**AP Physics** _____ **Instructor: Bartonius Maximus**

**Casa Grande High School** **name here please** **Spring 2026**

# Physics: Determining the speed of sound using tuning forks over "cylinders of air"

Using four (4) different tuning forks, students will hold them over a "variable height" cylinder of air to determine at what height, d, the "standing sound waves" (a.k.a the harmonic series) develop.

In a system which is "closed at one end", the harmonic series must look like this.

*Can you determine the general "wave function" to predict the rest of the series? (i.e., what is the wavelength of the 7$^{th}$ harmonic?)*

Strategy. The student will raise and lower the glass cylinder until a clear "resonant tone" is achieved. Once the clear tone is established, the student will measure the distance from the bottom of the tuning fork to the top of the water to establish d. Then, based on the trial and error method, students will calculate lambda using the above series of possibilities, and then calculate V (speed of sound). The accepted value ~340 m/sec. If the calculated velocity is significantly off, the student is likely hearing a different harmonic (and should try using a different function for lambda, using the harmonic series above).

| Tuning fork frequency (f) | Measured height of air (d) | Harmonic wavelength function (of d.. see above, i.e., $\lambda_1 = 4d$) | Calculation of lambda | Speed of sound $V = \lambda \cdot f$ |
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What is the average velocity of sound (in air) today?

What is the 'general function' for harmonic wavelengths in a system "open at one end'.