Physics Department
Image and Sound Laboratory

Lab group		Student Names	Stamp
Session date			
Deadline			

STATIONARY SOUND WAVES IN TUBES

Note:
- Include units and errors in all tables
- The least squares fit lines will be drawn on the same graph as the experimental points.

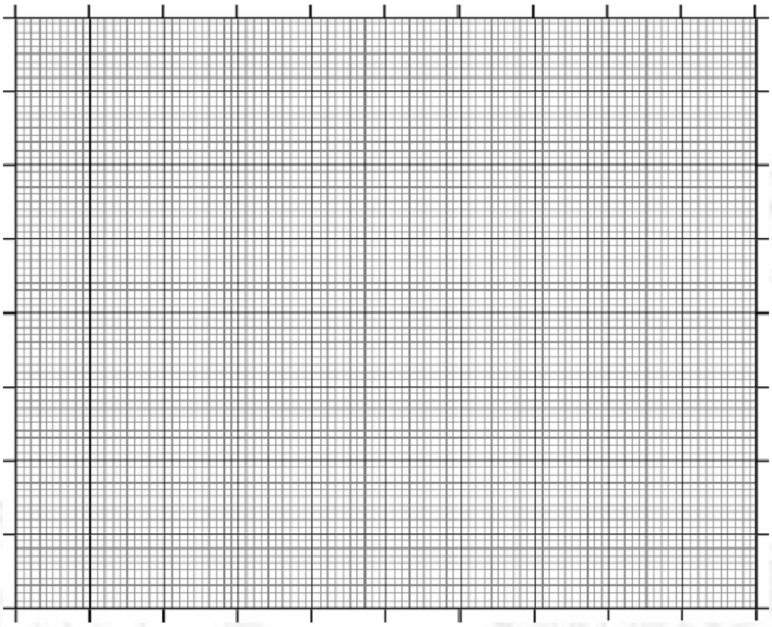
6. Measurement of the frequencies of standing waves in a tube.

6.1. Tube open at both ends.

- Calculate the average value of the resonance frequencies found (ν_{res}). Express them with their corresponding error. Complete the following table (n is the corresponding harmonic and for a tube open at both ends, the fundamental harmonic corresponds to n=1).

ν_1	ν_2	ν_3	ν_n (±)	n

- Represent $y=\nu_{res}$ against $x = n$.



- Fit by least squares $y = v_{res}$ versus $x = n$

•.

$$\sum x_i =$$
$$\sum y_i =$$
$$\sum x_i y_i =$$
$$\sum x_i^2 =$$
$$n =$$
$$\sigma =$$

<u>Results:</u>

- Slope:

m =   Δm =

m =   ±   (   )

- y intercept:

b = $\quad\quad\quad\quad$ Δb =

b = $\quad\quad$ ± $\quad\quad$ ($\quad$)

- Interpret the fitting parameters, using equation [4] and obtain the propagation speed v_{pro},

v_{pro} = $\quad\quad$ $\pm$

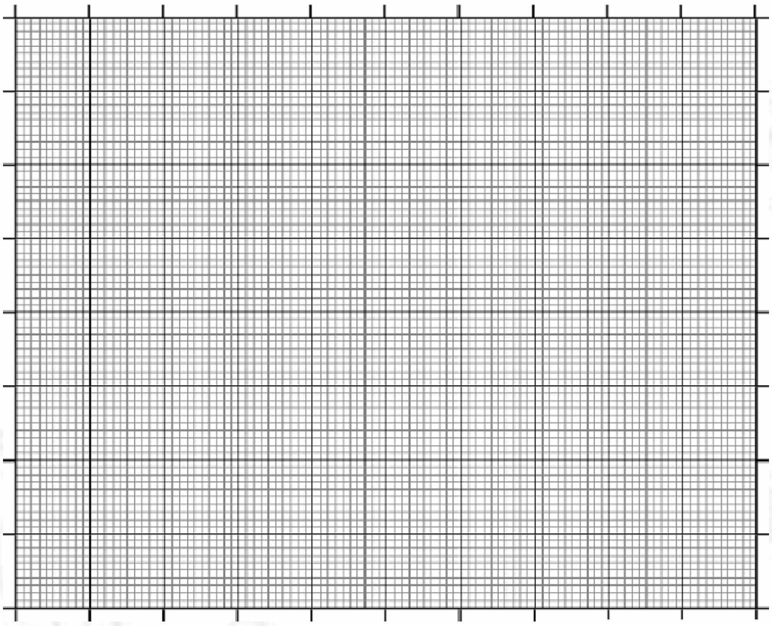
- What is the fundamental frequency of the tube?

6.1. Tube closed at one end.

Calculate the average value of the resonance frequencies found (vres). Express them with their corresponding error. Complete the following table Remember that in the case of a closed end the first value of n is 0

v_1	v_2	v_3	$\overline{v_n}$ ($\pm$)	n

- Represent y=v_{res} against x = n.



- Fit by least squares y = v_{res} vs x=n.

$\sum x_i$	=
$\sum y_i$	=
$\sum x_i y_i$	=
$\sum x_i^2$	=
n	=
σ	=

<u>Results:</u>

- Slope:

m = Δm =

m = ± ( )

- Intercept:

b = Δb =

b = ± ( )

• Using equation [5], interpret the fitting parameters and find the propagation speed v_{pro}

v_{pro} = ±

• What is the fundamental frequency of the tube? Does it coincide with the observed one?

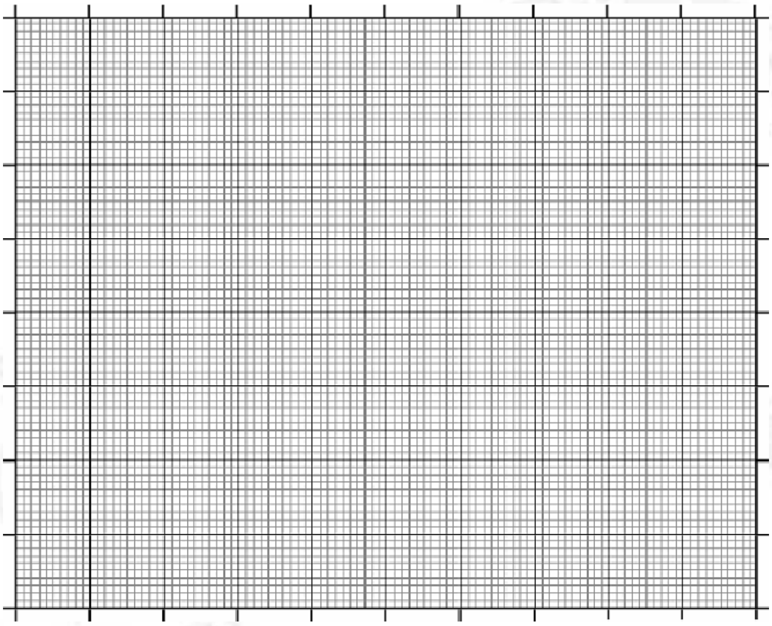
7. Measurement of the tube lengths that cause the condition of resonant standing waves..

Calculate the average value of the tube lengths, L, that produce the resonance condition. Indicate the error of each measurement. Complete the following table.

L_1	L_2	L_3	$\overline{L_n}$ (±)	n

Indicate what value of n corresponds to each of the values of L in the former section. What is the meaning of n in this case?

• Represent y = L against x = n.



• Fit by least squares y=L versus x=n

$$\sum x_i =$$
$$\sum y_i =$$
$$\sum x_i y_i =$$
$$\sum x_i^2 =$$
$$n =$$
$$\sigma =$$

Results:

- Slope:

m = Δm =

m = ± ( )

- y intercept:

b = Δb =

b = ± ( )

- Interpret the fitting parameters, using equation [2] and [3] and obtain the propagation speed v_{pro}

v_{pro} = ±

8. Characterization of a resonant standing wave in a tube.

8.1. Tube open at both ends.

Indicate the distances from the origin at which the nodes and antinodes measured in this section are located. Give the values with their error by completing the following table

L	Node/Antinode

Draw a diagram of the standing wave that has formed in the tube, indicating the nodal and antinodal pressure variation points.

From the values in the table and the diagram, calculate the wavelength. Compare with the theoretical value, from equation [1].

λ = ±

8.1. Tube open at one end.

- Indicate the distances from the origin at which the nodes and antinodes measured in this section are located. Give the values with their error by completing the following table

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L	Node/Antinode

- Draw a diagram of the standing wave that has formed in the tube, indicating the nodal and antinodal pressure variation points.

- From the values in the table and the diagram, calculate the wavelength. Compare with the theoretical value, from equation [1].

$\lambda =$ $\pm$