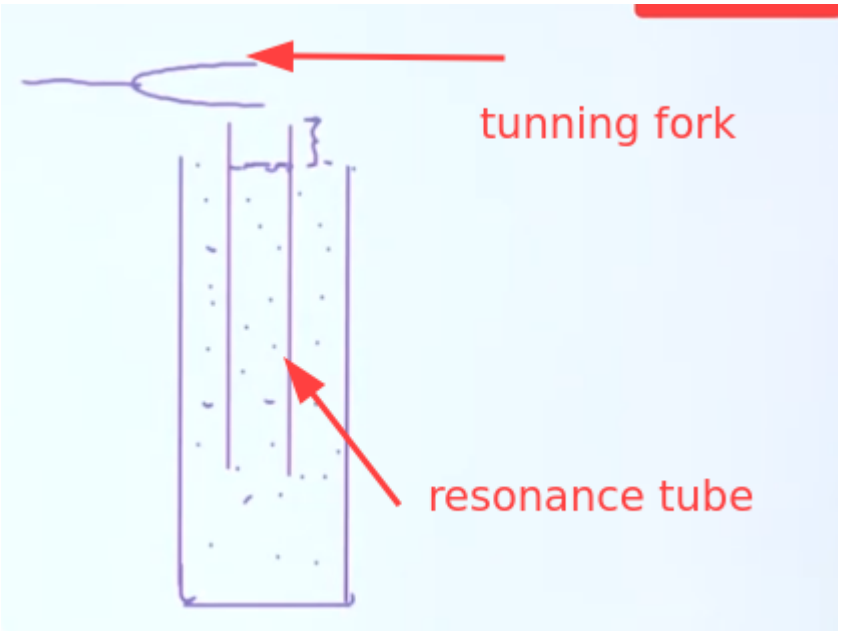
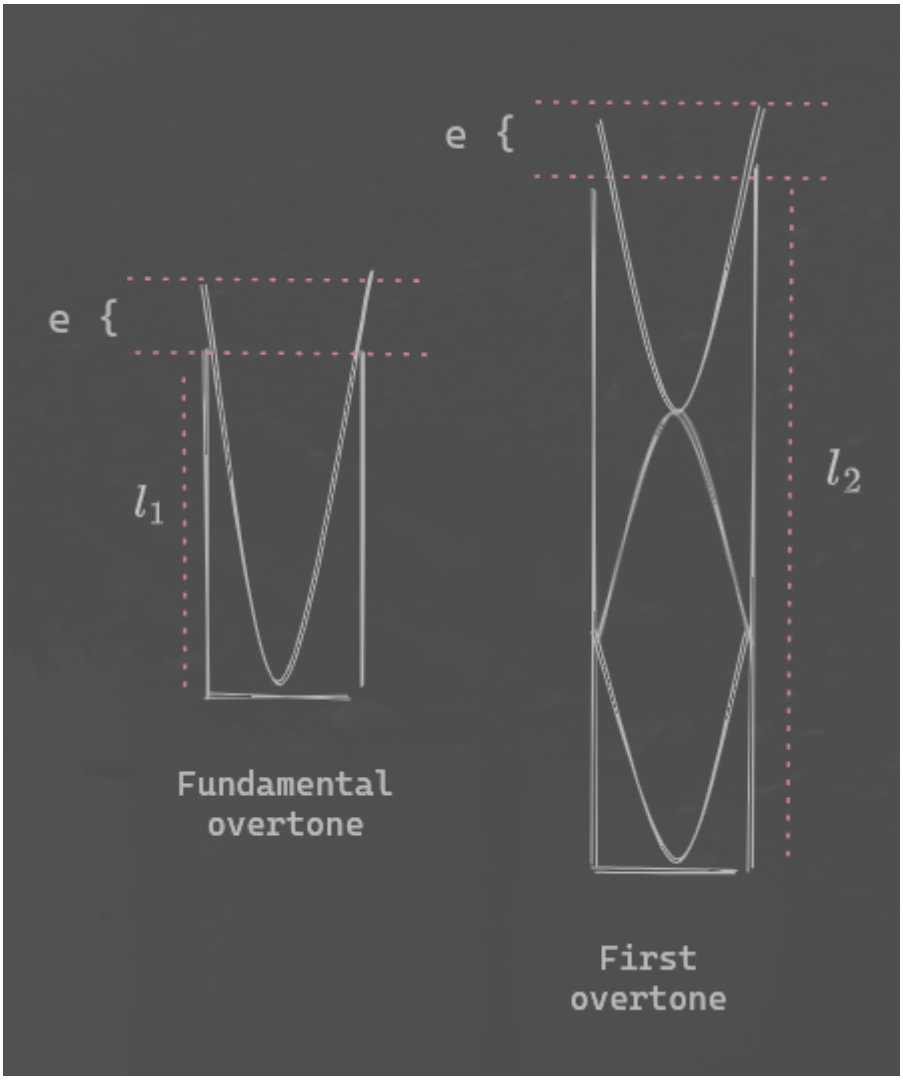
- Initial setup





> Here we get a longitudinal standing wave

Here we can take 2 equations for l_1 and l_2 2 instances.

$$l_1 + e = \frac{\lambda}{4}$$
$$l_2 + e = 3\frac{\lambda}{4}$$

Therefore we can use them in $v = f\lambda$ and build 2 equations for the 2 different cases.

$$v = f\lambda$$
$$l_1 + e = \frac{\lambda}{4}$$
$$\therefore v = f4(l_1 + e)$$
$$l_1 + e = \frac{v}{4f} - (1)$$

$$l_2 + e = 3\frac{\lambda}{4}$$
$$\therefore v = f\frac{4}{3}(l_1 + e)$$
$$l_2 + e = \frac{3v}{4f} - (2)$$

Now using these 2 equations, we can find 2 equations to get `v` and `e`

$$(2) - (1)$$
$$l_2 - l_1 = \frac{2v}{4f}$$
$$\therefore v = 2f(l_2 - l_1)$$

$$(1).3 - (2)$$
$$0 = (3l_1 - l_2) + 2e$$
$$\therefore e = \frac{1}{2}(l_2 - 3l_1)$$

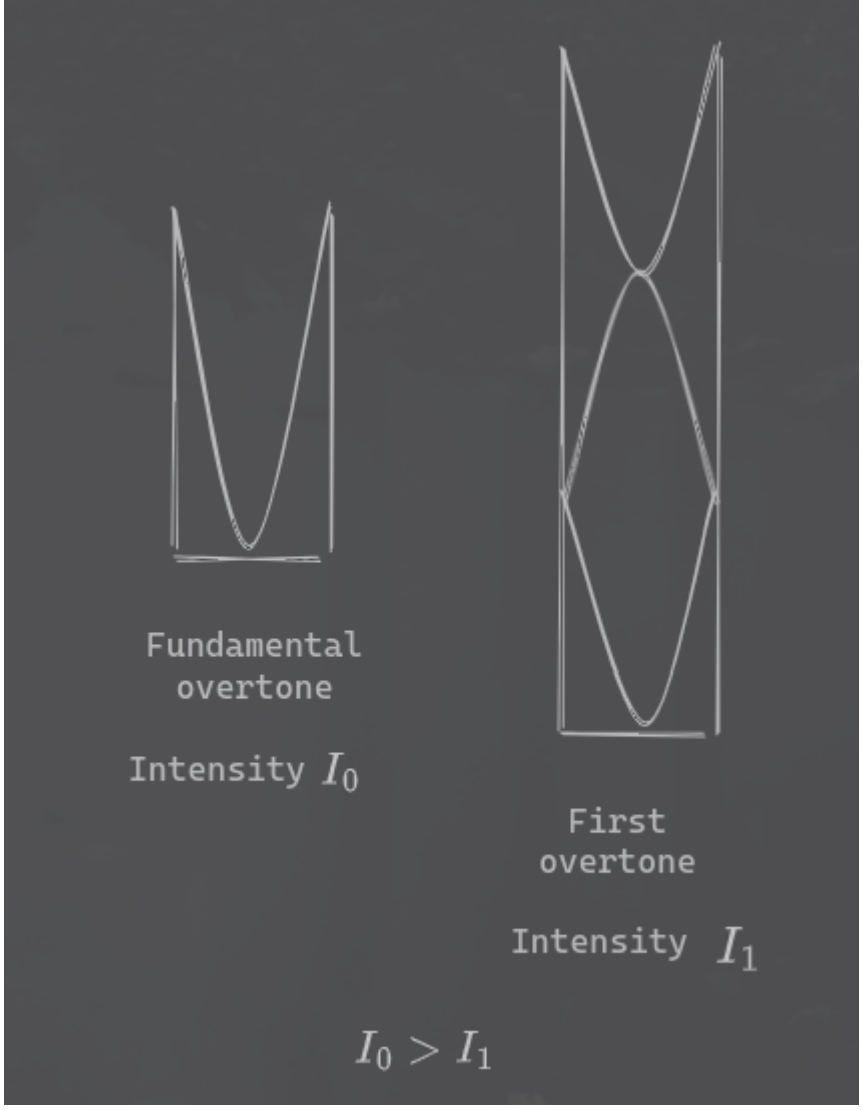
Important points

- What's the point of immersing the tube in water?

To close one end of the tube and have adjustable legnth of the tube.

- The intensity heard from the fundamental overtone is greater than the intensity heard from the 1st overtone. Why?

Because in the fundemental overtone, a short length of air column is vibrated according to the frequency of the tunning fork so the intensity is higher compared to the 1st overtone which has a bigger length of air column vibrating.



- When placing the tube in the jar, you need to sink it as low as possible when taking the first reading. Why?

Because only if we start from the lowest length and increase the length gradually, we can find the fundamental ovetone (as it gives at the lowest length). Otherwise, if you place it in the middle and it starts to resonate, we can't ensure whether that was the fundamental resonance or not. So to confirm that the first resonance we get is the fundamental overtone, we have to start from the lowest length

- When taking the readings, for each overtone, we need to check the base level measurement relevant to the water level. Why?

Because, when we sink the tube, amount of water equal to the sunk volumne of tube is going to displaced. Therefore the water level will rise up. So when we take the tube up, the water level will go down. Therefore, we need to check the base water level measurement everytime we get a reading.

> If we were asked to draw a graph for different overtones and the relevant vibrating lengths of the tube, we should take `n` as the independent variable and `l` as the dependant variable.

$$
\begin{aligned}
v &= f\lambda \\
l &= n\frac{\lambda}{4} \\
where\ n &= 1,3,5,7.. \\
\therefore v &= f\frac{4l}{n}
\end{aligned}
$$

$$
\begin{aligned}
l &= \frac{v}{4f}n \\
y &= mx
\end{aligned}
$$

Therefore the v will be given from the gradient.

$$
\begin{aligned}
Gradient &= \frac{v}{4f} \\
v &= Gradient.4f
\end{aligned}
$$

> If we were to told use end correction, this becomes a $y = mx + c$ type graph

$$
\begin{aligned}
l + e &= \frac{v}{4f}n \\
l &= \frac{v}{4f}n - e \\
y &= mx + c
\end{aligned}
$$

So the intercept will give the end correction.