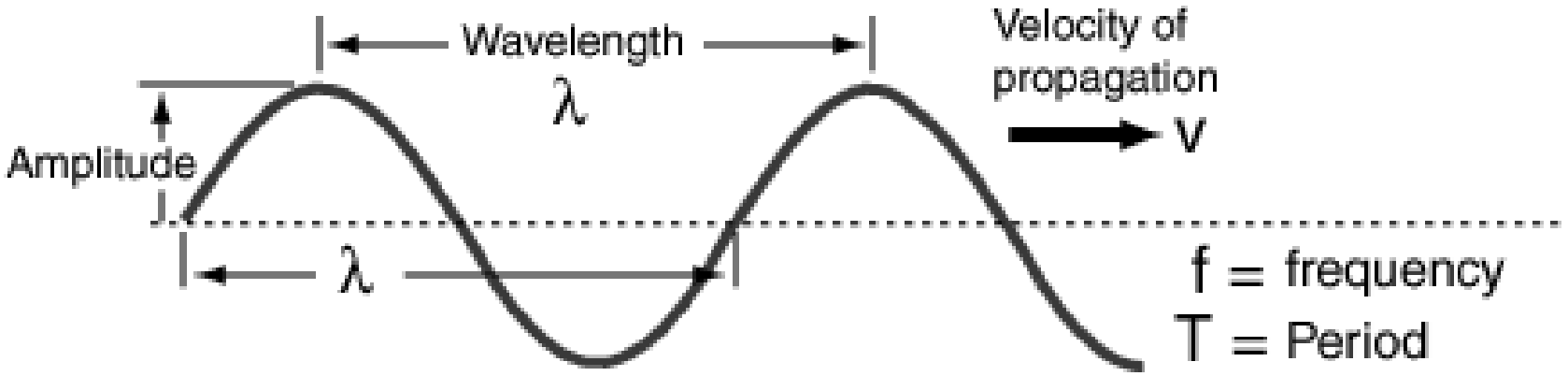
Transverse Waves

- For transverse waves the displacement of the medium is perpendicular to the direction of propagation of the wave

Longitudinal Waves

- In longitudinal waves the displacement of the medium is parallel to the propagation of the wave.

A single frequency traveling wave



The frequency

- The *frequency f* is the number waves passing a point per second and is determined by the source of the waves.
- in 1/seconds or Hertz (Hz)

The *period*

- The *period T* is the time between successive wave crests, or the inverse of the frequency
- in seconds/cycle $T = 1/f$

The *velocity*

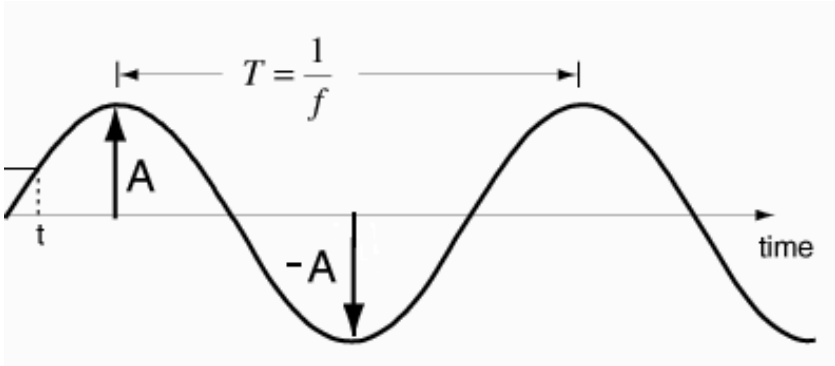
- The *velocity v* of a wave is the speed at which a wave peak travels.

The *wavelength*

- The *wavelength* λ of a periodic wave is the distance between successive wave peaks.

The amplitude

- *the amplitude A* is the maximum magnitude of the displacement;
- the displacement of a periodic wave varies back and forth between A and –A.



The velocity of the wave v is the distance travelled divided by the time.

$$v = \lambda / T \qquad v = f\lambda$$

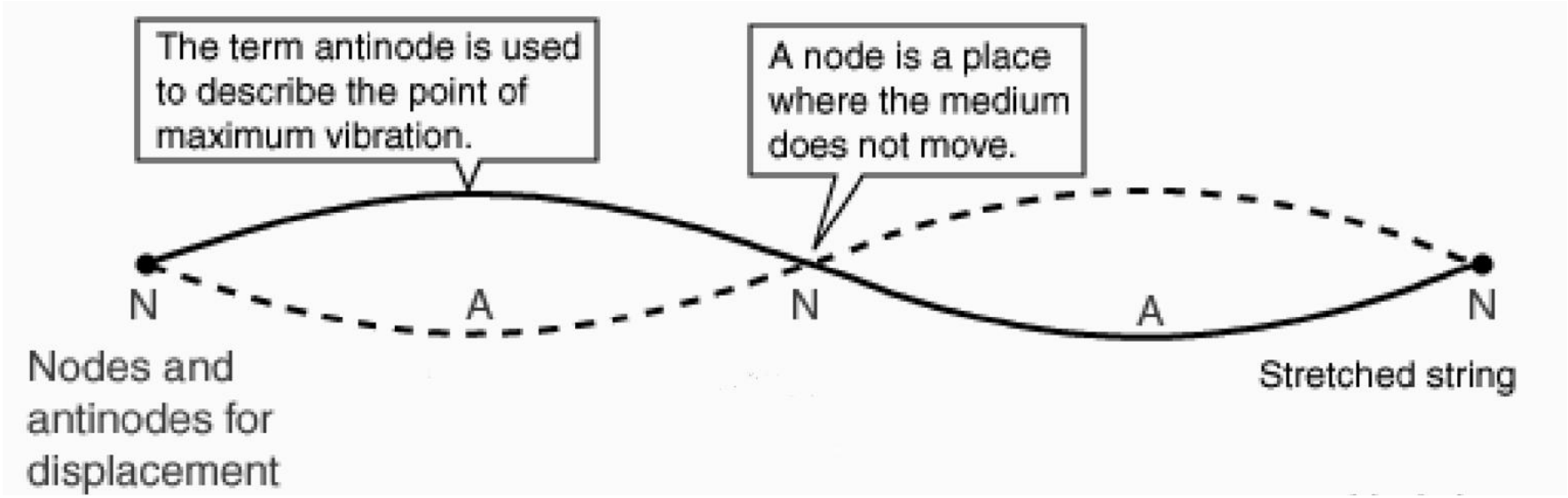
The effects of boundaries

Reflection of waves

Law of Reflection

„angle of incidence equals angle of reflection"

The standing wave



Refraction of Waves

- Refraction is the bending of waves when they enter a medium where their speed is different.

Diffraction of the Waves

- Diffraction: the bending of waves around small* obstacles and the spreading out of waves beyond small* openings.

* small compared to the wavelength

Harmonics

For the *n*th harmonic the wavelengths can be calculated from

$$\lambda_n = \frac{2l}{n}$$ Where n = 1, 2, 3,…(fixed end string)

The corresponding frequencies are found from

$$c = f_n \lambda_n$$ Where c is the wave velocity on the string

Thus on a string of length ℓ

$$f_n = \frac{n}{2l} c$$ Where n = 1, 2, 3,…(fixed end string)

Example 1

What is the wavelength of the sound wave with a frequency of 1000 Hz and a velocity 344 m/s?

Example 2

What is the frequency of a wave of velocity 200 m/s and wavelength 0.5 m?

Example 3

What are the frequencies of the first three harmonics of the longest string in a grand piano? The length is 1.98 m, and the velocity of the wave on the string is c = 130 m/s.