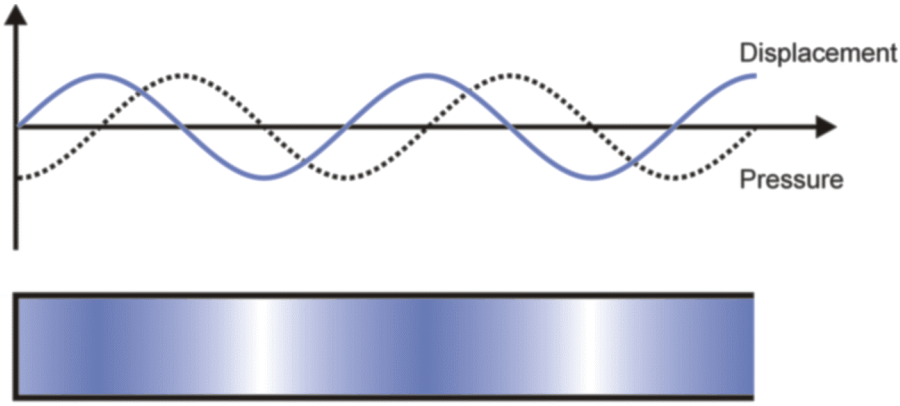
Standing waves in a column of air

When considering a standing wave in a resonance tube, it is important to realize that there is a difference between the *nodes* and the *antinodes* of the *molecular displacement* and of the *air pressure*.

Traditionally, the term node is used for the position where the molecules do not move, i.e. a *displacement node*. The displacement is 90 degrees out of phase with the air pressure. This means that where a displacement node is found, you will also have a pressure antinode – and vice versa.

If you have a standing wave in a half-open tube, there will be a displacement node (and a pressure antinode) at the closed end. This is due to the fact that the molecules cannot move back and forth at the closed end. In the open end you will, on the other hand, have a pressure node (and thus a displacement antinode). This is due to the fact that the pressure at the end of the tube is equal to that of the surrounding air.



Closed end
displacement node
pressure antinode

Open end
displacement antinode
pressure node

It is important not to misunderstand the concepts of pressure node and pressure antinode: A pressure node does not mean that the pressure is low; it simply means that the pressure is constant. Similarly, the pressure at the antinode is not “high”; it simply has the largest oscillations from low pressure to high pressure.