all detailed information for each unit is in the student and teacher unit booklets.

Unit Essential Question

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

Growing Human Impact

Lift-Off Task

Human overpopulation is one of the most pressing environmental issues Earth faces

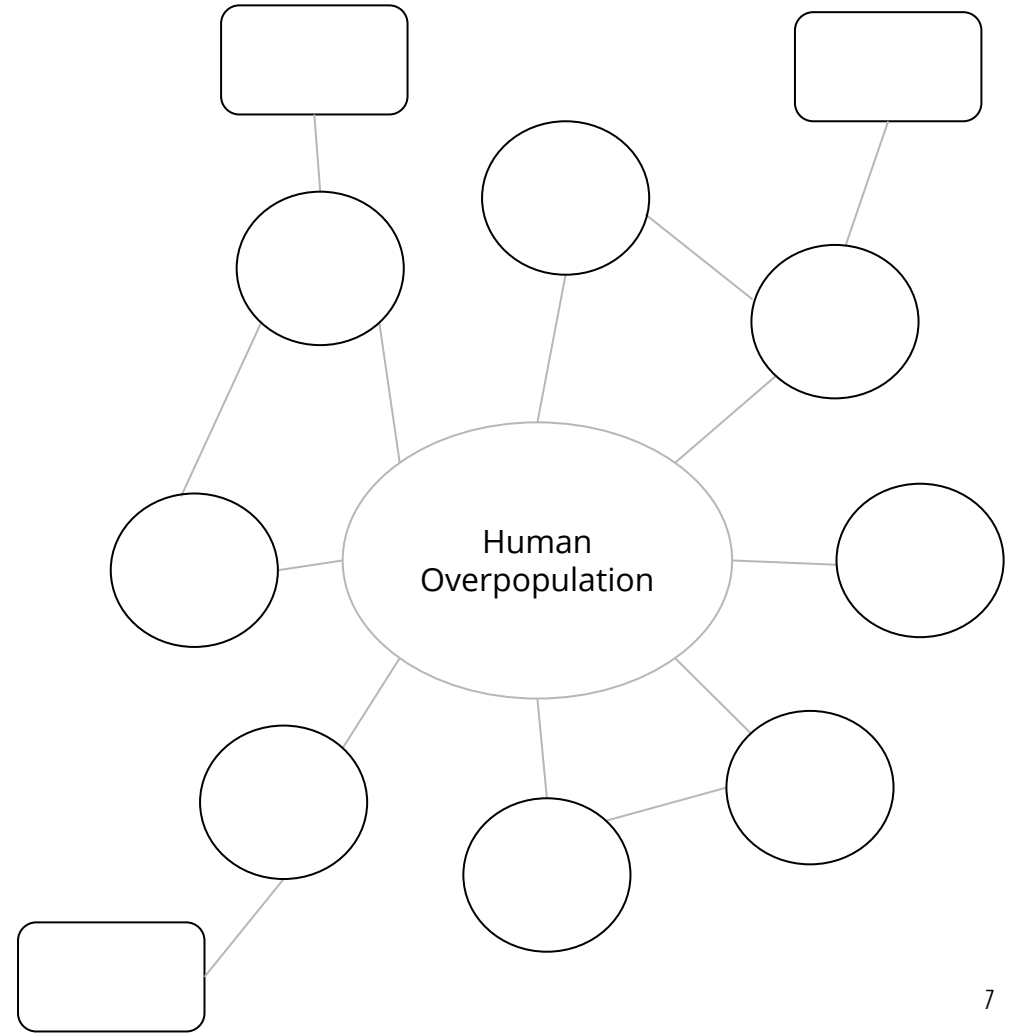
Generate Questions!

If you wanted to know more about human overpopulation, what questions would you ask?

Group Concept Map

As a group, create a concept map that shows:

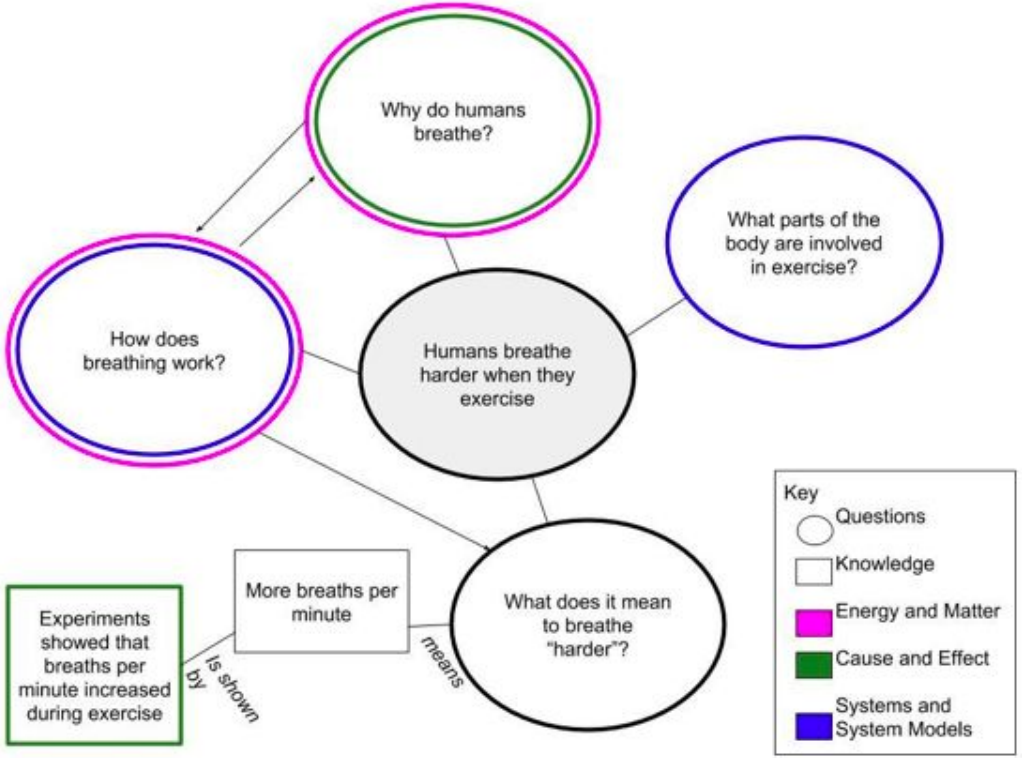
- Questions your group members had in common (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)



Class Concept Map

As a class, create a concept map that shows:

- Key questions (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)
- Crosscutting concepts used (trace in color)



Introduction to the Culminating Project

What technologies can we use to help monitor or lessen the effects of human overpopulation and excess resource consumption?

Pick 1 Solution to Research: Solar Energy, Ocean Wave Energy, or Satellite Image Monitoring

Group Project - Scientific poster presentation about your solution at a Resource Conservation Conference

Individual Project - Letter to an environmental non-profit organization recommending a solution

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?

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in the Lift-Off Task.

Human Population and Resource Consumption

Task 1

What questions do you still have?

Engage

Every human has an impact on the environment, but some humans have a larger impact than others

Carbon Footprint - The sum of all the carbon dioxide a person puts into the atmosphere by doing all the things they do in a year. This allows scientists to compare resource consumption by different people.

Let's Calculate Our Own Carbon Footprint

Individually,

1. Locate the carbon calculator online by typing "Trees for Life Kids Carbon Calculator" into your search browser.
2. Record your data in the table in your student guide.

Class Debrief

- How did your carbon footprint compare to the adult average? Why do you think yours was less or greater?
- What activity added the most to your carbon footprint?
- What could you do to reduce your carbon footprint?
- Did any of the questions surprise you?
- Did anything surprise you in your results?

Explore

Scientists need a bigger picture of how resource consumption compares on a global scale

Compare the per-capita emissions of carbon dioxide for each region

What does *Per-Capita* mean?

Using Mathematical and Computational Thinking

In pairs, calculate the per-capita (per person) emission of carbon dioxide for each region.

Example:

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

Explain

Compare Per-Capita Carbon Footprints of Different Regions

As a group,

1. Create a color gradient, like the example to the right, to represent low to high rates of consumption.
2. Use your calculations to decide how each region should be shaded.
3. Shade each region on the map in your student guide accordingly.
4. Discuss and answer the questions in your student guide to help you analyze the patterns in your map.

Class Debrief

1. Which regions have the highest average per-capita carbon dioxide emissions? Why do you think this is?

2. How does population size relate to the amount of carbon dioxide emissions?

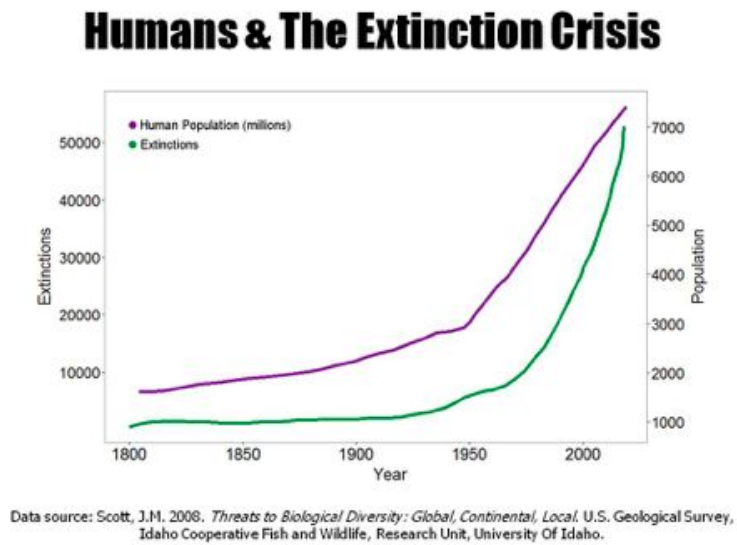
3. If global population has increased since this data was taken in 2012, how do you think this has affected total carbon dioxide emissions and natural resource consumption?

4. Do you think per-capita carbon emissions have increased since 2012? Why?

Elaborate

We know that if human population increases, then natural resource consumption also increases. But how does this affect Earth's systems?

How can we use knowledge from our past to help us understand what is happening on Earth now?



Data source: Scott, J.M. 2008. *Threats to Biological Diversity: Global, Continental, Local.* U.S. Geological Survey, Idaho Cooperative Fish and Wildlife, Research Unit, University Of Idaho.

Individually,

1. Read and annotate the article, *Effects of Overpopulation and Resource Consumption*.

With a partner,

2. Organize the information as *Causes* and *Effects* in the chart in your student guide.
    a. Cause: What are humans doing and why?
    b. Effect: What is the effect on natural systems?

Engage in an Argument From Evidence

There is 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. Use your calculations, evidence from the article, and cause-and-effect reasoning to support your argument.

Stronger Clearer

1. **Individual Think Time:** What will you say to your partner without looking at your argument?

2. **Partner Discussions:**
   a. **Student A:** Describe your argument.
   b. **Student B:** Listen and ask clarifying questions.
   c. **Student A and Student B:** Write down any notes to make your argument stronger and clearer.

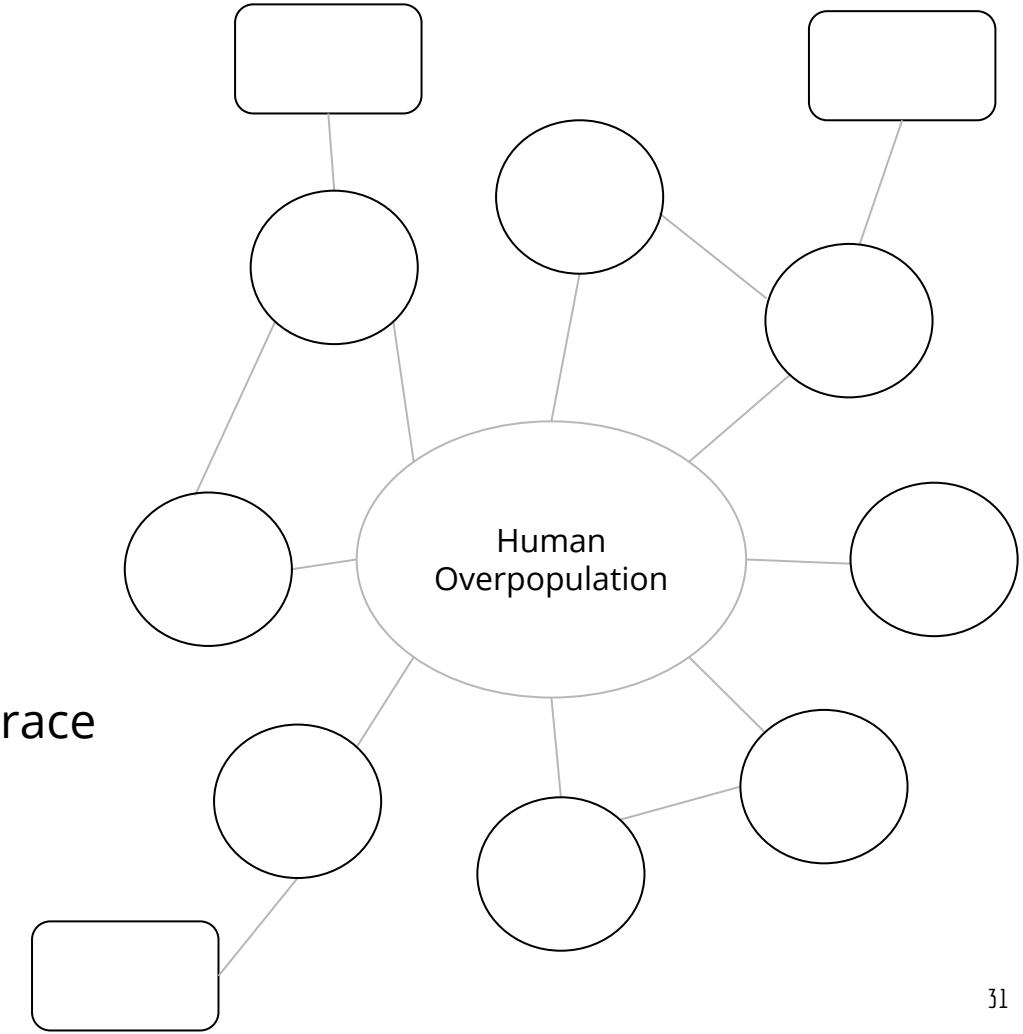
3. **Repeat with 2 more partners!**

4. **Revise your argument in your student guide.**

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
  - Patterns
  - Cause and Effect



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?

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 1.

Effects of Environmental Change on Biodiversity

Task 2

What questions do you still have?

Human overpopulation and resource consumption is changing many environments around the world. How does this environmental change affect plants and animals?

Engage

Think-Pair-Share

Discuss the term natural selection:

- Agree on a definition for natural selection. Write it or draw a flowchart of the process in your student guide.
- Give an example of natural selection from Unit 3.

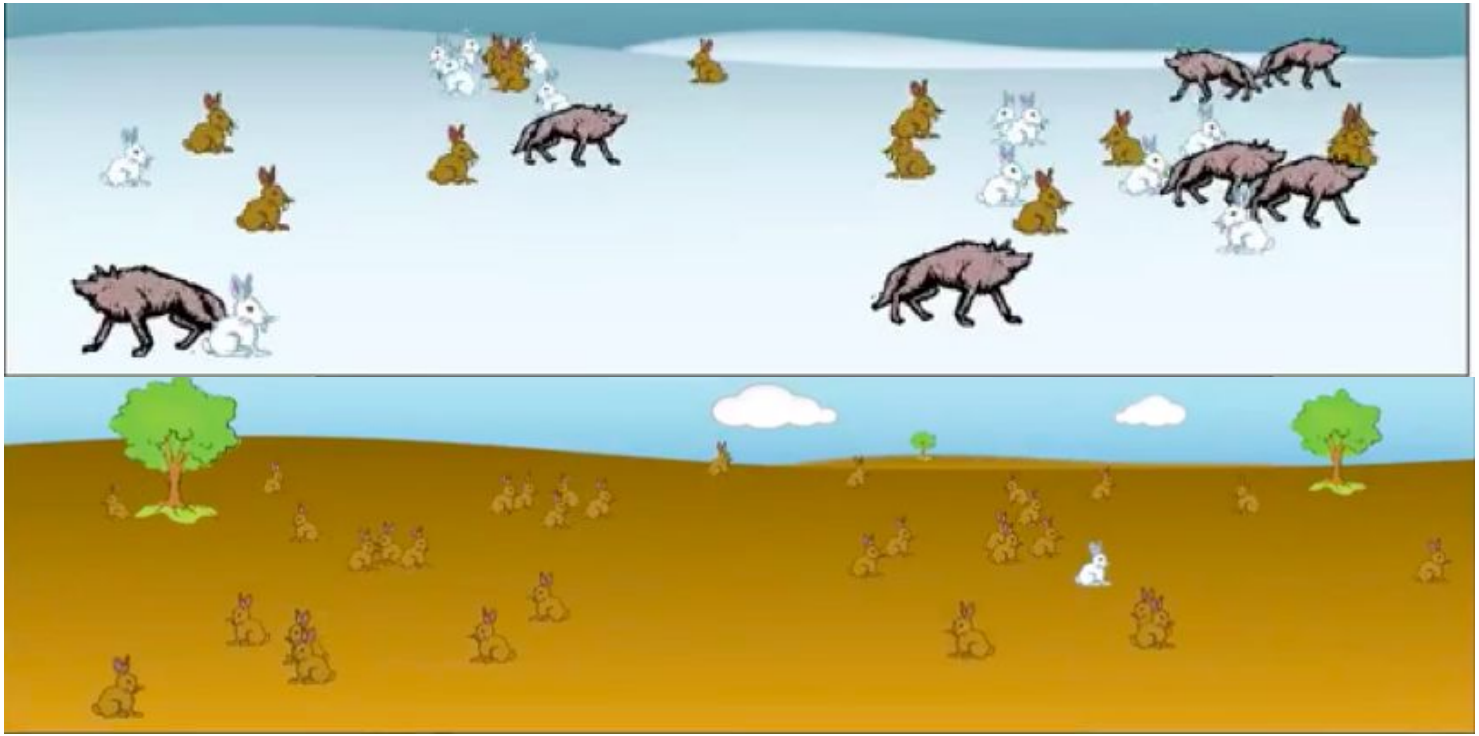
Think-Pair-Share

Based on your prior knowledge of natural selection, make a prediction:

How might resource consumption affect biodiversity (different plants and animals) on Earth? *Keep in mind that there might be many different effects!*

Explore

Remember this example of a human-caused environmental change affecting organisms?



Explore more examples of how human consumption of natural resources affects organisms

As a group,

1. Visit the research stations to learn about different plants and animals affected by human actions.
2. Discuss the guiding questions on the station cards to help you analyze the examples.
3. Take notes in the data collection table in your student guide.

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.

Elaborate

What happens when populations can't adapt quickly enough?

Individually, make a prediction based on the cause-and-effect relationship between environment and traits:

What happens when an environmental change is too extreme for the population of organisms to adapt?

What happens when populations can't adapt quickly enough?

https://www.youtube.com/watch?v=2mlT0HeVLv4

Think-Pair-Share

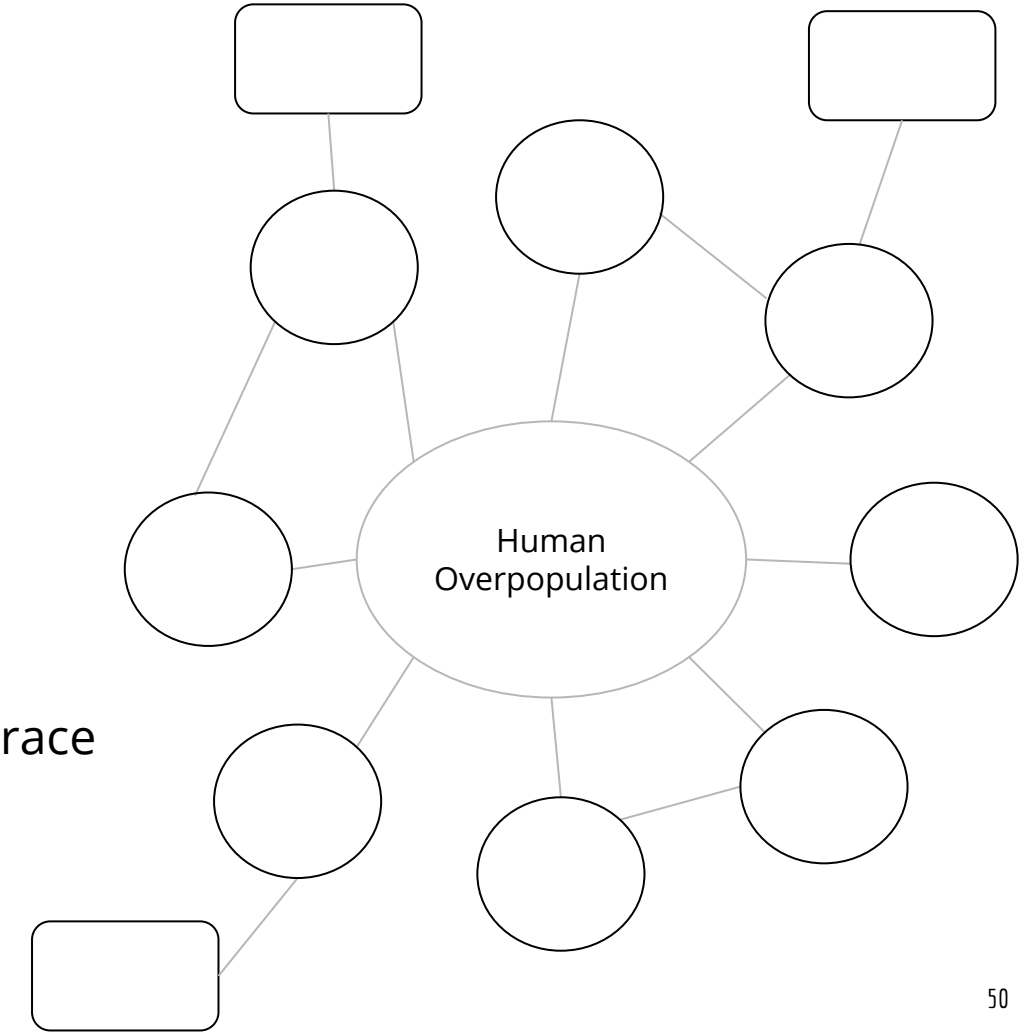
1. What happens when organisms can’t adapt quickly enough to these environmental changes?
2. The video named three major human-driven causes for animals going extinct. What are these causes? Based on the stations, could you add any more?
3. If humans continue to change environments at this rate, what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

Record your responses in your student guide.

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
  - Cause and Effect



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 reasoning 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?

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 2.

Waves and Energy

Task 3

What questions do you still have?

Engage

Moving from Problems to Potential Solutions

One of the biggest reasons we are negatively impacting Earth is to get the energy we need for our daily activities.

What if we could get our energy from other sources that are less damaging and more sustainable --such as waves?

Let's Explore One Type of Waves - Water Waves

Materials

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

As a group, use the materials above and follow the instructions in your student guide to generate different sizes and shapes of waves. Then answer the questions in your student guide to help you analyze the waves.

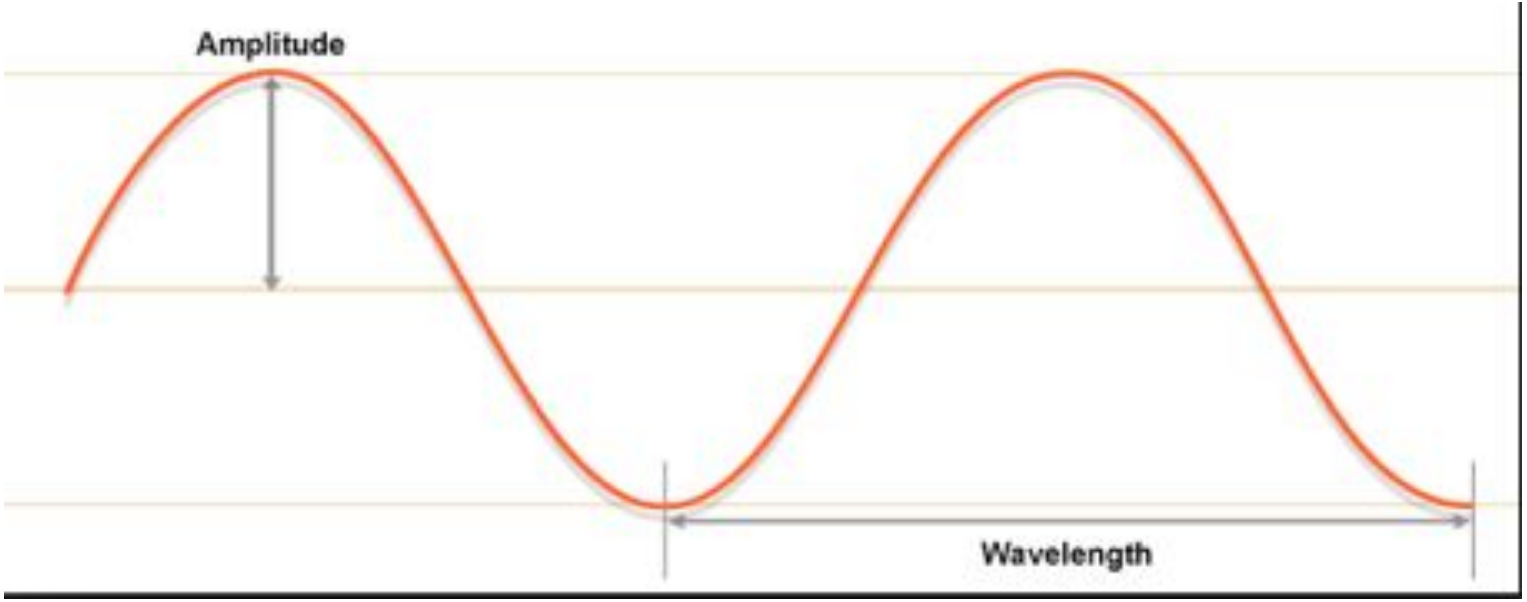
Class Discussion

Definition for Wave	Characteristics of Waves

Explore

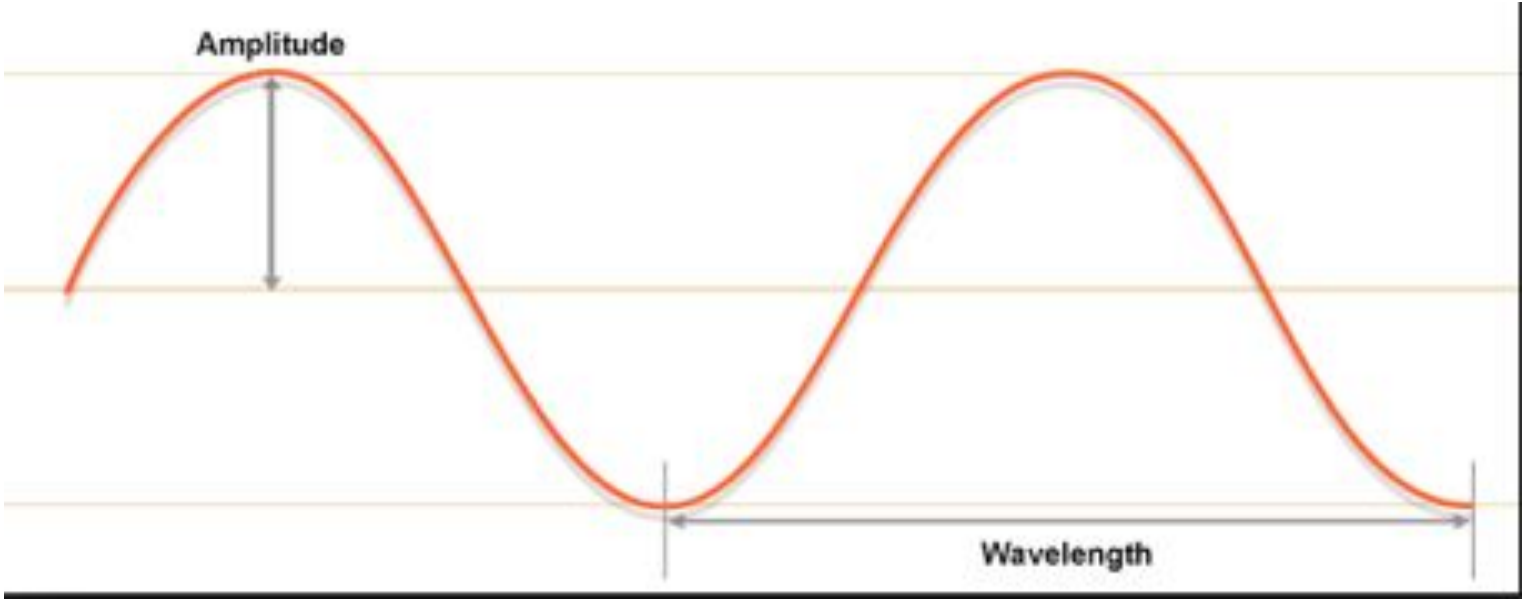
Scientists have specific words to describe these characteristics of waves!

Characteristics of Waves



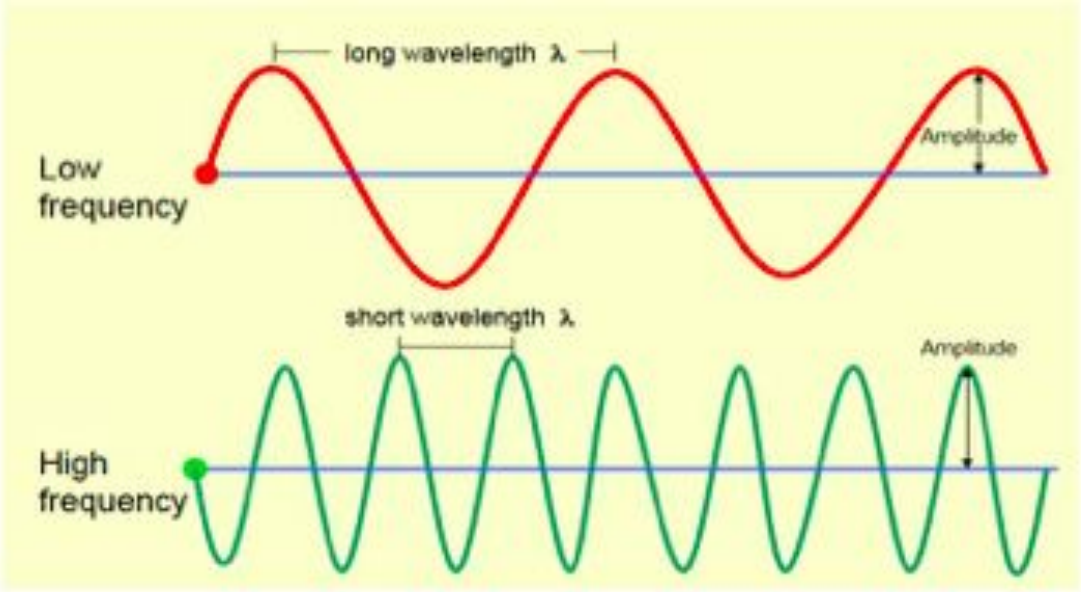
Amplitude: Distance between starting height and highest (or lowest) point of a wave.

Characteristics of Waves



Wavelength: The distance between identical points on consecutive waves.

Characteristics of Waves

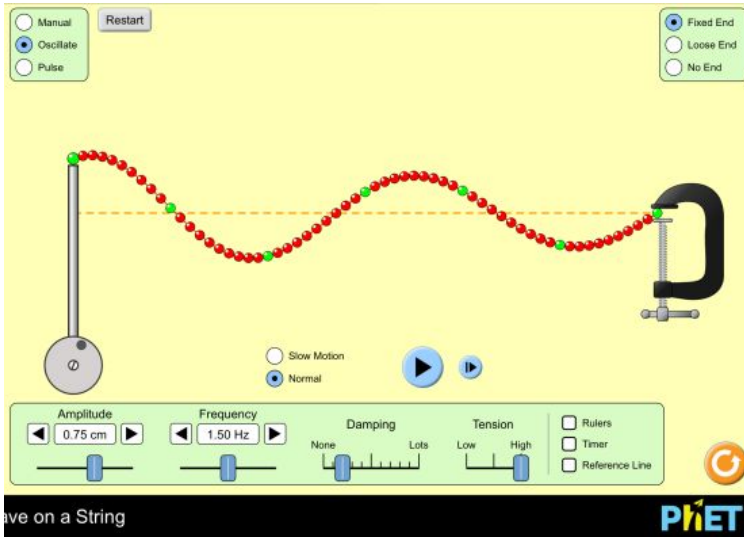


Frequency: The number of full wavelengths that pass a point in a given time interval.

Do you think a small wave or a large wave has more energy?

In groups,

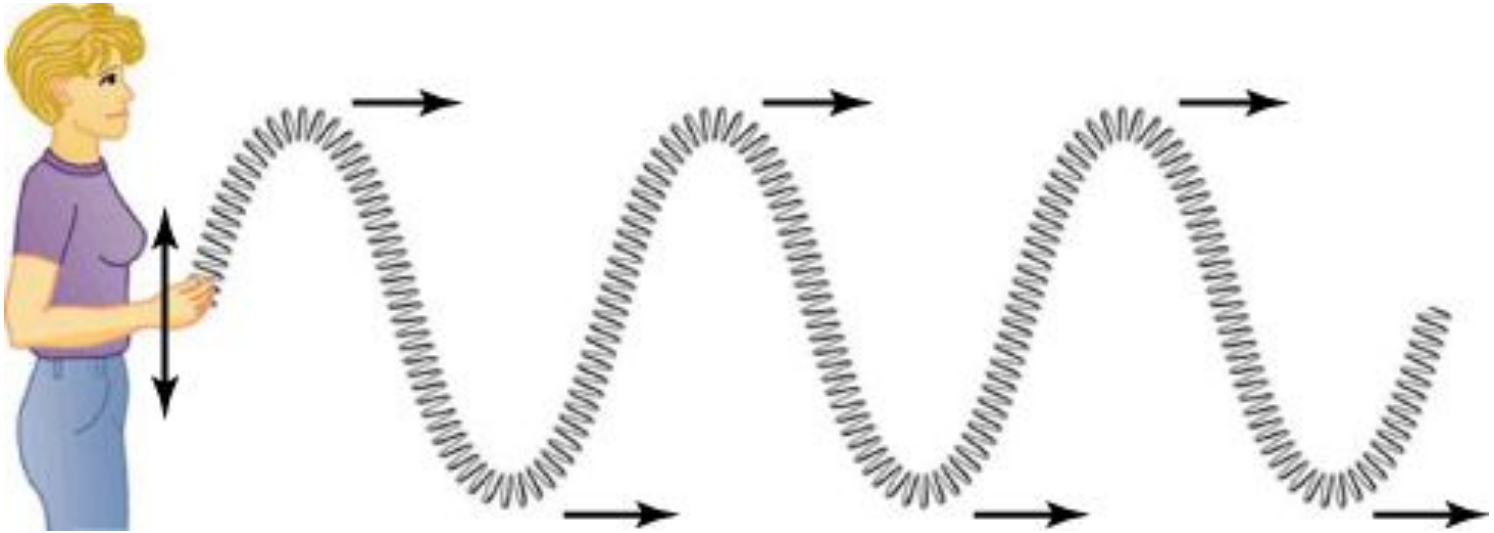
1. Follow the directions in your student guide to use the PhET computer simulation, *Wave on a String*.
2. Record data for each test.
3. Answer the questions in your student guide to help you identify the relationship between amplitude and energy.



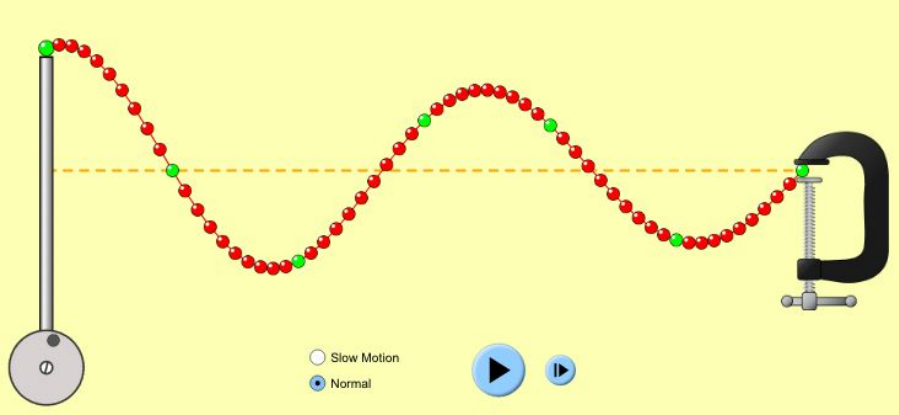
Class Debrief

Do large amplitude or small amplitude waves have more energy?

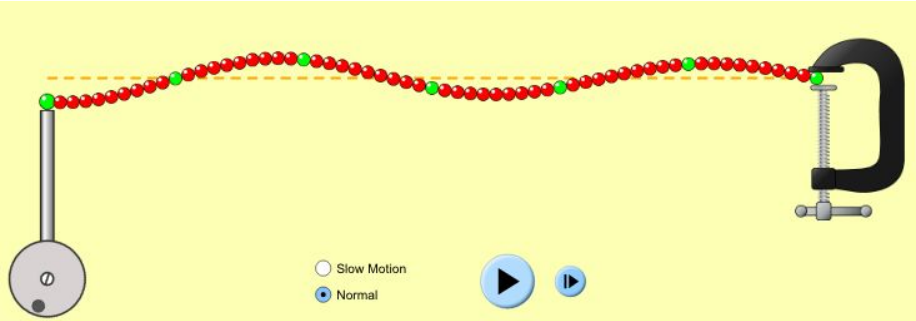
Confirm it with a slinky!



Check for Understanding



Large wrench distance
=
_____ amplitude
=
_____ energy



Small wrench distance
=
_____ amplitude
=
_____ energy

Explain

Developing Models of Water Waves

With a partner, draw 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.

Share with another set of partners!

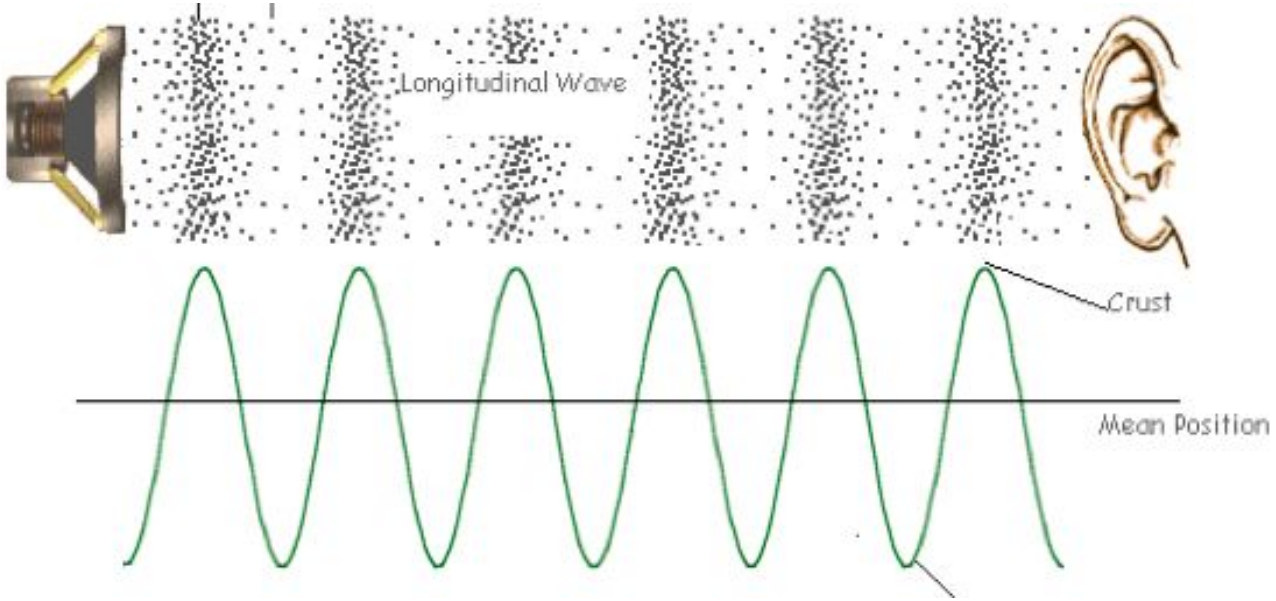
Elaborate

Waves can travel through matter

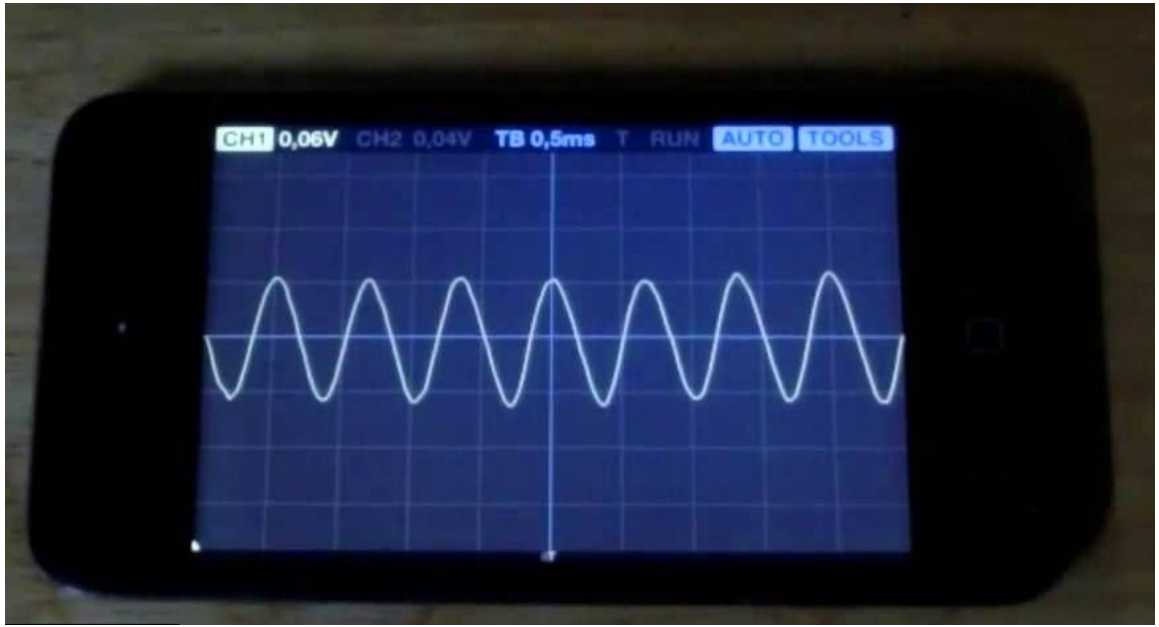
Water waves travel by water molecules colliding and passing along their energy.

Sound waves can travel through air

Just like water waves, sound waves travel by air molecules colliding and passing along their energy.



Unlike water waves, sound waves are invisible!

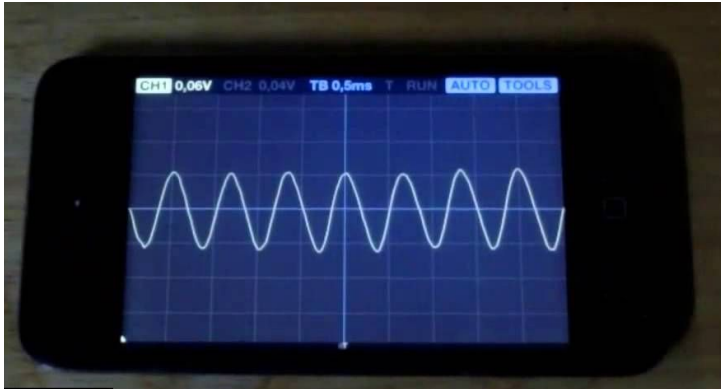


This is an **oscilloscope**, which helps us see sound waves.

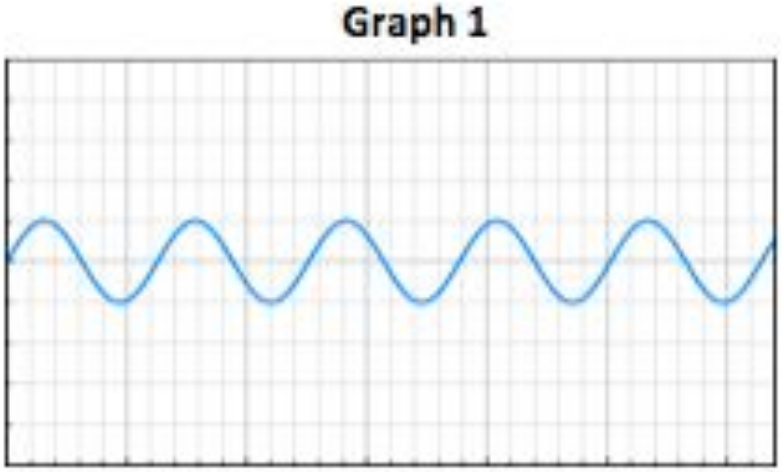
Use the Oscilloscope to make sound waves

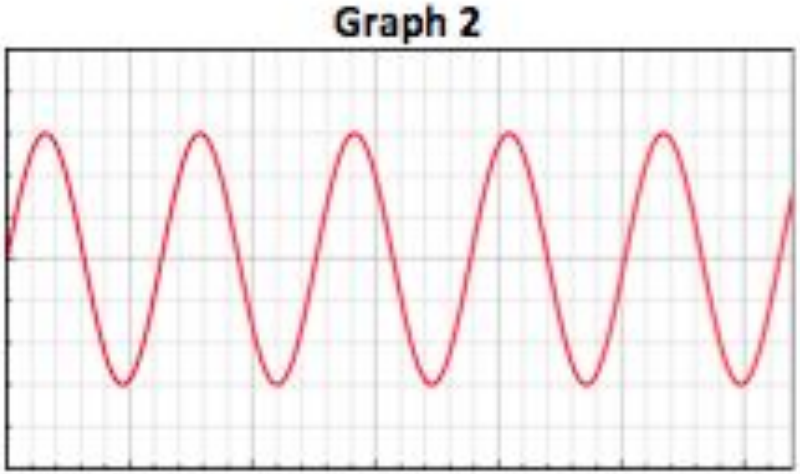
With a partner:

1. Download the “Oscilloscope” app on your phone or other device.
2. Using your voice, try to make waves of different amplitudes, wavelengths, and frequencies.
3. In your student guide, draw what the waves look like and describe what you did to make these different waves.



Think-Pair-Share: Analyzing Waves

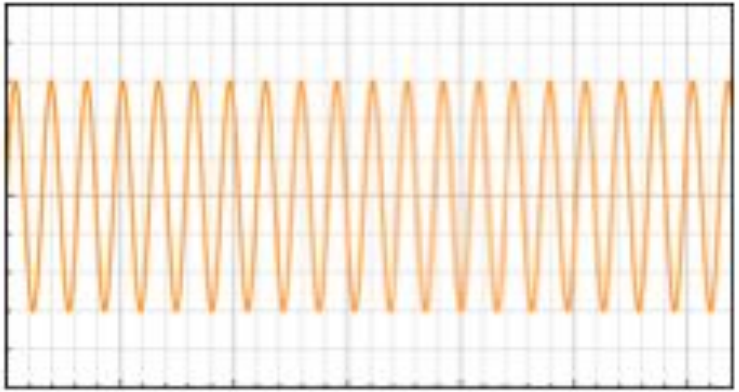




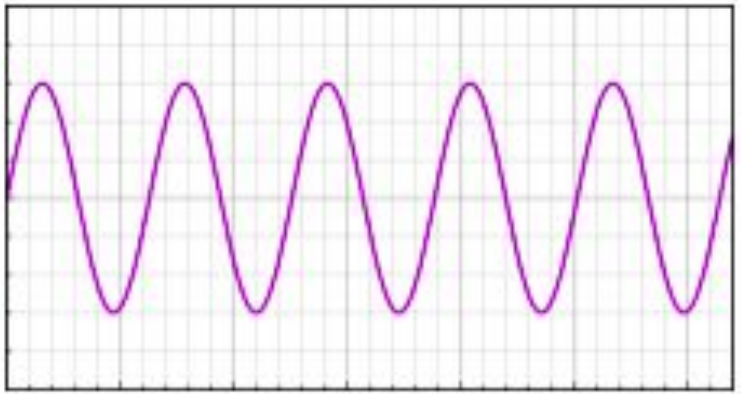
1. What is the difference in frequency, amplitude, wavelength, and energy?
2. What is the difference in the two sounds made by these graphs?

Self-Assessment: Analyzing Waves

Graph 3



Graph 4



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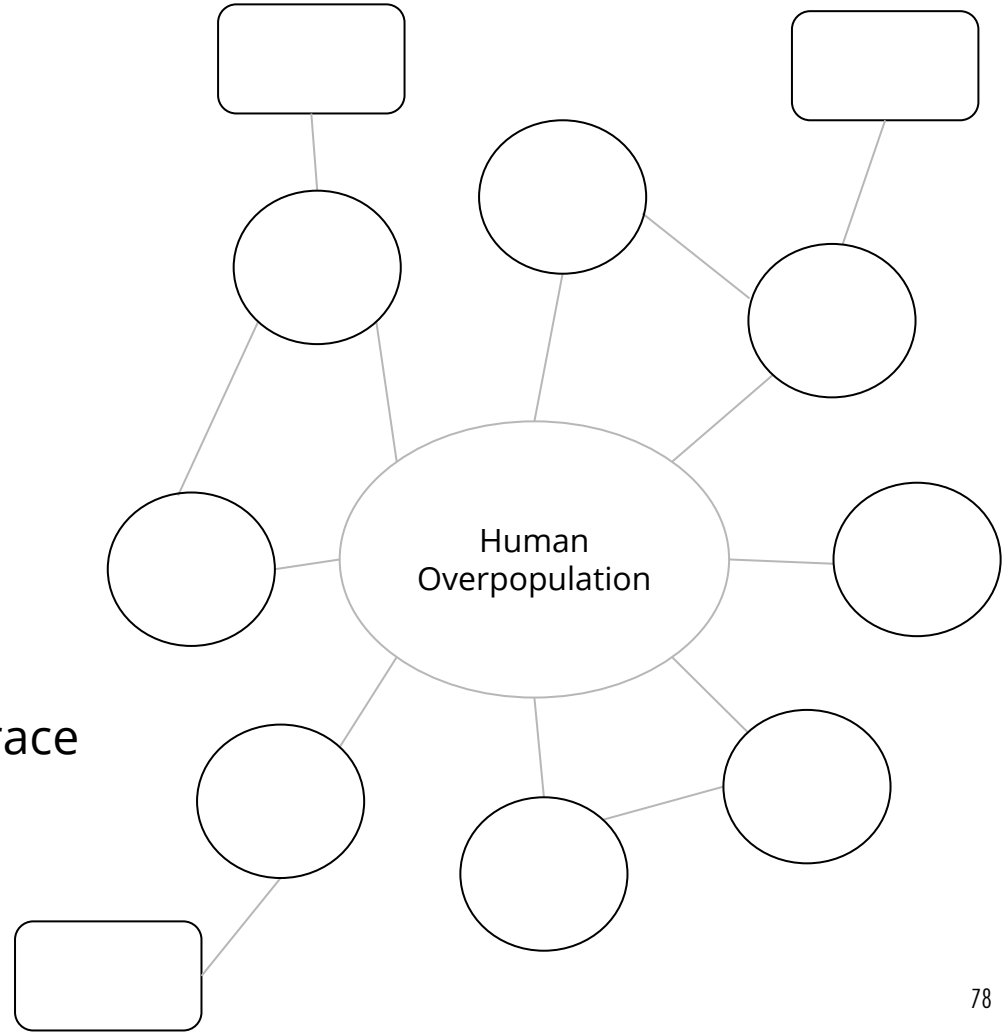
Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Patterns
    - Energy and Matter



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 might these ideas about waves and their energy help us use ocean waves as an energy source?

Complete this **individually** in your Project Organizer.

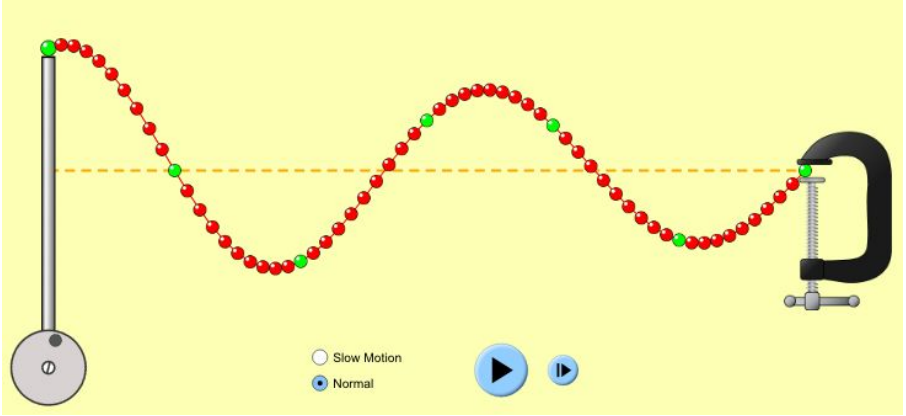
Reflection

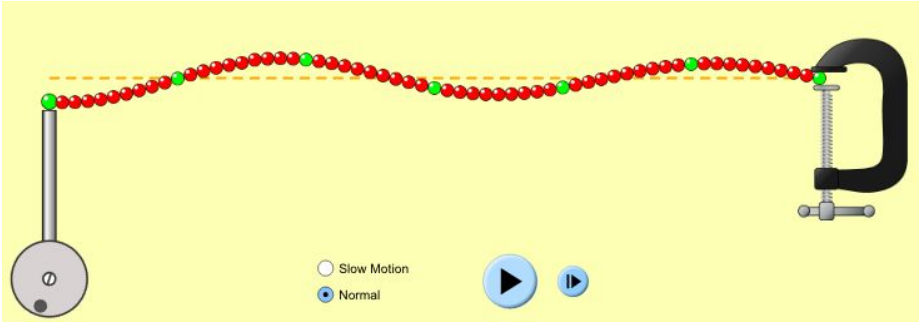
Complete the questions at the end of your student guide to reflect on what you have learned in Task 3.

Wave Interactions

Task 4

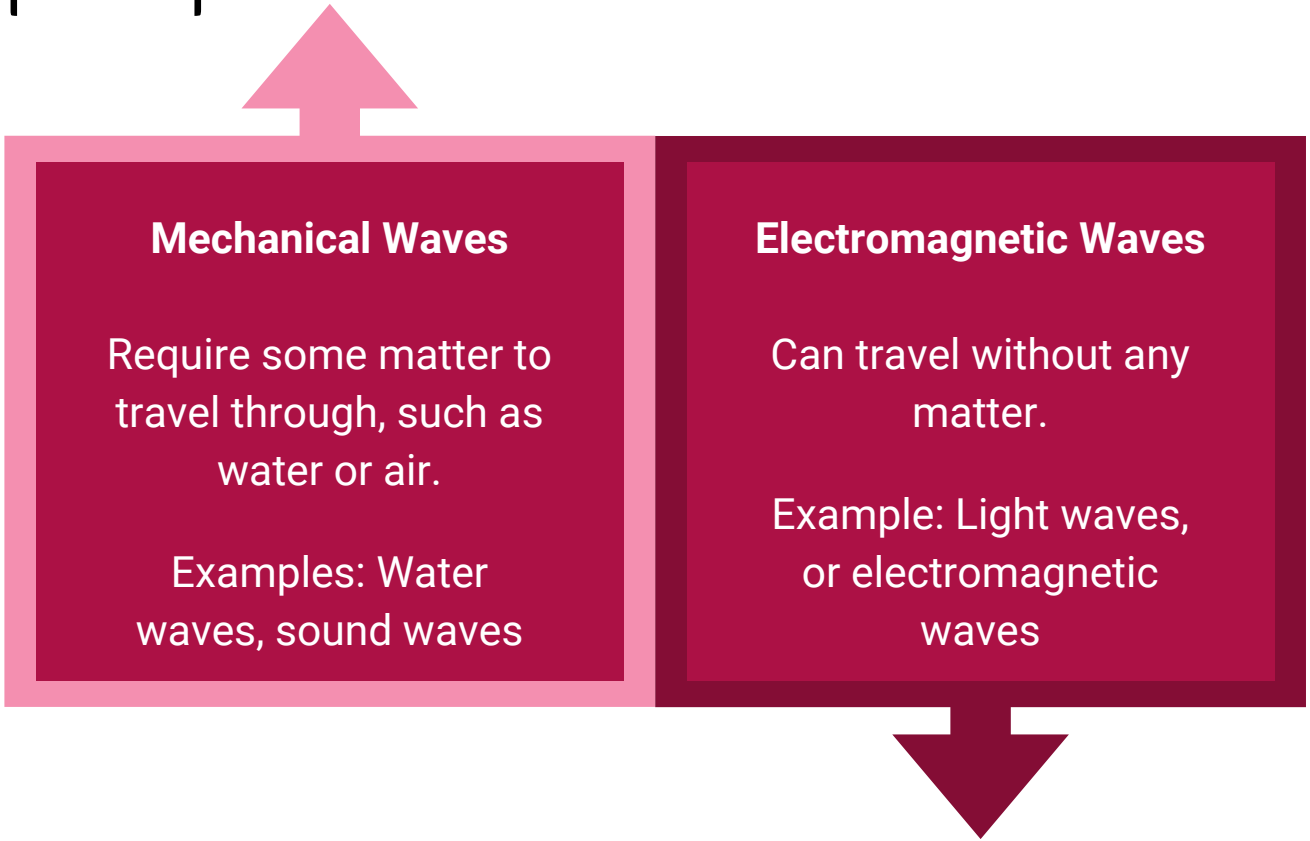
What questions do you still have?





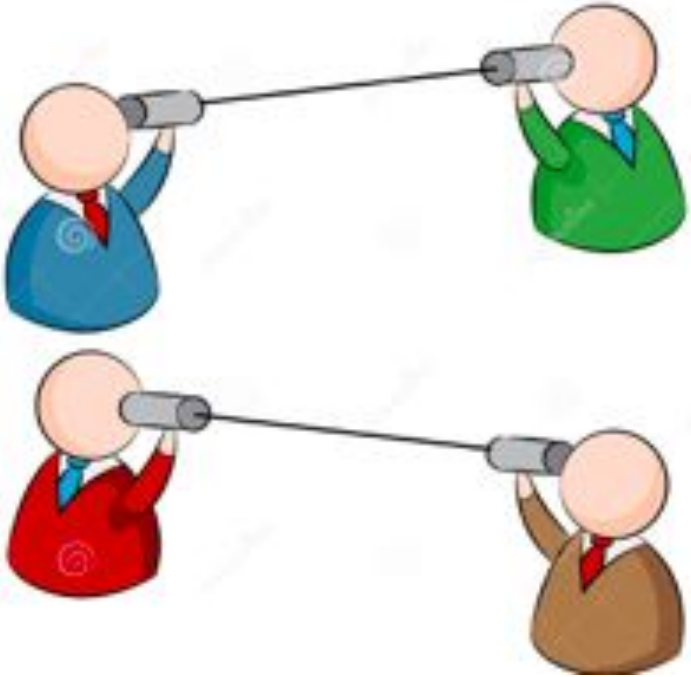
Engage

Two Types of Waves



Water waves carry energy we can use...do light waves also have energy we can use?

How are sound waves affected by different materials?

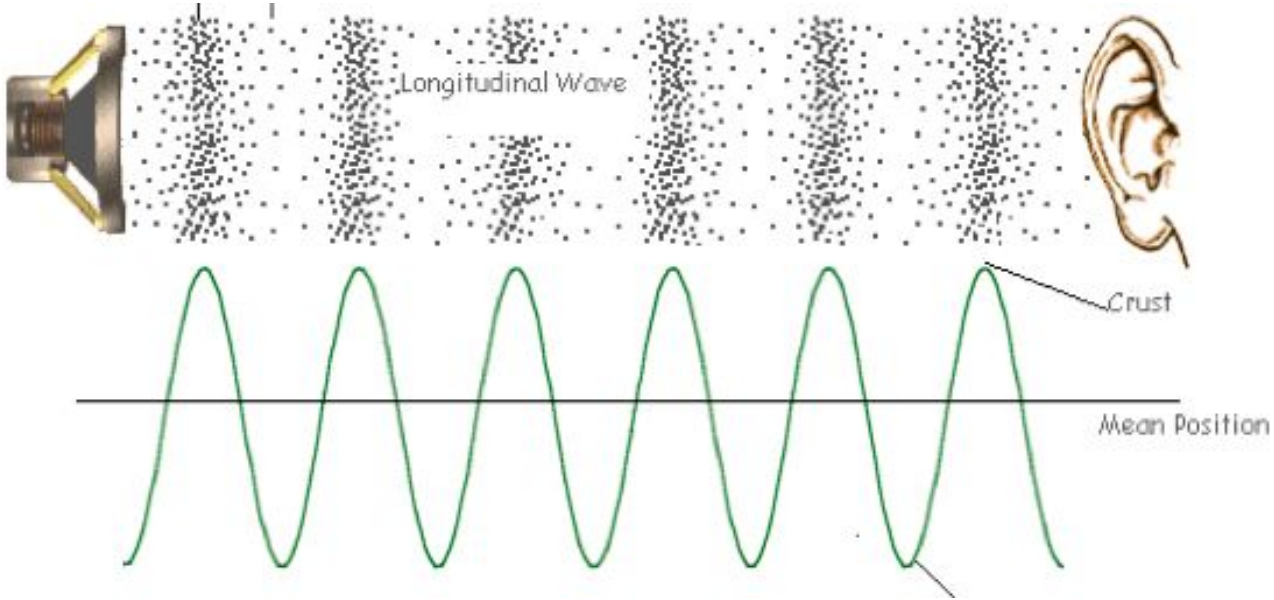


Sound waves are similar to light waves in some ways. Because we are familiar with sound waves, let's start our investigations with sound waves.

1. With a partner, follow the instructions to make a string telephone.
2. Stand 10 feet apart from your partner and try communicating with and without the string telephone.
3. Record your data and analysis in your student guide.

Class Debrief

Did sound travel better through air or through the string? Why do you think so?

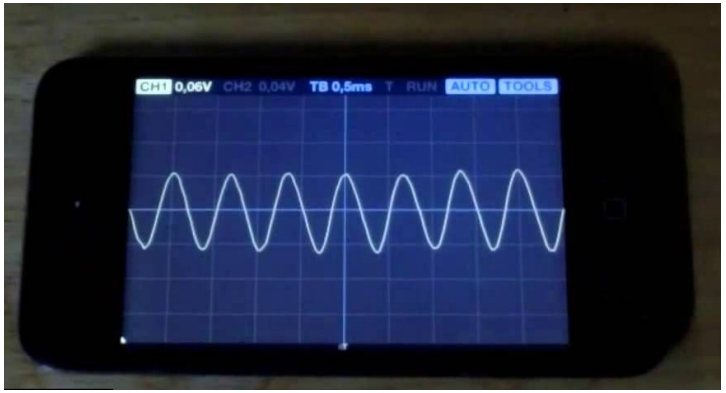


Explore

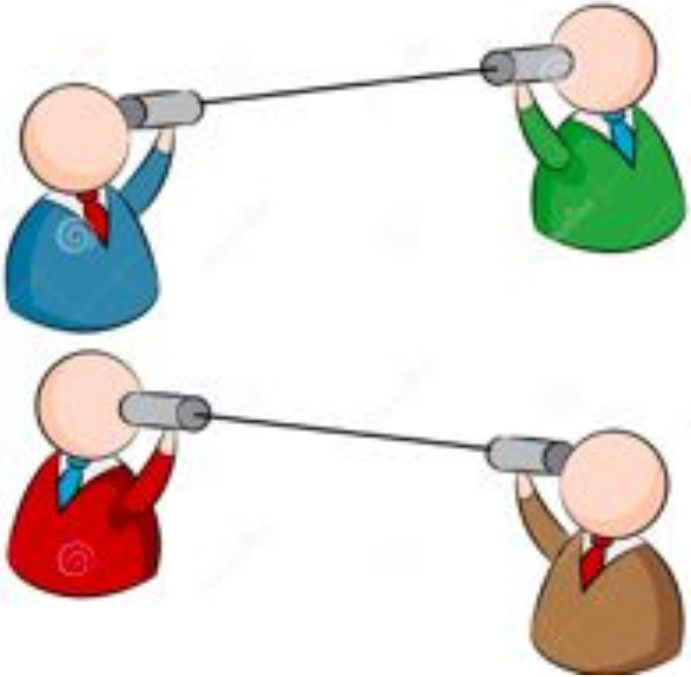
Observe the sound wave travelling through the string telephone

With a partner:

1. Place the oscilloscope app near you or your partner's ear.
2. Observe the sound wave that travels through the string telephone.
3. Draw and describe the wave in your student guide to use as a comparison throughout the rest of this task.



Part 1: How do different materials affect **sound** waves?



In groups,

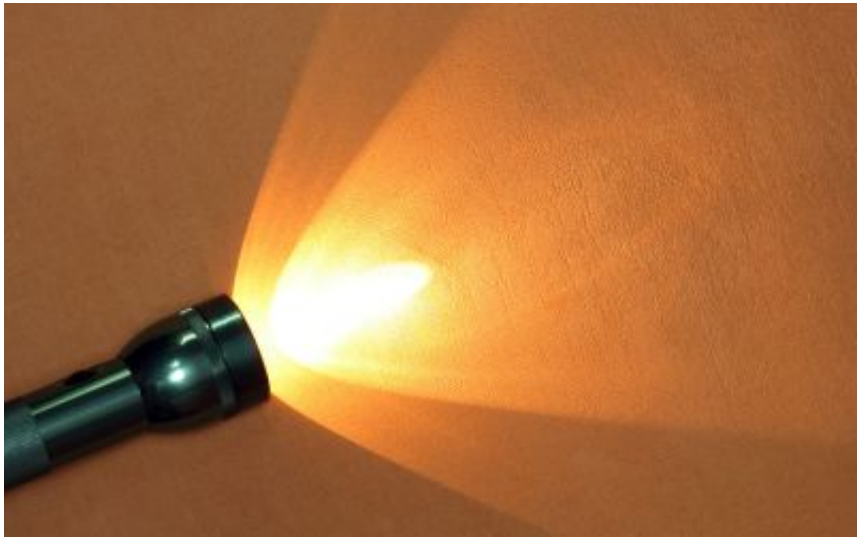
1. Decide whether you want to minimize, maximize, or change the sound.
2. Use different materials to re-engineer your telephone.
3. Test each re-design using the oscilloscope app.
4. Record data in your student guide.
5. Discuss and answer the questions in your student guide.

Class Debrief

- What materials seemed to make the sound louder?
- What materials seemed to make the sound softer?
- What materials seemed to change the sound?
- What happened to the sound wave when it went through materials that made the sound quieter?
- What happened to the sound wave when it went through materials that made the sound louder?

Now that we know how different materials affect **sound** waves, let's investigate this with **light** waves

Part 2: How do different materials affect **light** waves?



In groups,

1. Pick one material from each list on the student guide.
2. Test what happens when you shine light through each material.
3. Decide which description most closely matched what happened with each material (reflected, absorbed, or transmitted).
4. Discuss and answer the questions in your student guide.

Class Debrief

- What three different things can happen when a light wave interacts with a material?
- How do you think the light wave changes when it interacts in each of the ways you described in the above question?
- What kinds of materials cause each of these different behaviors?

Explain

Wave Interactions

When light and sound waves encounter different materials, they can behave in different ways. This is called a **wave interaction**.

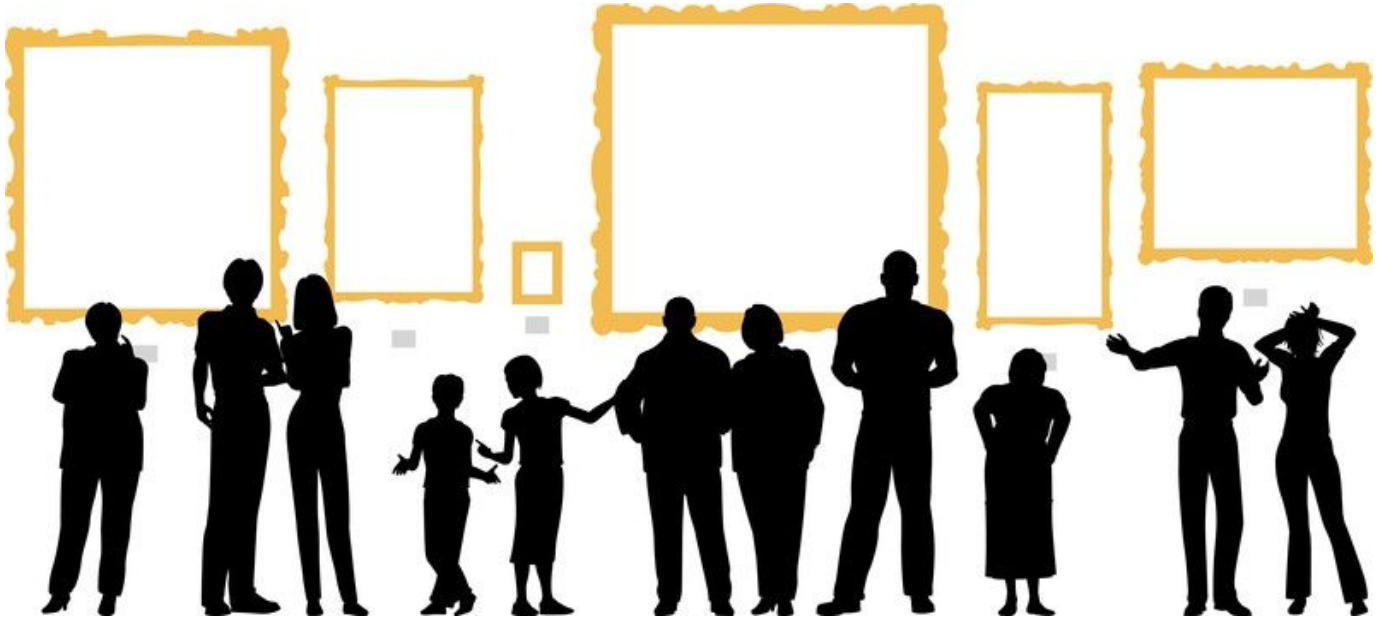
Individually, read and annotate the *Light Waves* article and *Sound Waves* article to practice using some of the new terminology and learn more about how and why these behaviors occur.

Developing Models of Wave Interactions

With your group, create a poster model of your assigned wave interaction. 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

Gallery Walk

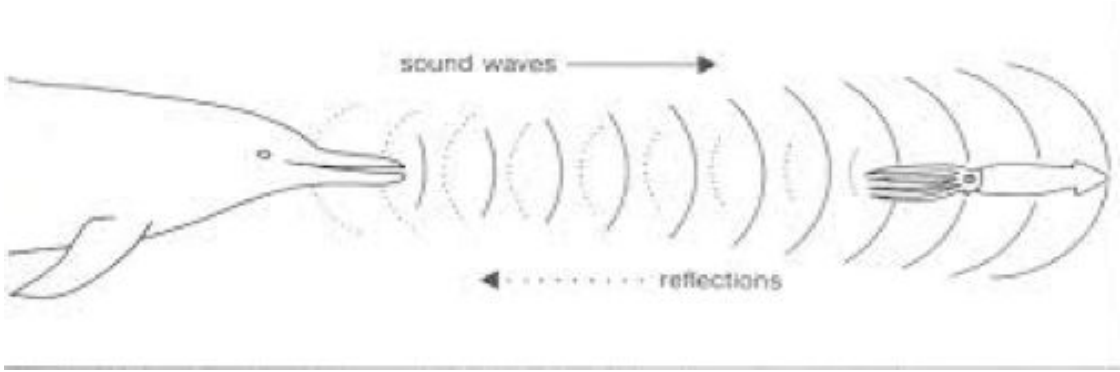


In the chart in your student guide, record your observations (drawings and words) of the different types of wave interactions you see.

Elaborate

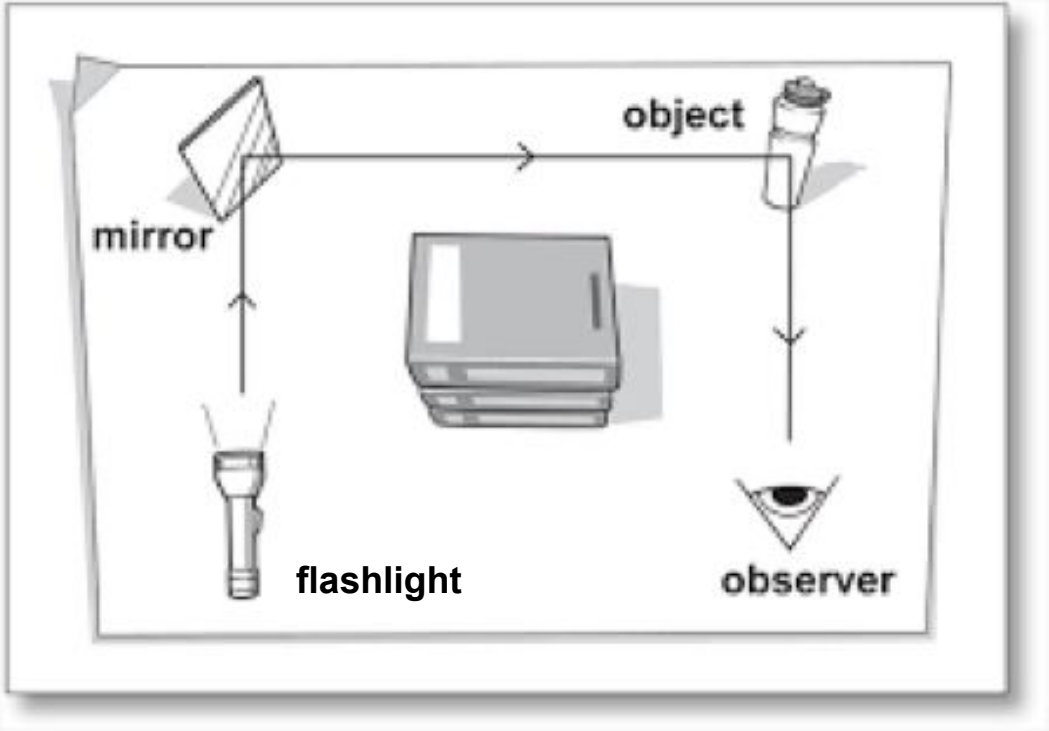
Apply what you know about sound and light waves to two new scenarios

Dolphin Echolocation



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. Will the reflected signal be quieter or louder than the original outgoing signal? Explain why.

Using Light and a Mirror to See Objects



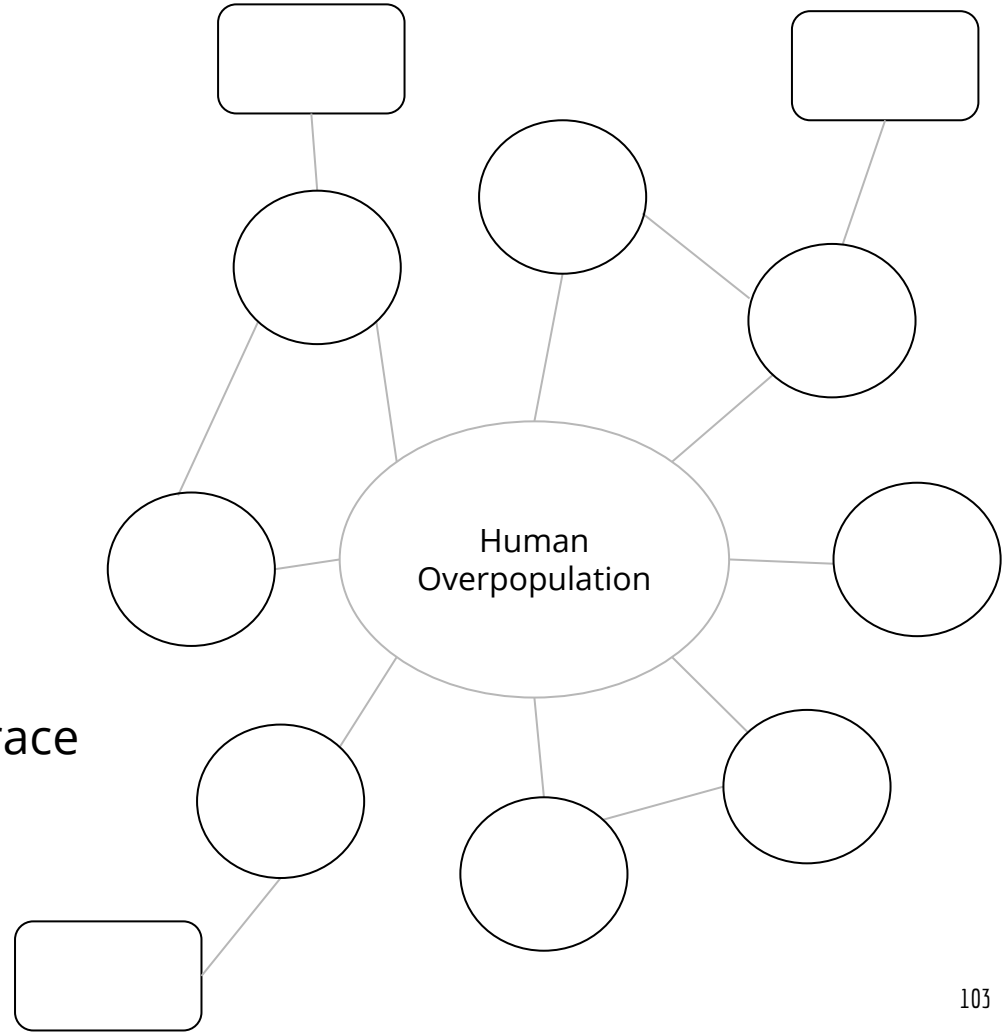
Use the questions in your student guide to figure out:

- When light is being absorbed, reflected, or transmitted
- If the observer will be able to see the light from the torch
- If the light will be as bright as if it was shined directly into the eye

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Structure and Function
    - Energy and Matter



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.

Complete this **individually** in your Project Organizer.

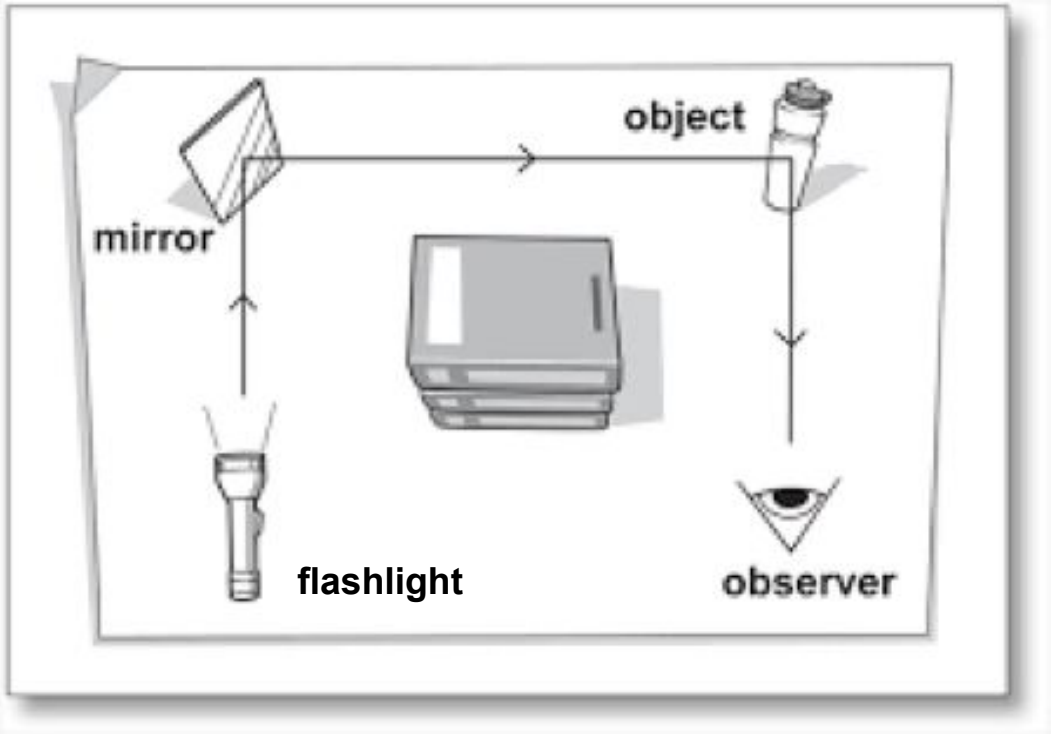
Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 4.

Using Waves to Communicate Information

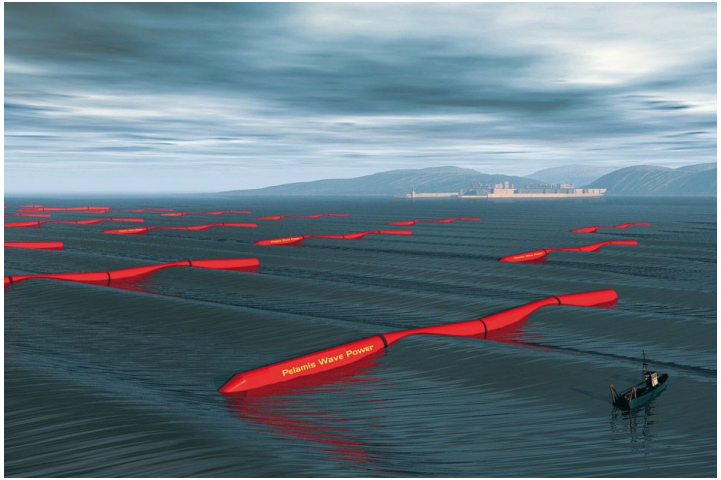
Task 5

What questions do you still have?



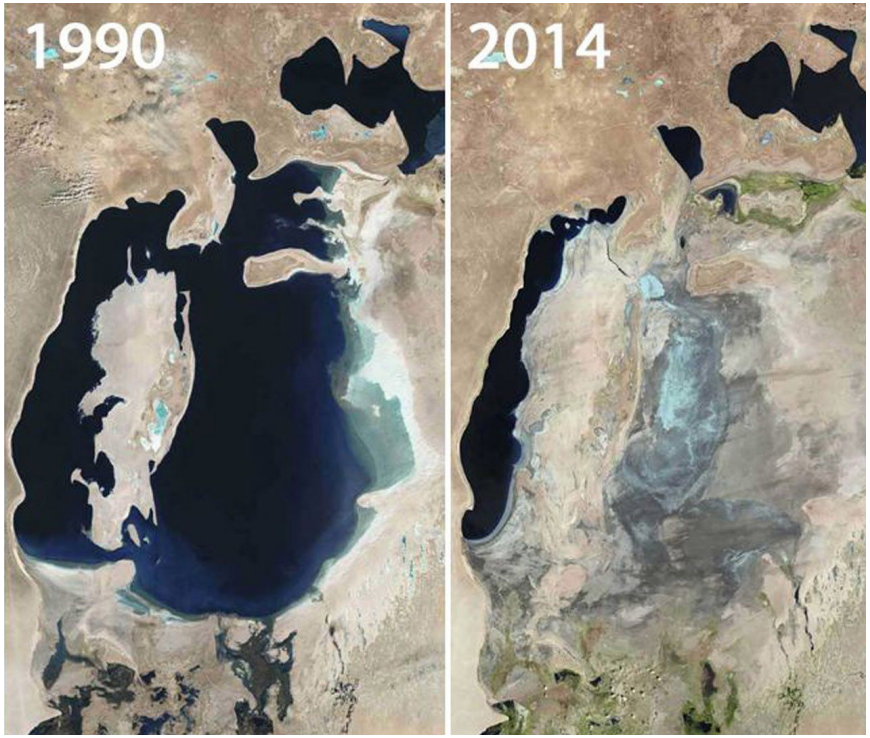
Engage

Water waves and light waves might be good options for alternative forms of energy.



But is this the only way waves might help you with the problem you face in the culminating project?

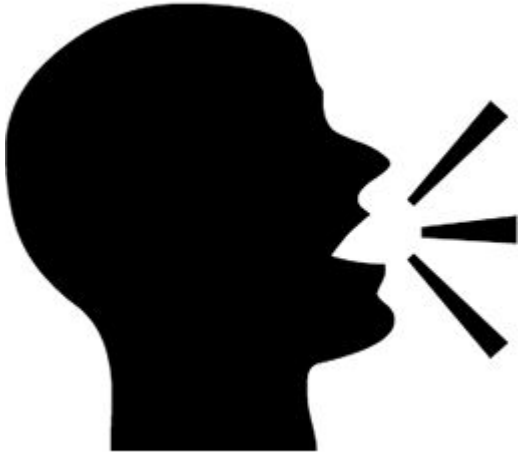
Satellite Image Technology



These images, taken from satellites in space, show the Aral Sea in 1990 vs. 2014. Can you see a difference?

Waves were used to communicate these images, so humans around the world can also see this difference!

Two Ways Waves Communicate Information

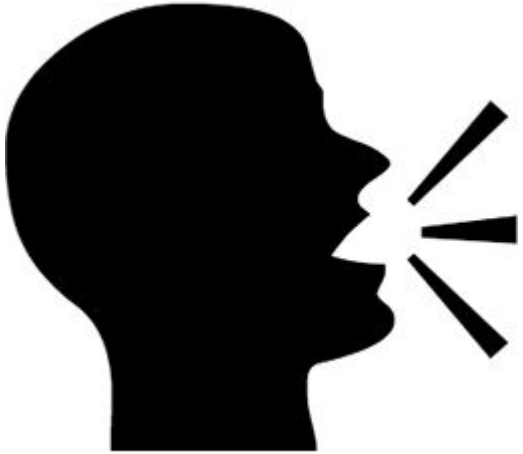


Analog Waves

Digital Waves

Which is a better option for communicating information about resource consumption, like the images of the Aral Sea?

Think-Pair-Share



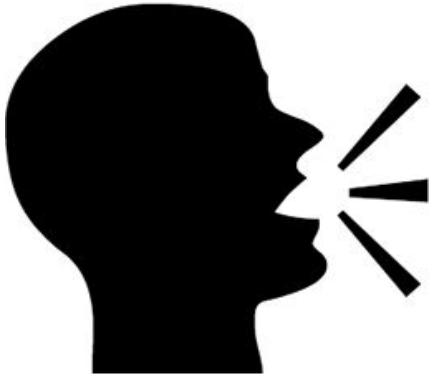
How do you think our voices compare to digital recordings?

Let's Investigate it!

With a partner, follow the directions in your student guide to conduct an initial investigation using the oscilloscope:

1. Speaking: Can you make two sounds that are exactly the same using only your voice?
2. Recording: Can you make two sounds that are exactly the same using a digital recording?
3. Discuss and answer the questions in your student guide to compare analog waves (your voice) and digital waves (the recording).

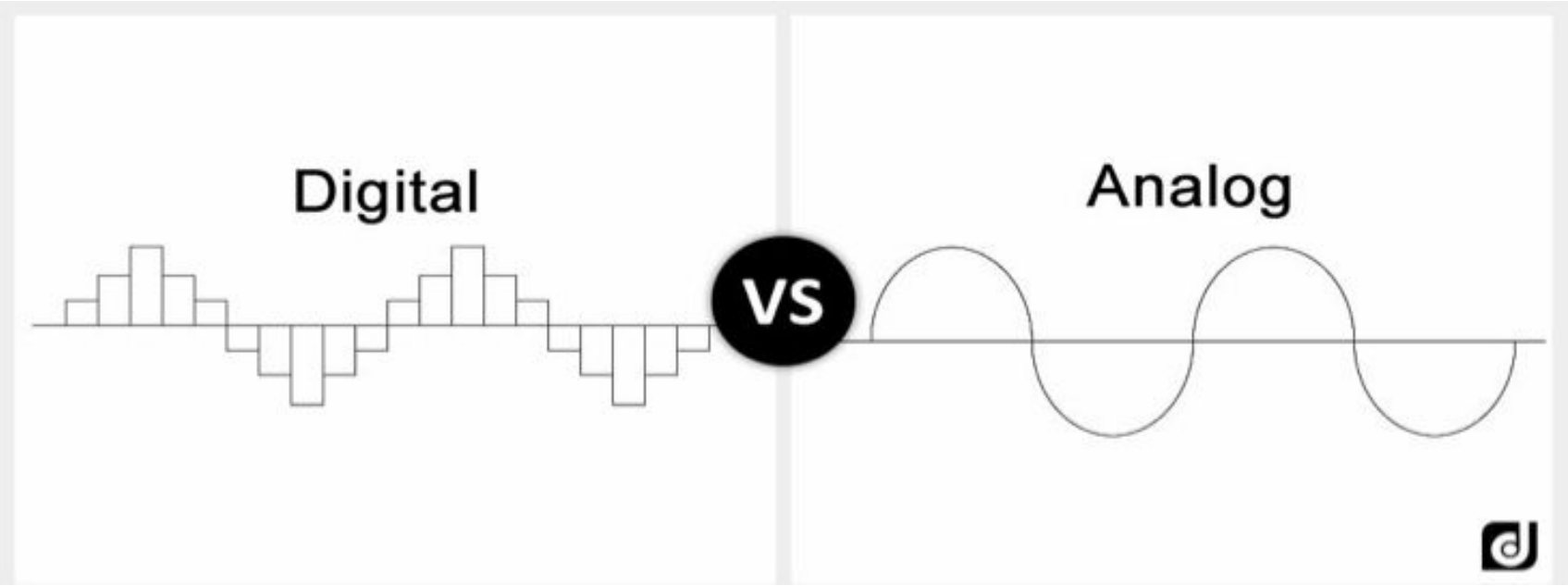
Class Debrief



1. Which type of sound (analog or digital) was easiest to copy exactly?
2. Why do you think it might be important that a wave be able to be repeated exactly the same each time?
3. Which type of sound (analog or digital) do you think is best for people who are far apart? Why?
4. Which type of sound (analog or digital) do you think is best for people who are close together? Why?

Explore

The Structure of Digital and Analog Waves



Compare the two photographs

Analog

Digital

Compare the two photographs

Analog

Digital

Compare the two music formats

Analog

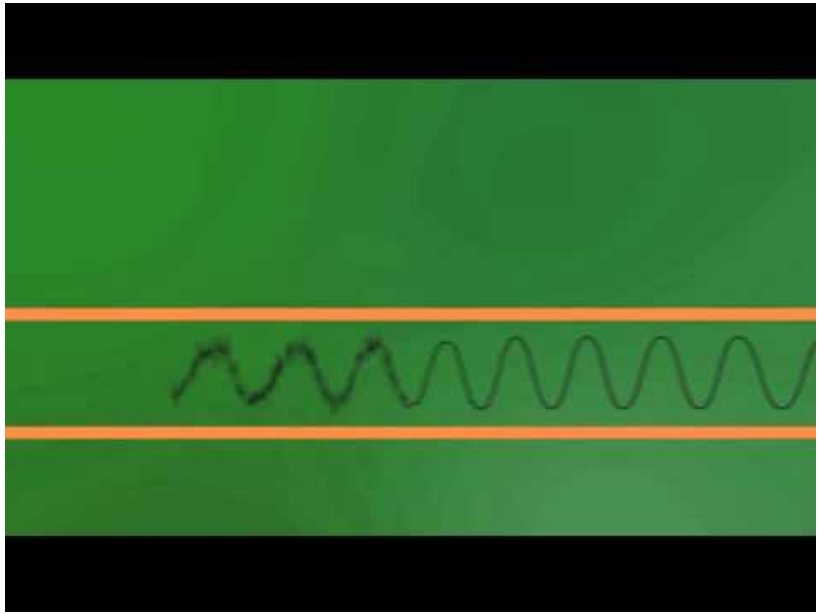
Digital

Compare the two music formats

Analog

Digital

Analog and Digital Waves



https://www.youtube.com/watch?v=XCu6L4kQF3k

Record notes in the chart in your student guide.

Class Debrief

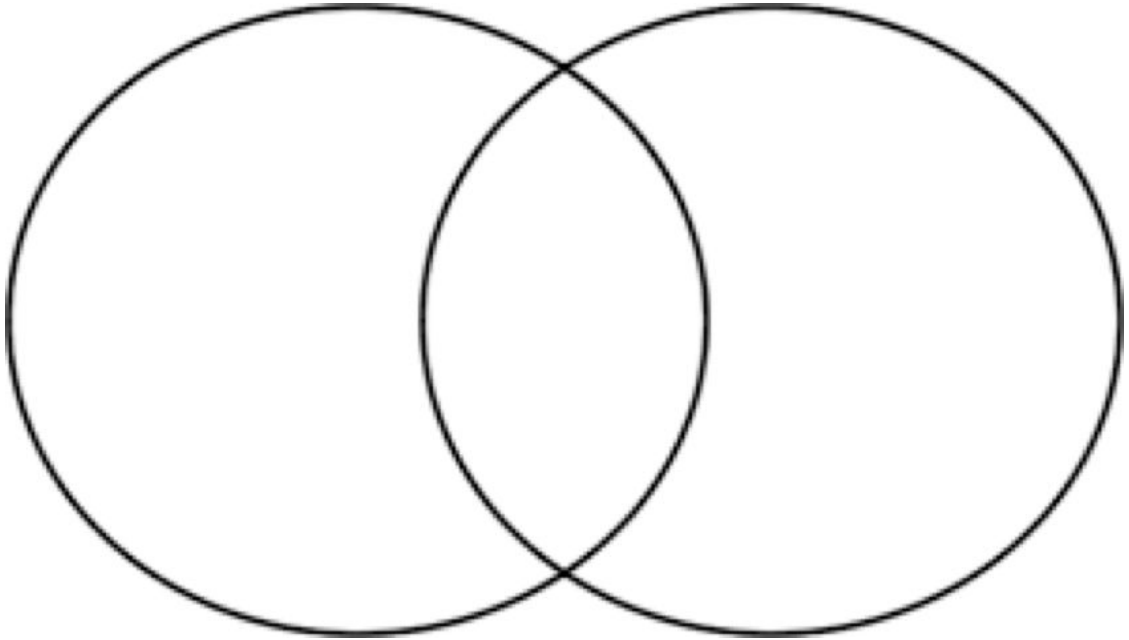
- What is one new thing you learned from the video?
- What questions do you still have?
- How does the structure of each type of wave affect its function?

Read and annotate the article *Analog and Digital*

Explain

Compare Analog and Digital Waves

In pairs, complete the Venn Diagram in your student guide to help you decide which type of wave is a better option for communicating information about resource consumption globally.



Engaging in Argument From Evidence

Which wave (analog or digital) 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 task and scientific reasoning to support your choice.

Critique, Correct, and Clarify

1. Critique: Analyze the argument for **evidence and reasoning**:

   I recommend using digital waves to communicate information about resource consumption because evidence shows that they are better for long-distance, accurate communication. I saw that with digital waves, you could create the same exact wave each time. They also create clearer images and sounds. We would want this for things like satellite imaging, so people could really see what is happening to Earth over time.

2. Correct: Write an improved argument in your student guide.
3. Clarify: Describe how and why you corrected the argument.

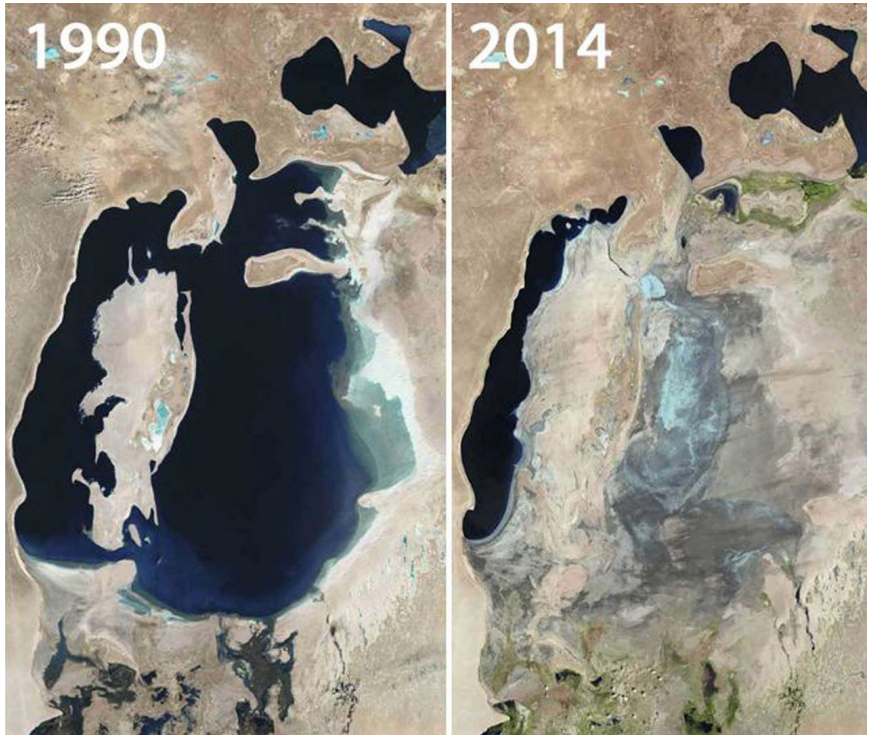
Elaborate

Satellite Images - How humans are affecting Earth

https://youtu.be/MNQ9z_Eb-Jc

Read about how this technology works in your student guide.

Think-Pair-Share



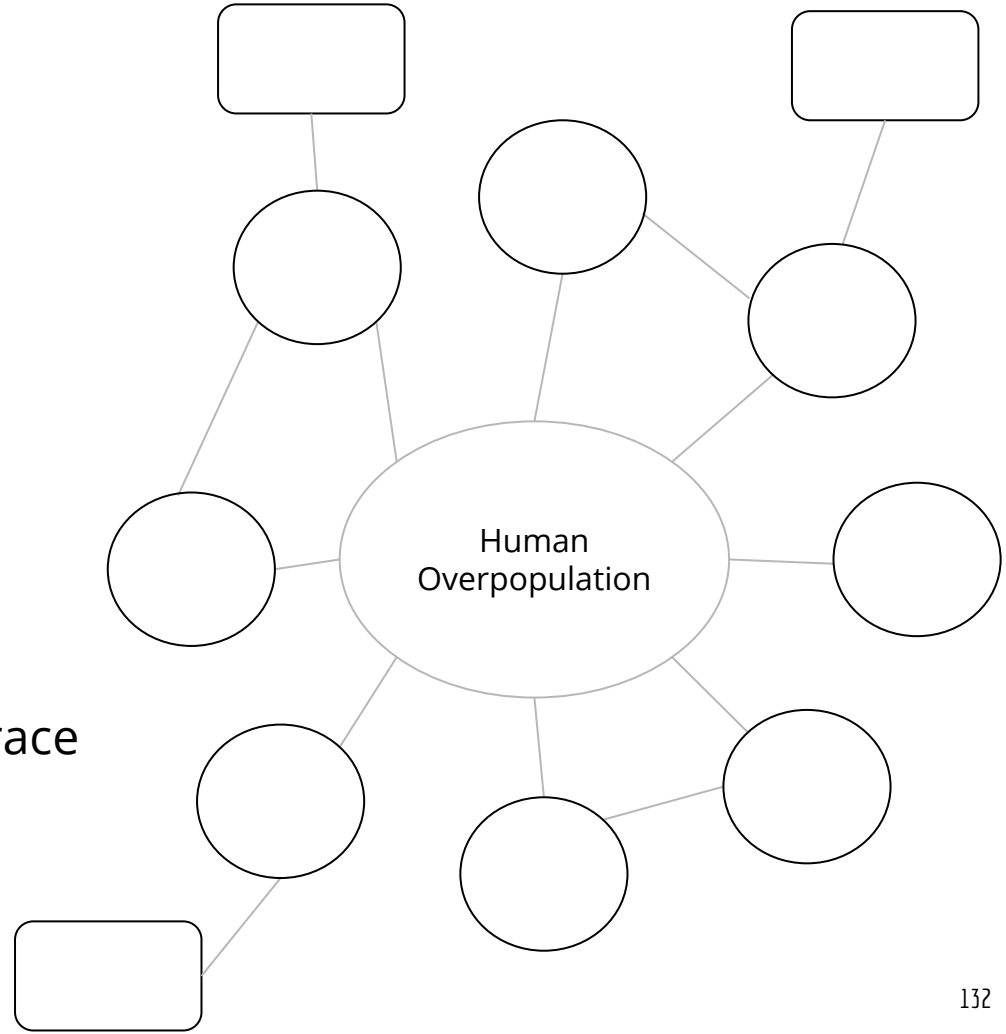
1. If comparing images of the same area over time is what helps us monitor resource consumption, do you think it would be best to use analog or digital waves? Why?
2. Why do you think using waves in this way might help mitigate (lessen) human impacts on Earth?

Record responses in your student guide.

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Structure and Function



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 this solution? Why? Explain using knowledge of their **structure and function**.

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 5.

Culminating Project

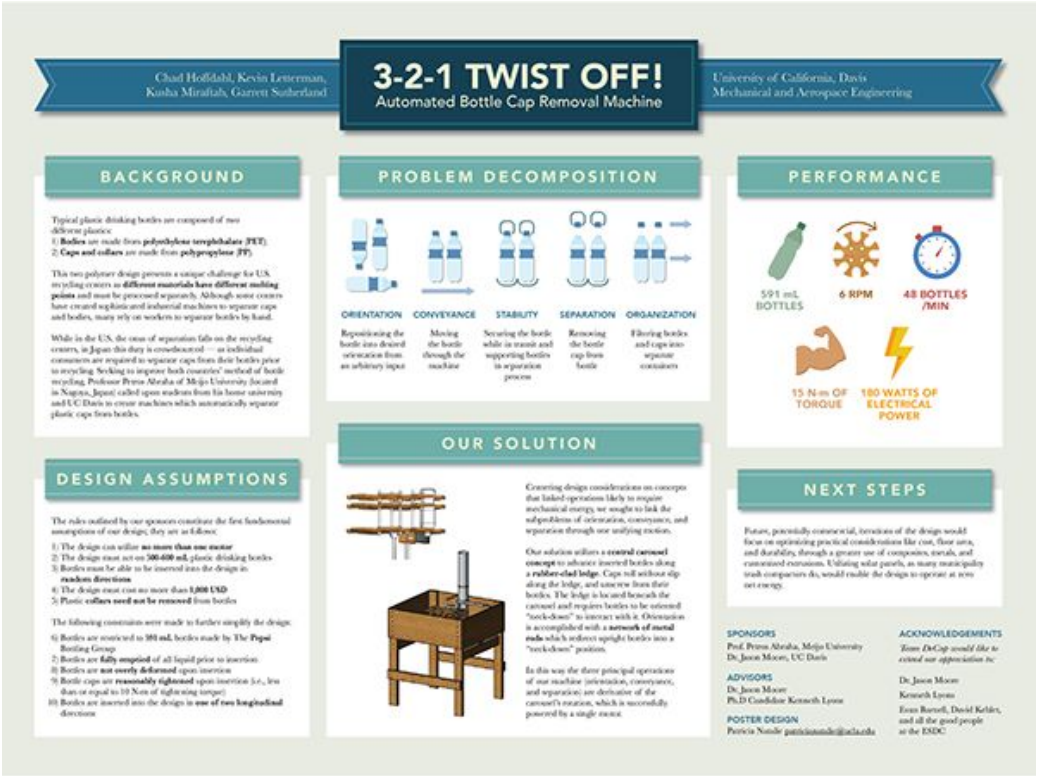
What technologies can we use to help monitor or lessen the effects of human overpopulation and excess resource consumption?

Pick 1 Solution to Research: Solar Energy, Ocean Wave Energy, or Satellite Image Monitoring

Group Project - Scientific poster presentation about your solution at a Resource Conservation Conference

Individual Project - Letter to an environmental non-profit organization recommending a solution

What is a Scientific Poster?



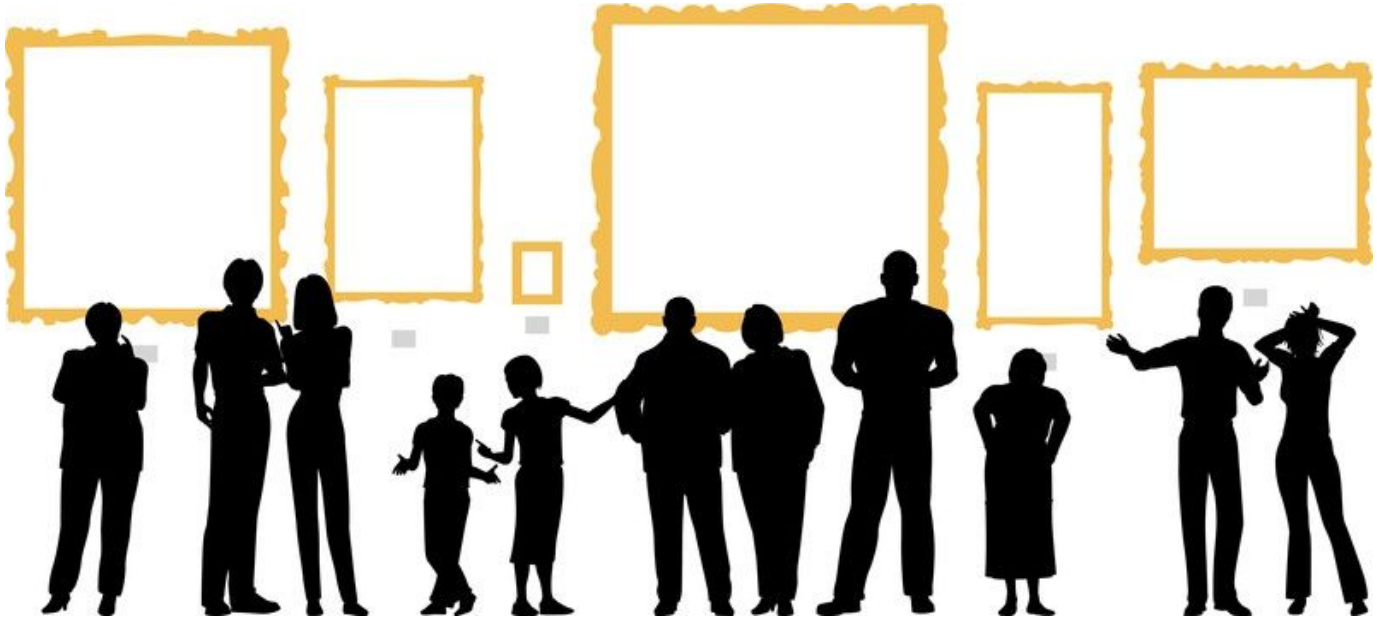
Don’t forget to use your checklist of criteria!

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

Resource Conservation Conference - Gallery Walk



Check out other groups' scientific posters and take notes

Optional Conference Notetaker

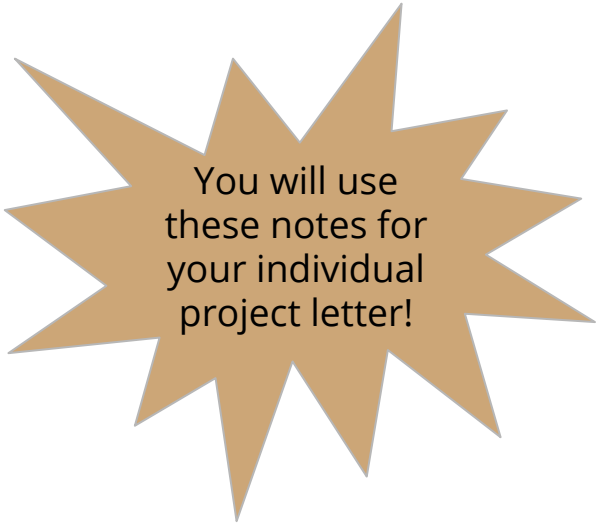
Resource Conservation Conference Notetaker

Instructions: As you visit other groups' posters, take notes in the boxes below. You will be able to use this information in your individual project.

Ocean Waves Energy	
Draw models that show the characteristics of different ocean waves.	Which wave characteristic affects the energy of an ocean wave? How?

Solar Energy	
Draw a model that shows and explains all the different wave interactions involved in solar radiation and solar panel technology.	How do the properties of the clouds, the air, and the solar panels affect how the light wave behaves?

Satellite Image Monitoring	
Take notes on the differences between digital and analog signals:	Which type of signals is best to communicate satellite images? Why?



What technologies can we use to help monitor or lessen the effects of human overpopulation and excess resource consumption?

Pick 1 Solution to Research: Solar Energy, Ocean Wave Energy, or Satellite Image Monitoring

Group Project - Scientific poster presentation about your solution at a Resource Conservation Conference

Individual Project - Letter to an environmental non-profit organization recommending a solution

Don't forget to use your checklist of criteria!

Individual Project Criteria for Success

Your letter to the environmental non-profit organization should:

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

- ❑ Construct an argument to convince the reader why this problem matters
  - o What is harming Earth?
    - o Describe the multiple cause-and-effect relationships at work.
  - o 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:
  - o 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.
  - o 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.
  - o 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:
  - o Why the solution you chose should be funded over the others.
  - o How well the solution you chose meets the criteria and constraints of the problem.

Peer Review

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:

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