

Music & Standing Waves

Musical instruments produce different notes by creating standing waves.

String instruments use strings to create standing waves. (We already know how this works.)

- Standing waves on tight strings disturb very few air molecules and create low amplitude (quiet) sound waves.
- Adding a larger surface area and an air cavity, or body, to the instrument disturbs more air molecules and creates higher amplitude (louder) sound waves.



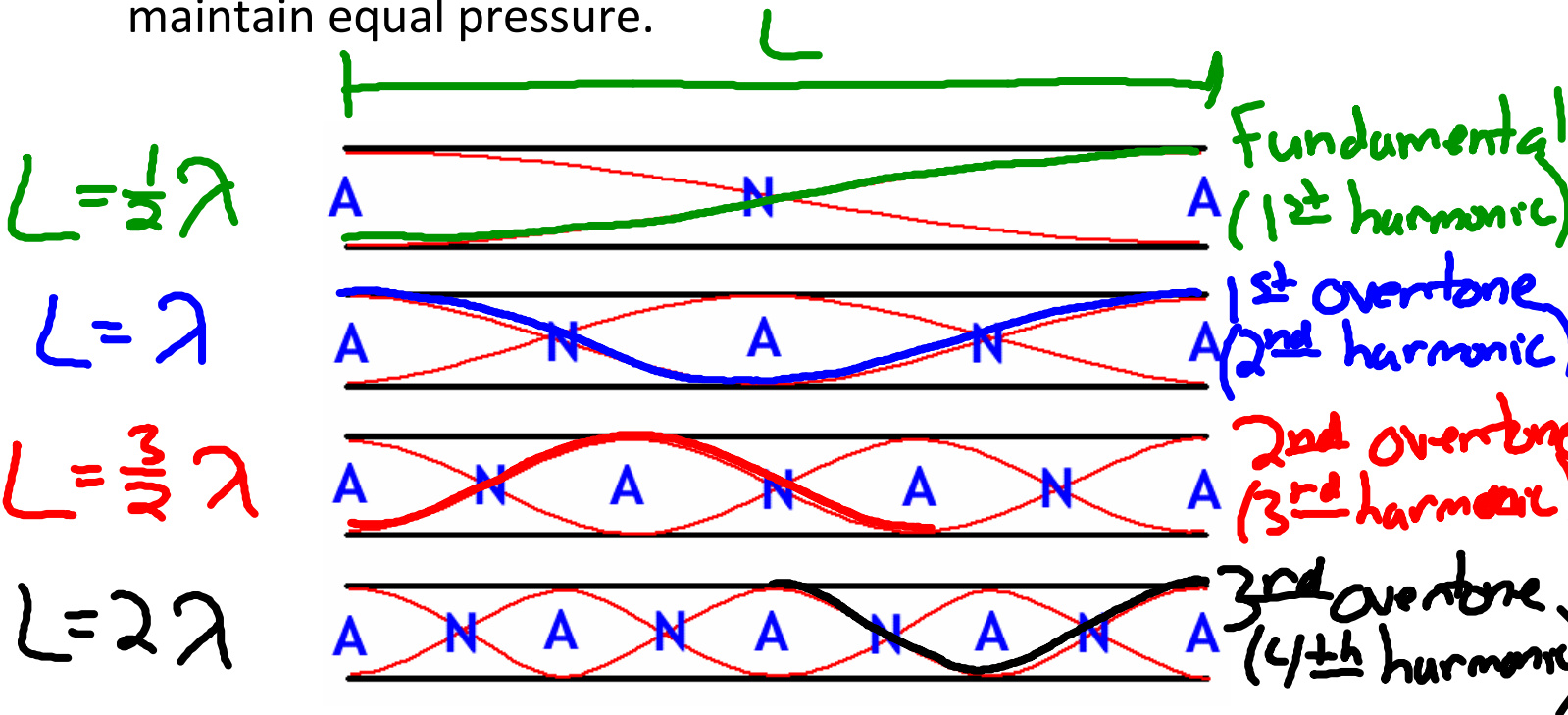
Standing waves are created in wind instruments due to the reflection of sound waves at the end of a tube (or air column), creating interference within the instrument.

- The lowest frequency of oscillation to create a standing wave is called the fundamental. The remaining frequencies that create standing waves are called overtones.

- In order for sound to resonate out of a tube, any open end must have an antinode and any closed end must have a node.

Open Tube

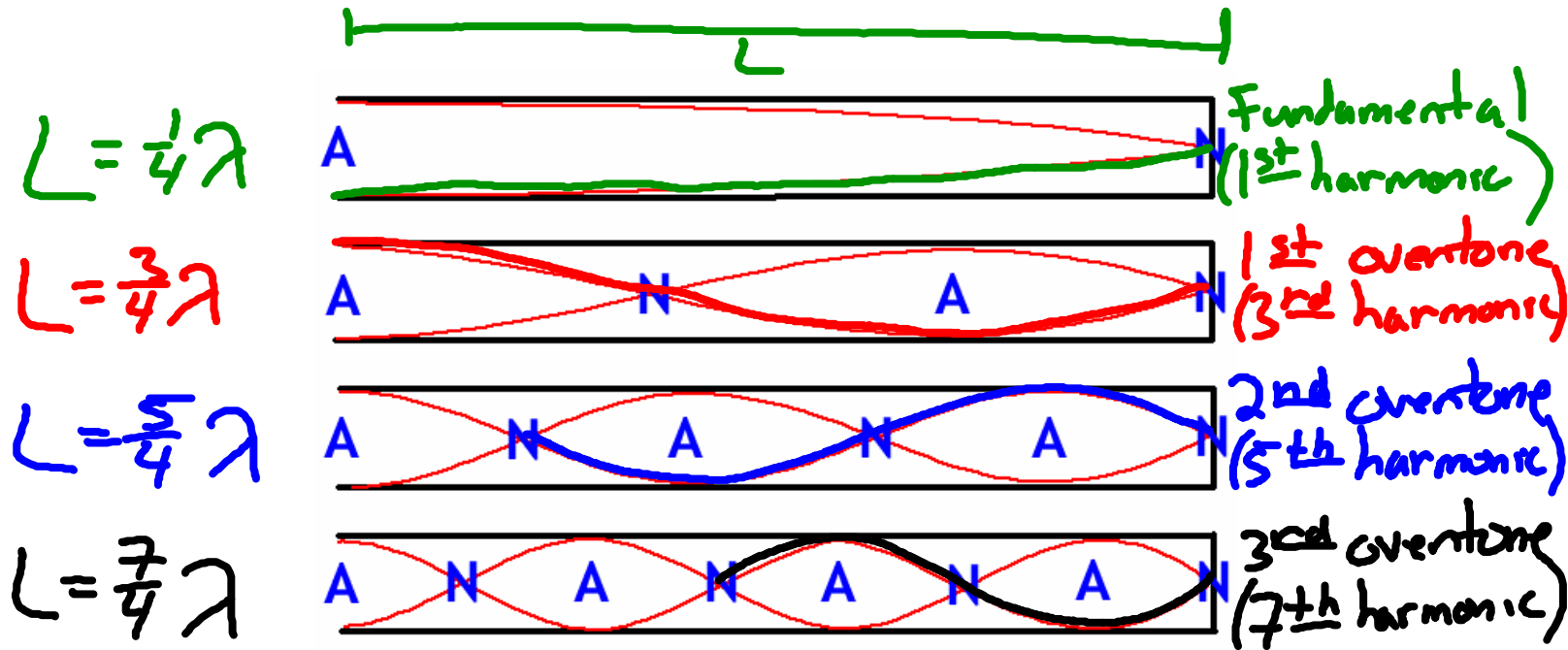
Open tube instruments are open at both ends.
 Sound waves reflect at the open boundary in order to maintain equal pressure.



Closed Tube

Closed tube instruments are open at only one end.

Sound waves reflect at the closed boundary.



Example Problem

Aaron blows across the top of a partially filled 20 cm tall glass bottle to produce a fundamental frequency of 472 Hz. How high is the liquid in the bottle?