Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hour \_\_\_\_\_\_\_\_\_\_\_\_

**Day 1**  **Sound Waves through Different Mediums**

Today we will be watching several videos, having class discussions and reading a short article on vacuums. Using the information you have gathered, construct a claim supported by evidence responding to the question: Is a vacuum a medium?

Focus Question: Is a vacuum a medium?

Pre-activity question:

1. What is a medium (in relation to sound)?

2. What is a sound vacuum?

Video #1: Sound traveling through different mediums. <https://www.youtube.com/watch?v=Q3oItpVa9fs&feature=youtu.be>

|  |
| --- |
| Video evidence: (Take note of the different mediums sound traveled through. |

Read the article Vacuum Reading

|  |
| --- |
| Article evidence: |

Video #2: How Long Could you Survive in Outer Space? <https://www.youtube.com/watch?v=RjkrqMm52JI&feature=youtu.be>

|  |
| --- |
| Video evidence: |

**Comprehension Questions: Answer using complete sentences and a restate.**

1. Draw a picture of a medium (related to sound) with a caption.

2. Draw a picture of a vacuum (related to sound) with a caption.

3. Define a mechanical wave.

Example

4. Define an electromagnetic wave.

Example

5. What happens when you’re exposed to the vacuum of space?

6. Using a piece of evidence to support your claim (include the source) answer the focus question: Is a vacuum a medium?

Purple

**Day 2:** Read the article “Waves Traveling Through Different Mediums” with your table partner. Remember when we partner read, each person takes turns reading one paragraph and the opposite person summarize what was read. After each paragraph write a connection, summary or answer the provided question in the space provided.

**Waves Traveling Through Mediums**

**Focus Question:** How does sound travel differently through a solid, liquid, gas or vacuum?

|  |  |
| --- | --- |
| **“Waves Traveling Through Mediums”** | Summaries connections |
| Sound waves are both **mechanical waves** and longitudinal waves and require a **medium** to travel through.  When something makes a sound, the sound waves cause the molecules in matter to vibrate and bump into each other (see FIGURE 1). |  |
| https://lh3.googleusercontent.com/OR3RlRNcuUvdGuP2FYrKeYKWH-MehLr2yNPpIlBfRMk2eFuDUmU65r2D7eXT9waf6ow9dn7uEin6pVO-BilD5_puLUfpfZZWPDIR9p-o8Z1dXjm_m3_v5gi00yQ5ZoSxWMJ7i5Uo  **FIGURE 1** |  |
| Sound waves, like all mechanical waves, need to travel through a medium such as a solid, liquid, or gas.  The sound waves move through each of these mediums by vibrating from molecule to molecule through the matter (FIGURE 2).  Because molecules are spaced differently between solids, liquids, and gases, sound travels through each state of matter at a different speed. |  |
| https://lh5.googleusercontent.com/RsYb1p9DUN2HDzapGvtH77z0Ba03PWATvz85k3FyxrboNld_X3C-DvExSSDUGaugmdo2pvXVnuaLfMoG4QUskMKmegG5Q1f-0eIS0_5RaywcbCqw-LpiYNI3m7mRo0x3g-y0GXM_  **FIGURE 2** |  |
| **Sound Waves in a SOLID**  The atoms or molecules in a solid are packed very tightly together, almost touching each other and remain in place. Since these particles are bonded tightly together, a sound wave moving from one solid molecule immediately transfers the sound wave to the next molecule touching it. Because there are no gaps between molecules, sound waves can travel very quickly from molecule to molecule in a solid without losing energy. |  |
| **Sound Waves in a LIQUID**  In a liquid, the atoms or molecules are touching each other, but they are not fastened to each other as strongly as they are in a solid. When sound waves travel through a liquid, some of sound's energy is wasted pushing the particles around because they can slide past each other. Sound cannot travel across gaps between molecules, which can slow a sound wave down. Sound travels about four times faster and farther in water (liquid) than it does in air (gas). |  |
| **Sound Waves in a GAS**  In a gas (example: air), the molecules are far apart. For sound to travel through a gas, the molecules must move quite a distance before they collide with other molecules. Sound energy cannot move as quickly when the molecules are not in contact with each other. Sound waves travel about thirteen times faster in wood than air. |  |
| **Sound Waves in a VACUUM**  Sound travels by vibrating the particles in the medium so that they bump into each other. In a vacuum, there are very, very few particles to vibrate, so sound cannot travel. |  |
| **Electromagnetic Waves in a VACUUM**  How can we communicate with astronauts orbiting earth if sound waves cannot travel through space? We use radio waves. Radio waves travel through a vacuum because they are electromagnetic waves, and do not need a medium to travel. We can see light traveling through the space because light waves are also electromagnetic. |  |
| https://lh3.googleusercontent.com/LHmbdOPGf6zz7oG7LYIYvK6XNg4e290NGhhpeOik9fDBZXQ95MpsYTxxvfNcyoq5UUHG8q1XthAGp_CHLoCExk10l2BAJMTlLL8aPjBfiCWVgm71x5mQ50_NjHVIvZv51PVmCLRy | *Is the album cover scientifically accurate? Explain.* |

**Answer the following questions using complete sentences and a restate.**

1) How does sound travel differently through a solid, liquid, gas, or vacuum?

2) Dolphins and whales communicate through great distances underwater. How is this possible?

3) Native Americans who lived on the Great Plains used to put an ear on the ground to tell if buffalo or horses were coming. Why didn’t they listen through the air?

4) Would you expect sound waves to move faster on a hot day or a cold day? Explain your reasoning.

**Day 3: Lab activity**

Watch the video: Can you Hear Sound in Space? <https://www.youtube.com/watch?v=MqF3pPU1Z4U&feature=youtu.be>

1. Can you hear sound in space?

Explain why

Watch the video: Bell Jar Video

<https://www.youtube.com/watch?v=TnPS3ZpKmcM>

2. Describe what is happening.

3. Why is it happening?

Watch balloon in a bell jar: <https://www.youtube.com/watch?v=4d6PX1o5liY>

4. Explain what is happening.

5. Why do you think I would show you these videos? What is the connection?

**Pre-activity questions**

A. Where can you hear best (circle one for each)

Back of the class vs front of the class

Auditorium vs gym

B. Which is louder?

Walking on carpet vs. on tile

C. Why are movie theatre walls covered by carpet or fabric?

D. Form your hypothesis, which medium do you think sound travels best through?

**Materials**

Wooden blog Large Bowl 2 metal objects

Plastic bag Water

**Procedure**

1. Use the same object to hit all three models (pencil, spoon). When you hit all the objects use the same amount of force.

2. Place the wooden block on the table, one partner place their ear on the table while plugging the ear that is not touching the table. Tap the wooden block. Record how the time it takes for the sound to travel to your ear. Describe the clarity of the sound on your data table.

3. Fill the plastic bag with air and zip lock it. Place the plastic bag on the table, one partner place their ear on the table while plugging the ear that is not touching the table. Tap the bag and record your results.

4. Fill the plastic bag with water and zip lock it. Place the plastic bag on the table, one partner place their ear on the table while plugging the ear that is not touching the table. Tap the table and record your results.

|  |  |  |
| --- | --- | --- |
|  | Time | Observations (describe the sound) |
| Wooden block |  |  |
| Air filled bag |  |  |
| Water filled bag |  |  |

6. Can sound travel through solids? (circle one) Yes No

Tap on the table with your ear against it, and then tap on the table when you are sitting up. Describe the difference between the sounds you hear.

7. Can sound energy pass through liquids (circle one) Yes No

Fill the bowl with water. Collect two pencils or two spoons. Tap the objects together under the water and above the water. Describe the difference between the sounds you hear.

8. Can sound pass through gases (air) (circle one) Yes No

Feel your throat and write down your observations from the following tests:

Hum with your mouth and nose open:

Hum with your mouth open and nose closed:

Hum with your mouth closed and nose open:

Hum with your mouth and nose closed:

**Comprehension questions: Please answer using complete sentences with a restate.**

1. In your own words describe what we mean when we say “sound travels through a medium”.

2. Which medium did sound travel through the best?

How do you know?

3. How can understanding how sound travels, help engineers?

4. Is there sound on the moon? Explain your answer.