



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Jason Dong</b>	<b>Project Number</b>  <b>J1707</b>
<b>Project Title</b>  <b>The Speed of Sound in Varying Gas Conditions</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The purpose of my experiment is to determine how the temperature, gas type, and pressure affect the speed of sound.</p> <p><b>Methods</b> To isolate the air in which the test will take place, I used a vacuum chamber; to heat up the chamber, I used an external heat source such as the bottom of a refrigerator to add heat or exposed it to cold ventilation to reduce heat. To change the pressure, I used a vacuum pump (which came along the vacuum chamber) to create a partial vacuum, which effectively reduced the air pressure. To change the molar mass, I would create a half vacuum and replace the missing atmospheric air with a different kind of gas- either carbon dioxide or helium. After I changed the gas conditions, I used my contraption built inside the vacuum chamber to measure sound based off of maximizing resonance to find the wavelength.</p> <p><b>Results</b> My results show that the speed of sound is inversely affected by the molar mass due to sound taking less energy to propagate lighter matter, the speed of sound was proportional to the temperature due to the air containing more energy as the temperature rises, and that the speed of sound is proportional to the pressure as the smaller distances between particles allowed for faster propagation.</p> <p><b>Conclusions</b> There have not been many studies on how the speed of sound is affected by molar mass nor pressure, though there are some to test its relation to temperature. This project confirms previous conclusions of the relation of the speed of sound to temperature (positive) and makes new conclusions of its relation to pressure (positive) and molar mass (negative). I hypothesized that the speed of sound to pressure and temperature was positive and that its relation to molar mass was negative, and these hypotheses were proven correct.</p>	
<b>Summary Statement</b>  I created a relation of the speed of sound to different gas conditions, including temperature, pressure, and molar mass.	
<b>Help Received</b>  I designed most of the model, the use of a pulley idea discussed and approved by my teacher. He gave me the idea of the experiment, the speed of sound, and I furthered it to be about the relations of it with gas conditions.	