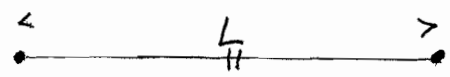
Standing Waves

Giancoli 6. ed: 11-13, 12-4

[You are not supposed to know details about formulas with tension F_T of a string, but can just use them].

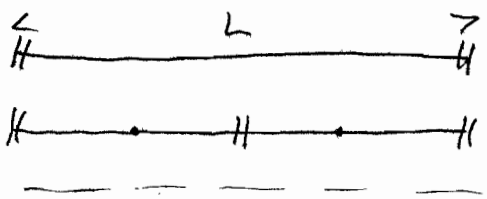
Nodes in both ends: (closed)



n		
1	$L = \frac{1}{2}\lambda$.	$f = \frac{v}{2L}$
2	$L = \lambda = \frac{2}{2}\lambda$	$f = \frac{v}{L} = 2\frac{v}{2L}$
3	$L = \frac{3}{2}\lambda$	$f = 3\frac{v}{2L}$
n	$L = \frac{n}{2}\lambda$	$\boxed{f = n\frac{v}{2L}}$

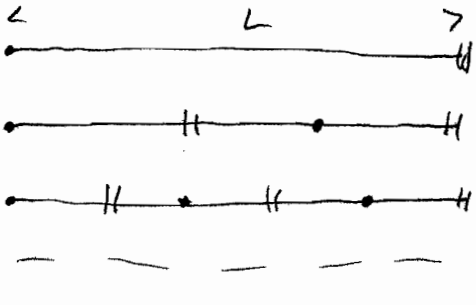
$\lambda f = v$.

Antinodes in both ends: (open)



Same formulas as above.

Node + antinode in ends: (half-open)



n		
1	$L = \frac{1}{4}\lambda$	$f = \frac{v}{4L}$
2	$L = \frac{3}{4}\lambda$	$f = \frac{3v}{4L}$
3	$L = \frac{5}{4}\lambda$	$f = \frac{5v}{4L}$
n	$L = \frac{2n-1}{4}\lambda$	$f = \boxed{(2n-1)\frac{v}{4L}}$

$\lambda f = v$.

- As applied on strings and organ pipes.

For sound in air:

molecular displacement	pressure
node	anti-node
anti-node	node