

Applying Waves and Sound to Design

In this unit, you learned about several different structures, technologies, and devices that apply the properties of waves and sound. Some applications minimize the effects of waves to keep bridges and large buildings stable. Others use the properties of waves and sound in medical applications, such as ultrasound technology (Figure 1), or to produce sound, such as musical instruments. Many future applications will use the properties of waves and sound in new and innovative ways.

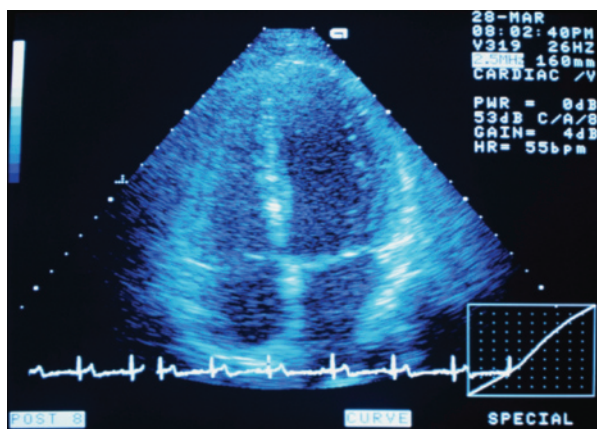


Figure 1 This ultrasound image shows the four chambers of a human heart.

There are two suggested tasks for this unit. Your teacher may assign one or have you choose one.

Option 1: Research a Structure or a Technology

As a group, research how the properties of mechanical waves and sound have influenced the design of a particular structure or technological device. You could research a structure or device already mentioned in the text or a new one. Suggestions are the design of bridges or buildings; the acoustical design of concert halls; and applications such as headphones, hearing aids, a musical instrument, wave pools, and tidal energy. In your research, include societal implications, such as noise pollution and hearing loss. Your research must contain new information and applications beyond those already studied in this unit. With your research, you will create a visually appealing, informative, and entertaining poster or electronic slide presentation.



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Option 2: Design and Construct a Device

As a group, design and construct a device that uses several concepts related to waves and/or sound, is safe, and meets one of the following criteria:

- The device demonstrates characteristics of waves or sound in an innovative way. The demonstration(s) can involve different types of waves as well as the properties of waves (for example, wavelength, frequency, and amplitude). Concepts such as wave speed, the Doppler effect, standing waves, and resonance could also be included. The device could serve as a teaching aid for a physics class.
- The device performs a task using the properties of waves and/or sound; for example, moving an object, triggering an event or series of events, keeping time, or creating sound or music.
- The device is a visually appealing, creative piece of kinetic art that involves in its operation the properties of waves and/or sound. You could partner with an art or design technology class. The art may or may not produce pleasant sounds, but it must demonstrate several properties of waves and/or sound.

Purpose

SKILLS
HANDBOOK  A5.1

- To create a poster or electronic slide presentation that shows how the properties of mechanical waves and sound have influenced the design of a structure or technology (Option 1)
- To design and construct a device that uses several properties of waves and/or sound (Option 2)

Equipment and Materials


Option 2


Many different materials can be used for this task. You can probably find some materials at home; you may be able to get other materials from your teacher.

Procedure

Option 2

- Decide which device you will construct.
- As a group, decide the main ideas or tasks for your device.
- Draw a simple sketch of the device that clearly shows how it will look or work and which properties of waves and/or sound the device will apply.

- Keep the materials and the size of the device reasonable. The device should fit comfortably on a science classroom desk. Create a materials list. 

 Ensure that your materials, tools, and final product are safe to use.

- Prepare a report or summary of your design for approval by your teacher. In your summary, describe in detail the physics principles you are using and the expected performance of your device based on those principles. Note any suggestions from your teacher, and make appropriate changes to the design. Have the modified design approved by your teacher.
- Construct the device, making notes of any design changes or difficulties in a log. Include diagrams in your log when necessary.
- Demonstrate the device in the classroom, and be prepared to answer questions about how it applies the physics principles related to waves and/or sound.

Analyze and Evaluate

Option 1

- How does the structure or technology apply properties of waves and/or sound?
- What are the main uses of the structure or technology? Who uses it?
- What positive impact does the structure or technology have on society? Are there any negative impacts?
- What careers are involved with producing and maintaining the structure or technology?
- What new research is being done to improve these types of structures or technologies?

Option 2

- Which physics principles related to waves and/or sound does your device apply?
- How did your group test and improve your device?
- Describe in detail how your device works.
- How have the design and construction of your device improved your understanding of the physics principles related to waves and/or sound?
- What would you do differently if you built another device for a similar task?

ASSESSMENT CHECKLIST

Your completed Unit Task will be assessed according to these criteria:

Option 1

Knowledge/Understanding

- ✓ Demonstrate knowledge of different types of waves, as well as terminology associated with waves and sound.
- ✓ Demonstrate knowledge of technologies that apply principles and concepts related to waves and sound.
- ✓ Describe the impact of waves and/or sound on society and the environment.
- ✓ Demonstrate an understanding of the physics principles behind the structure or technology, as well as the wave equation, standing waves, and resonance.

Thinking/Investigation

- ✓ Research how the design of a structure or technology has been influenced by waves and/or sound.
- ✓ Create a poster or electronic slide presentation on a structure or technology involving waves and/or sound.

Communication

- ✓ Synthesize findings in the form of a poster or electronic slide presentation.
- ✓ Communicate recommendations clearly and concisely.

Application

- ✓ Identify careers associated with the structure or technology.
- ✓ Provide current research on the structure or technology.

Option 2

Knowledge/Understanding

- ✓ Demonstrate knowledge of different types of waves, as well as terminology associated with waves and sound.
- ✓ Demonstrate knowledge of technologies that apply principles and concepts related to waves and sound, as well as the wave equation, standing waves, and resonance.

Thinking/Investigation

- ✓ Design a device according to given specifications.
- ✓ Evaluate the design and modify it to improve performance.

Communication

- ✓ Prepare a log of the design and modifications.
- ✓ Demonstrate an understanding of the design of the device and the physics principles behind it.

Application

- ✓ Use equipment and materials safely and effectively to construct and modify the device.
- ✓ Demonstrate how the physics principles related to waves and/or sound can be applied to the device.