Experiment: 1 Helmholtz resonator

Aim: verify the relation between the frequency (*v*) and the resonating volume (V) and hence find the unknown frequency of the given tunning fork.

Operators: Resonator bottle, set of tunning forks, rubber pad, and measuring jar.

Introduction:

- Hermann von Helmholtz studied about frequency of the tuning fork and its relation with the volume. Now a days it plays a very important role in everyday life. A coke bottle makes unique sounds when air blown through it. The Helmholtz resonator is used in many sound deducing places. This is placed inside the sound making instruments and used to decrease the sound.

- These are placed even inside the musical instruments like guitars in everyday life. In these resonators water is filled completely and some amount is released by loosing the cork. Then the water in the Helmholtz resonator Oscillators producing sound. If the frequency of the tuning fork matches the resonating colunm then a high sound produced.
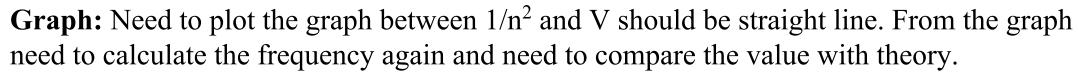
- Sound absorbers in noise reduction applications, air conditioning rooms, auto mobile engines.

Principle: spring mass system. Air in the neck will act like piston alternatively compressing and rarefying the air contained in the resonator when tunning fork is sounded above the neck.

If n is the frequency of tunning fork and V is resonating air volume then for a particle resonator n^2V = const. We need to plot the graph between V and $1/n^2$ should be straight line.

$$N_x^2 V = const$$

$$N_x = \sqrt{\frac{n^2 V \ (mean)}{V_x}}$$

Graph: Need to plot the graph between $1/n^2$ and V should be straight line. From the graph need to calculate the frequency again and need to compare the value with theory.

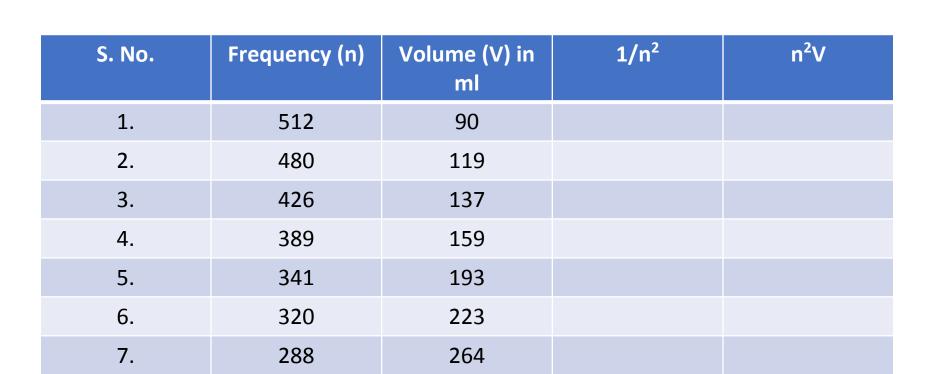**Note:** To find the frequency of unknown tunning fork we need to fill the water again till neck of the bottle.

Procedure:

- The resonator is filled with water till its neck.
- Then arrange the set up as shown in fig.
- Keep the tuning fork in decreasing order of frequency.
- Note that you are placing the tuning fork horizontally above the neck of the tuning fork.
- Then keep the tuning fork on the neck by exciting with the rubber fork.
- Note the values of the corresponding frequency and volume in the table.
- Also plot the graph V vs $1/n^2$ with the values obtained in the table.

S. No.	Frequency (n)	Volume (V) in ml	$1/n^2$	n^2V
1.	512	90		
2.	480	119		
3.	426	137		
4.	389	159		
5.	341	193		
6.	320	223		
7.	288	264		
8.	256	381		
9.	n	268		

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