

# Sound Speed

**Overview:** Sound has the ability to travel through the states of matter: solids, liquids, and gases. Generally, solids are the densest, liquids are next, and gases are the least dense. In this experiment we will study the movement of sound through these three states to see if density affects what we hear.

## Materials

- 3 baggies (re-sealable)
- sand
- water
- air
- desktop
- spoon
- partner

## Experiment

1. Fill each bag two-thirds of the way full with each material. You should have one bag with sand, one with water, and one with air. Seal each baggie well.
2. Put the baggies on the desk or on a table. Note the density of the materials. Which is *most dense*, *medium*, and *least dense*?
3. Place your ear down on the first baggie that is filled with sand. Have your partner use the spoon to tap the table. Listen for the sound through the bag of sand.
4. Repeat step 3 with the baggie full of water and then the bag of air. Compare what you hear through each state of matter. Rank the tapping you hear through the solid, liquid and gas in order from *loudest (3)*, to *medium (2)*, to *quietest (1)*.
5. When you have completed the tapping portion of the experiment, hold the bag of sand up to your ear. Have your partner speak to you through the baggie.
6. Repeat step 5 with the bag of water and again with the baggie of air. Note the clarity of the speech you hear through each bag. Rank each bag from *loudest (3)*, to *medium (2)*, to *quietest (1)*.

## Sound Speed Data Table

<b>Trial</b>	<b>Solid</b> <i>(1 = quiet, 2 = loud)</i>	<b>Liquid</b> <i>(1 = quiet, 2 = loud)</i>	<b>Gas</b> <i>(1 = quiet, 2 = loud)</i>
spoon			
talking			

### Reading

Sound is made by waves travelling through the air. They pass their energy along to the matter through which they are traveling. But now you know that sound doesn't just travel through the air. Molecules in water are closer together than air molecules, which makes it much easier for them to bump into one another. So the speed that sounds travel through liquid is actually faster than it travels through the air, and the sounds travel further as well. Sound travels fastest of all in solids because the molecules in this state of matter are very densely packed together. Solids pass sound much farther and at much greater speeds. If there is no matter to bounce their energy along, sound waves can't really form. So once you leave earth's atmosphere, there isn't any sound!

### Exercises

1. What is density?
2. Put these in their general order of density: liquid, gas, solid.
3. Which material passes sound waves along farther and faster?

**Answers to Exercises: Sound Speed**

1. What is density? (how tightly packed the molecules in substance are)
2. Put these in their general order of density: liquid, gas, solid. (solids are normally densest, liquids are next, gases are least dense)
3. Which material passes sound waves along farther and faster? (solids)