Lab 2: Resonant Air Columns

Learning Goals	Concepts
• Understand the boundary conditions and node structure of waves. • Compare a measured value to an expected value and identify error sources.	• Resonance • Speed of sound • Boundary conditions

Vocab & Notation

• Standing wave	• Sound wave	• Longitudinal wave
• Amplitude	• Node	• Antinode
• Sound quality	• Displacement wave	• Pressure wave

Equations

$$\lambda = 2|X_2 - X_1| \quad (1)$$

$$v = \lambda f \quad (2)$$

$$v = 331\sqrt{\frac{T}{273}}\ \mathrm{m/s} \quad (3)$$

$$f = \frac{1}{\lambda}$$

Theory Outline

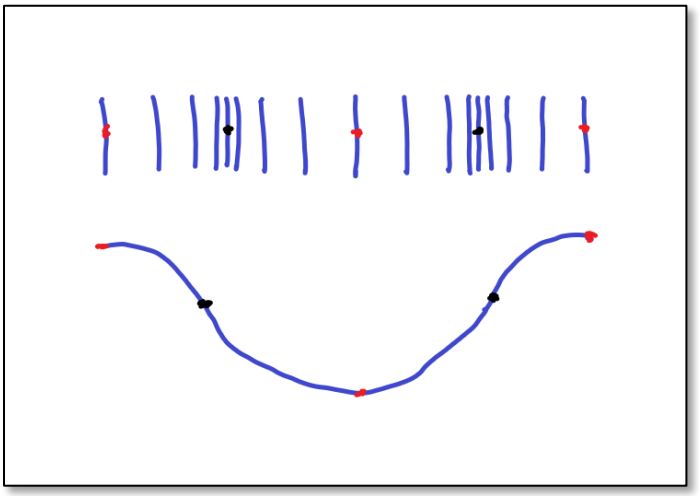
- Transverse representation of sound – *Transverse Representation*
- Standing wave constructive interference – *Resonance*
  - Volume increases
- Boundary conditions and nodes
  - *Open tube*
  - *Closed tube*
- Resonance point conditions - *¼ Wavelength & ¾ Wavelength*
- Calculating the speed of sound
  - Wavelength – *Equation 1*
  - Speed – *Equation 2*
- Expected speed of sound value – *Equation 3*

Procedure Outline

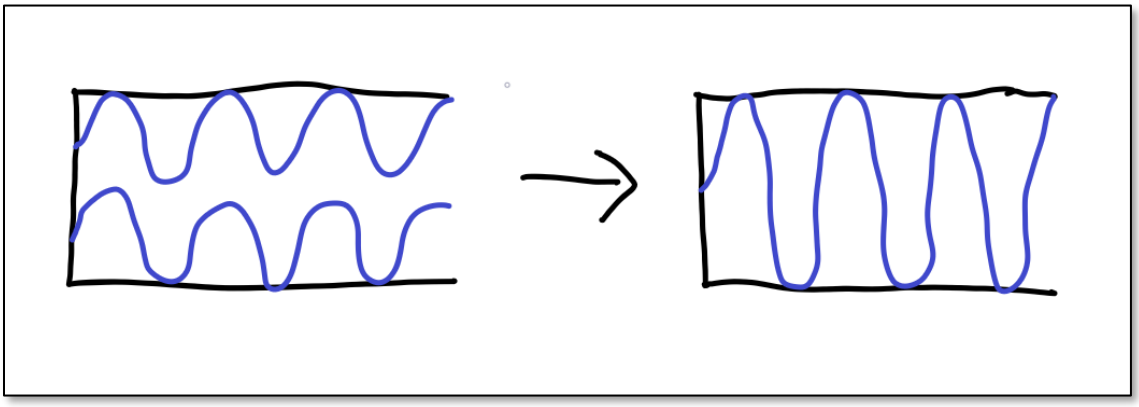
- Check the reservoir is filled with water
- Select a tuning fork
- Calculate the expected resonance points
- Measure at least two resonance points (volume increases)
- Repeat with two more tuning forks
- Calculations: predicted resonance points, wavelengths, measured speeds of sound, expected speed of sound

Diagrams

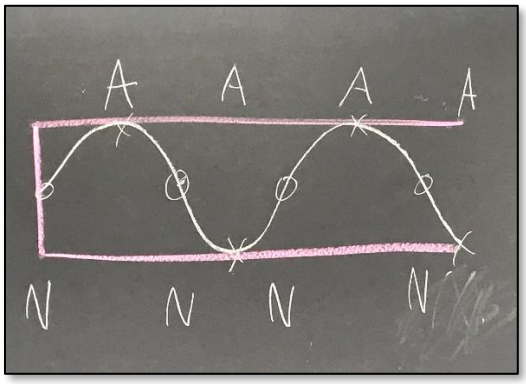
Transverse Representation



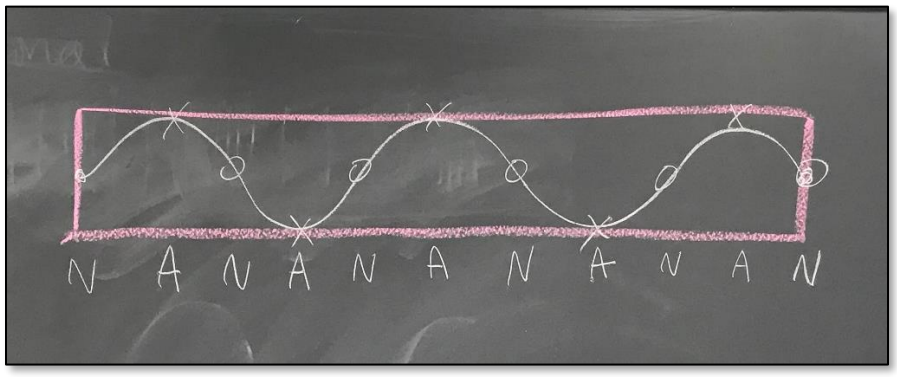
Resonance



Open Tube



Closed Tube



¼ Wavelength & ¾ Wavelength