Lesson Topic: Sound Waves

Objective:
Students will be able to:

1. Understand how sound is created and transmitted
2. Create sound waves at various frequencies

Time Required: 90 minutes

Materials Needed:

- Rope/string of 12 - 15 ft lengths (1 per group)
- Glass bowl
- Parchment paper
- Rubber band
- Salt - colored (you can do this with a couple drops of food color)
- Portable bluetooth speaker
- Phone with a tuner app (there are several apps you can download for free)
- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Sound Waves handout (attached)
- Sound Waves Activity handout (attached)

Teacher Preparation:

- Assign a Legends of Learning Instructional Quick Play playlist for the day(s) you will be teaching the lesson.
    - Instructional - Middle School - Sound Waves
- Assign a Legends of Learning Content Review Quick Play playlist for the day(s) you will be teaching the lesson.
    - Content Review - Middle School - Sound Waves
- Assemble Sound Demo
    - Take the speaker and place it in the glass bowl
    - Cover the top of the bowl with parchment paper and seal with a rubber band
    - Sprinkle salt over the parchment paper
- Pre-cut rope (if needed)
- Make copies of Sound Waves handout (1 per student)
- Make copies of Sound Waves Activity handout (1 per student)

Engage (15 minutes):

1. To engage students, bring out preassembled bowl-speaker with salt
2. Ask for student volunteers to predict what will happen to the salt when music/ tones are played
    a. Accept reasonable answers and have students support their answers with reasoning
3. Play low tone with phone app, observe what happens
    a. Note: The salt should start to move into patterns on the parchment paper. Low

tones create large geometric patterns. High tones create smaller geometric patterns

4. Play high pitched tones with phone app, observe what happens
5. You can experiment with various tones and discuss as a class what happens, and draw conclusions as to why.
    a. *Explain to students that sound is actually waves being created and received by your ear. This demo helps you "see" sound waves (bc they are invisible to the naked eye). HIgher pitched sounds are waves that are moving quickly, while lower pitched sounds and waves moving more slowly.*

Explore (30 minutes):

1. Have your students sign in to Legends of Learning. Instruct students to complete the Instructional playlist.
2. As students complete the assigned game, students should fill out the Sound Waves handout (attached).
3. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

Explain (10 minutes):

1. Review answers to Sound Waves handout by drawing diagrams on board or using Smartboard.
2. Use Youtube video to further explain some of the topics from the hand out
    a. Slinky Demo
    b. Stop video at 3:00 minutes, as the first part is the relevant information
3. Explain to the class that they are going to use knowledge of sound waves and their properties to "create" sound waves similar to what the video showed

Elaborate (25 minutes):

1. Distribute materials and divide students into groups (3-4 students)
2. Instruct students to work through Sound Waves Activity hand out with string, filling in all parts.
    a. Review drawings of sound waves with students.

Evaluate (10 minutes):

1. Have your students sign in to Legends of Learning. Instruct students to complete the Content Review playlist.
2. Analyze student results to determine what concepts need to be a focus for reteaching.

Additional Lesson Strategies:

- To use Legends for additional instruction, create a custom playlist with an instructional game and pre and post assessment.
- To use Legends for a quick formative assessment, create a 5-question assessment in a playlist.
- To use Legends for a student-directed experience, create a targeted freeplay playlist.

- Encourage students to play on their own at home in Legends of Learning: Awakening for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

Sound Waves

Directions: As you are working through your playlist, fill in the definition of each term below.

1. Sound waves: _____

_____

2. Mechanical waves: _____

_____

3. Longitudinal waves: _____

_____

4. Wavelength: _____

_____

5. Frequency: _____

_____

6. Speed: _____

_____

7. Amplitude: _____

_____

Sound Waves Key

Directions: As you are working through your playlist, fill in the definition of each term below.

1. Sound waves: vibration, or wave, that travels through all matter and can be heard
2. Mechanical waves: waves that travel through a medium (gases, liquids and solids)
3. Longitudinal waves: the disturbance of the wave travels in the same direction of the wave
4. Wavelength: measured from compression to compression, or refraction to refraction
5. Frequency: the speed of vibration
6. Amplitude: distance of wave peaks from the center line, or the intensity of the wave

Sound Waves Activity

Directions: Tie one end of your rope to a chair leg or table leg. Pull the rope out to it's full length on the floor to create "sound waves".

Challenge 1 - Vibration

To make a vibration, hold the rope in your hand and jerk to one side and back. Make sure the waves travel all the way to the end. Draw a picture below of how your wave looks in the box below.

Challenge 2 - High Frequency

Now that you have successfully created a single vibration, create a pattern of vibrations that resemble high frequency waves. Draw a picture below of how your waves look in the box below.

Challenge 3 - Low Frequency

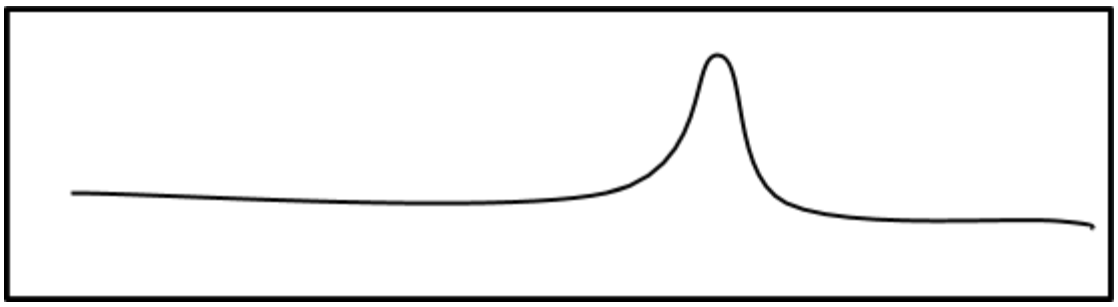
Create a pattern of vibrations that resemble low frequency waves. Draw a picture below of how your waves look.

Sound Waves Activity Key

Directions: Tie one end of your rope to a chair leg or table leg. Pull the rope out to it's full length on the floor to create "sound waves".

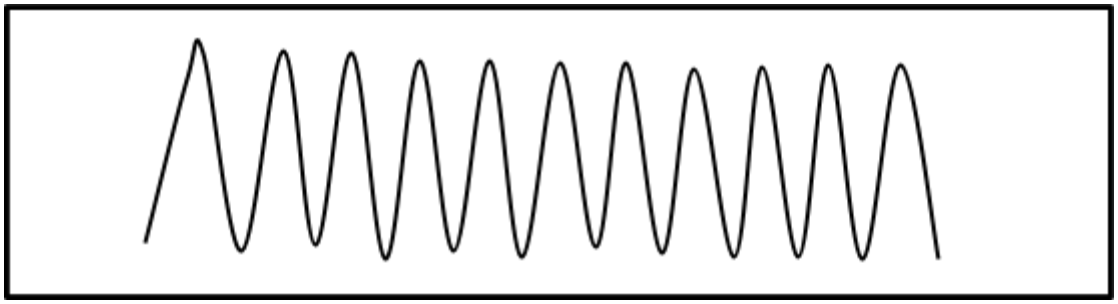
Challenge 1 - Vibration

To make a vibration, hold the rope in your hand and jerk to one side and back. Make sure the waves travel all the way to the end. Draw a picture below of how your wave looks in the box below. (depiction should show single wave traveling through rope)



Challenge 2 - High Frequency

Now that you have successfully created a single vibration, create a pattern of vibrations that resemble high frequency waves. Draw a picture below of how your waves look in the box below. (depiction should show waves close together)



Challenge 3 - Low Frequency

Create a pattern of vibrations that resemble low frequency waves. Draw a picture below of how your waves look. (depiction should show waves spaced apart and not as high)