How Does Sound Travel?



**Grade Level:**4th - 7th; **Type:**Physical Science

**Objective:**

To determine if sound travels best through the air, water or a solid.

The purpose of this experiment is to test how sound travels through the three phases of matter and to see if one of these phases transfers sound better over greater distances.

**Research Questions:**

* How does sound travel through the air?
* What happens to sound as it travels?
* What are the different states of matter?
* What makes the states of matter different from one another?
* What is a sound wave?

We tend to think of a sound wave as something that travels through the air. After all, we can hear each other when we speak across long distances in the air, but not when speaking to someone separated by a wall or another object. Furthermore, in the air, molecules are distant and it would seem that sound waves have room to travel. In reality, sound is passed from molecule to molecule, and it travels through liquids better than gasses, and through solids better than in liquids. This is because the molecules in a solid are closer together and can easily pass the sound wave along. This experiment is designed to test whether the human ear can hear sounds more easily through a gas, liquid or solid.

**Materials:**

* A swimming pool
* Two tin cans
* 20 meters of heavy-duty string
* A friend to help
* An adult with a drill
* (optional) A decibel reader

You can borrow a decibel reader from your school’s science lab if they have one available. If not, you will need to do your best to keep your voice at a constant volume during each phase of the experiment.

**Experimental Procedure:**

1. Begin by testing how well you can hear sounds in the air. Stand ½ meter from your friend and speak one word at a normal volume.
2. Record the word you said. You will compare results with your friend at the end of the experiment. Use a chart such as the one below.
3. Have your friend record the word that you said on their chart.
4. Move to a distance of 1 meter.
5. Say a different word at the same volume. If you have a decibel reader you can check to see if you are speaking at a constant volume.
6. Record the word you said.
7. Have your friend record what they heard you say and how loud they thought your voice was on a scale of 1 to 10.
8. Move to a distance of 3 meters and repeat steps 5-7.
9. Move to a distance of 6 meters and repeat steps 5-7.
10. Move to a distance of 10 meters and repeat steps 5-7.
11. Move to a distance of 15 meters and repeat steps 5-7.
12. Move to a distance of 20 meters and repeat steps 5-7.
13. Continue the experiment by finding a swimming pool. You or your friend may have access to one at home or you may visit the community pool. It helps to visit the pool at a time when there are few other swimmers.
14. Hold your breath and go underwater with your friend.
15. Remain underwater at a distance of 1 meter from your friend.
16. Say a word. Try to speak at the same volume you did while you were on the land. Remember to enunciate clearly.
17. Record the word you said.
18. Have your friend record what they heard you say and how loud they thought your voice was on a scale of 1 to 10.
19. Move to a distance of 3 meters and repeat steps 16-18.
20. Move to a distance of 6 meters and repeat steps 16-18.
21. Move to a distance of 10 meters and repeat steps 16-18.
22. Move to a distance of 15 meters and repeat steps 16-18.
23. Move to a distance of 20 meters and repeat steps 16-18.
24. As it is impossible to speak while inside a solid, you will simulate being inside a solid by making a simple tin can telephone.
25. Have an adult drill a hole in each of the tin cans just large enough to fit the string through.
26. Insert one end of the string into one of the coffee cans.
27. Tie a knot in the end of the string so it doesn’t slip out. The knot should be on the inside of the can.
28. Insert the other end of the string into the other coffee can.
29. Tie a knot in the end of the string so it doesn’t slip out. The knot should be on the inside of the can.
30. Stand 1 meter apart from your friend.
31. Pull the string until it is tight between the two cans. The string will come out the middle of one or both cans.
32. Speak one word into the coffee can.
33. Have your friend listen by placing the can against their ear.
34. Record the word you said.
35. Have your friend record what they heard you say and how loud they thought your voice was on a scale of 1 to 10.
36. Move to a distance of 3 meters and repeat steps 31-35.
37. Move to a distance of 6 meters and repeat steps 31-35.
38. Move to a distance of 10 meters and repeat steps 31-35.
39. Move to a distance of 15 meters and repeat steps 31-35.
40. Move to a distance of 20 meters and repeat steps 31-35.
41. Compare the results you have recorded.

**SPEAKER’S DATA**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|   | 1 meter | 3 meters | 6 meters | 10 meters | 15 meters | 20 meters |
| Word (Air) |   |   |   |   |   |   |
| Word (Water) |   |   |   |   |   |   |
| Word (Tin Can) |   |   |   |   |   |   |

**LISTENER’S DATA**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|   | 1 meter | 3 meters | 6 meters | 10 meters | 15 meters | 20 meters |
| Word Heard (Air) |   |   |   |   |   |   |
| Volume (1-10) |   |   |   |   |   |   |
| Word Heard (Water) |   |   |   |   |   |   |
| Volume (1-10) |   |   |   |   |   |   |
| Word Heard (Tin Can) |   |   |   |   |   |   |
| Volume (1-10) |   |   |   |   |   |   |

**Terms/Concepts:** Gas; Liquid; Solid; States of matter; Sound wave; Molecule; Atom