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Deluxe Resonance Apparatus
#RESON01

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including lead and styrene, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

The Resonance Apparatus is useful to demonstrate standing waves. It can be used to observe the phenomena of resonance, measure the speed of sound in air by exploiting standing waves, observe resonance effects in longitudinal waves, and to find resonance points for a certain frequencies in relation with the standing wave length.

Theory

Resonance is a special case of forced vibrations. It is said to occur whenever a body is set into oscillations of large amplitude due to sound vibrations coming from another source, in such a way that the frequency of the source forcing the vibrations equals the natural frequency of the driven body forced to vibrate.

If l1 and l2 are the lengths of the air columns for the first and second positions of the resonance

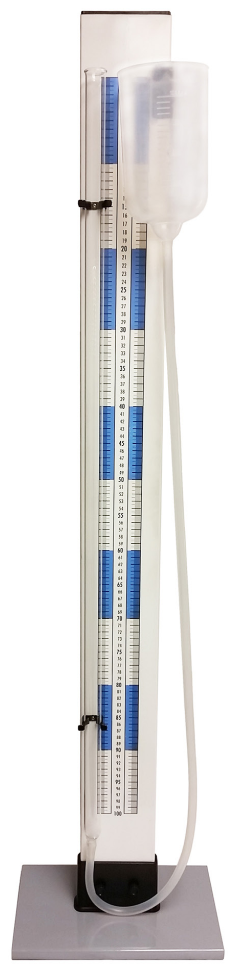
$$l_2 - l_1 = \frac{\lambda}{2}$$

The velocity of sound v is given by the relation

$$V = \nu \lambda$$

where ν is the frequency of the sound wave

$$v = 2\nu(l_2 - l_1)$$



The velocity of sound at 0ºC is given by the equation

$$v = 2\nu(l_2 - l_1)$$

where vt is the velocity of sound at room temperature t°C

How to Use

1. Set the resonance tube vertical with the help of the plumb line and leveling screws at the base of the apparatus. Fill the reservoir and some portion of the resonance tube with water.
2. Record the room temperature.
3. Release the pinch cock and adjust the level of water in the resonance tube near the upper end by adjusting the position of the reservoir and then after closing the pinch cock lowering the position of the reservoir.
4. Strike a tuning fork gently and place it just above the upper end of the resonance tube so that the prongs of the vibrating tuning fork are in a vertical plane. Now open the pinch cock and lett he water level in the resonance tube fall slowly. At some position of the water level, you will notice that the sound will become louder!
5. Repeat steps 2 and 3 to get the exact position of the water level in the resonance tube at which the sound is at its maximum intensity. Note the position of the water level. Note the length (l1) of the resonance column. This corresponds to the first resonance position. Take more readings to confirm the resonance position.
6. Lower the position of the water level so that it is increased by about three times the length (l1). Repeat steps 2, 3 and 4 to get the second position of the resonance using a tuning fork. Note the length (l2) of the air column.

Observation

Frequency of the first tuning fork =

Frequency of the second tuning fork =

Room temperature in the beginning of the experiment =

Room temperature at the end of the experiment =

Position of the upper end of the resonance tube (r1) =

Frequency of tuning fork (Hz)	Resonance	No. of observation	Position of water level at resonance when: Water is falling	Water is rising	Mean (r_2) (cm	Mean resonant length $r_2 - r_1$ (cm)
	1st	1	......	......	......	$l_1 = \dots$
		2	......	......	......	
	2nd	1	......	......	......	$l_2 = \dots$
		2	......	......	......	
	1st	1	......	......	......	$l'_1 = \dots$
		2	......	......	......	
	2nd	1	......	......	......	$l'_2 = \dots$
		2	......	......	......	

Calculation

$$v_1 = 2v_1(l_2 - l_1)$$

The mean velocity of sound at room temperature

$$v_t = \frac{v_1 + v_2}{2}$$

The mean room temperature = velocity of sound at 0°C

$$v_o = v_t \sqrt{\frac{273}{273 + t}} = \text{ metre/sec}$$

Or

$$v_o = (v_t - 0.61 \text{ x } t) \text{ metre/sec}$$