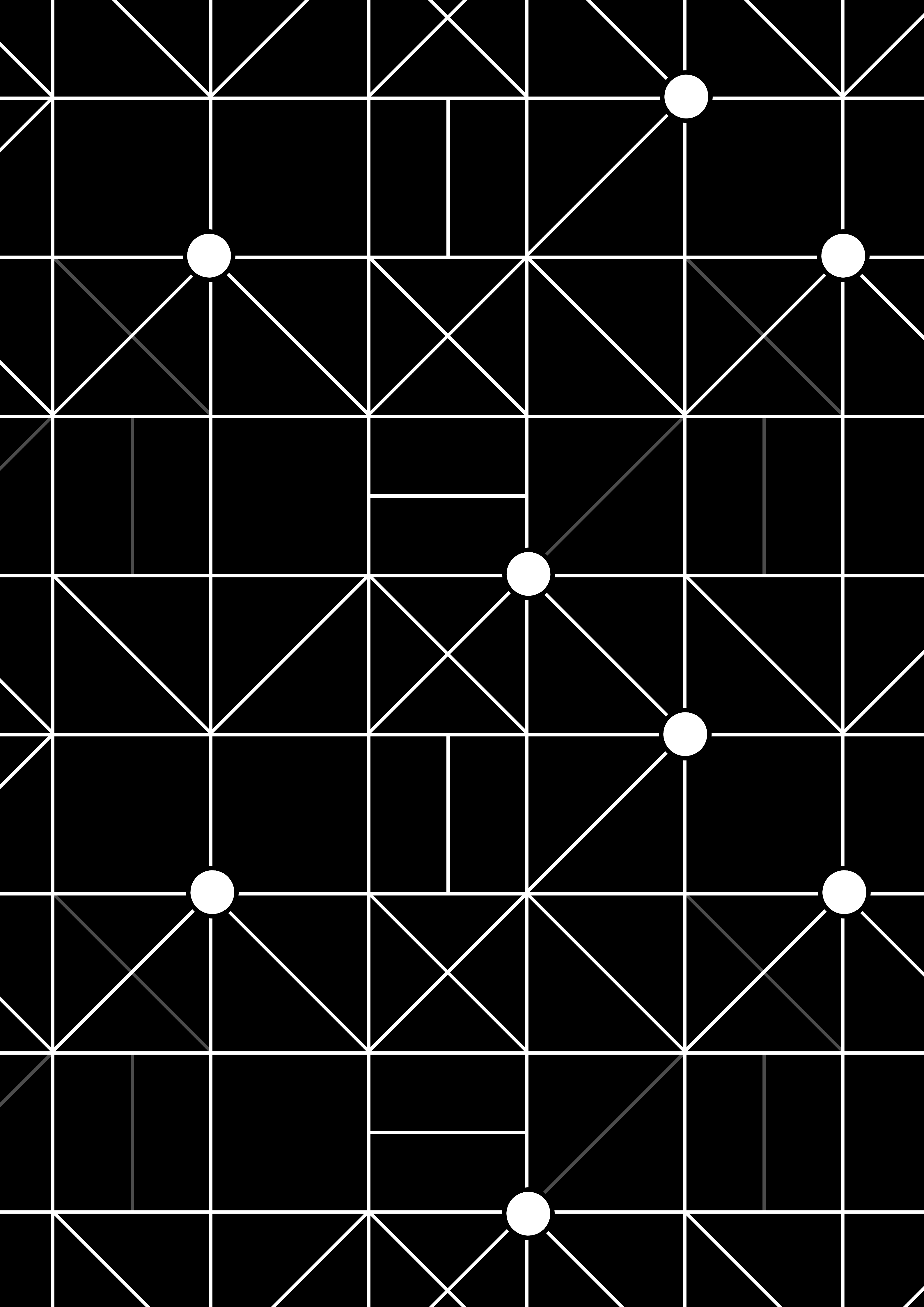
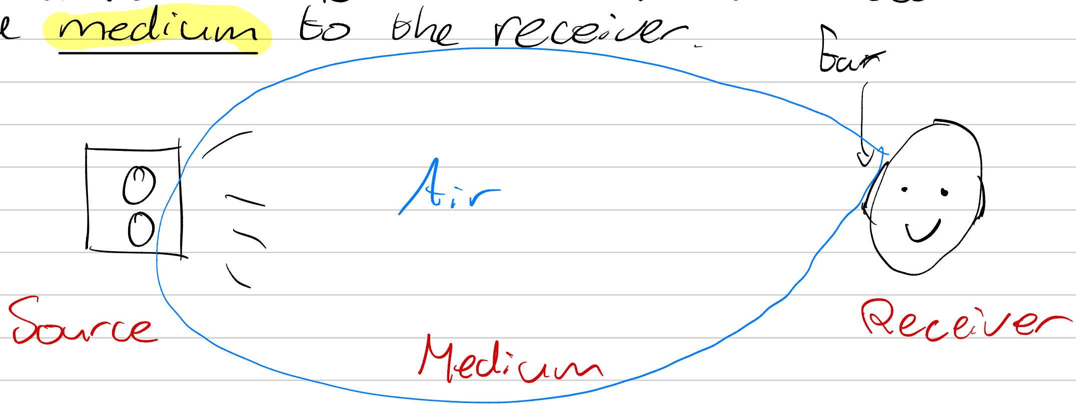


Introduction Sound

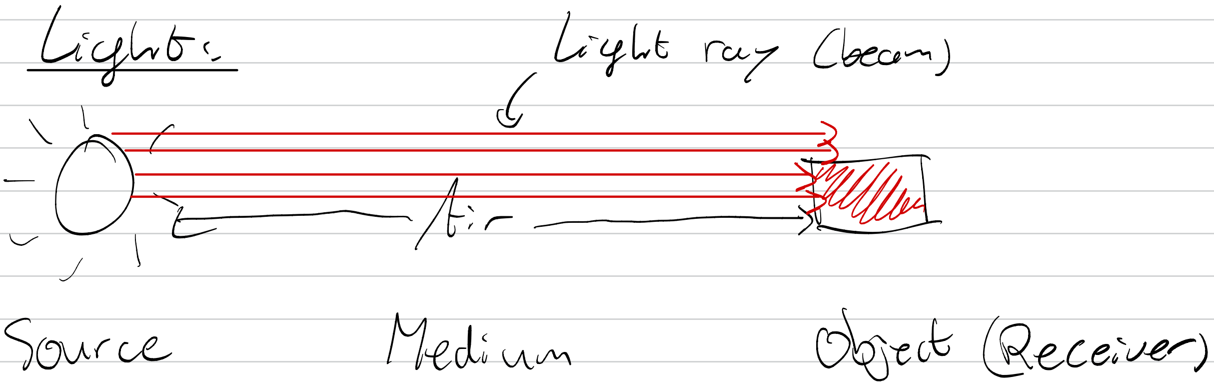
What is sound?

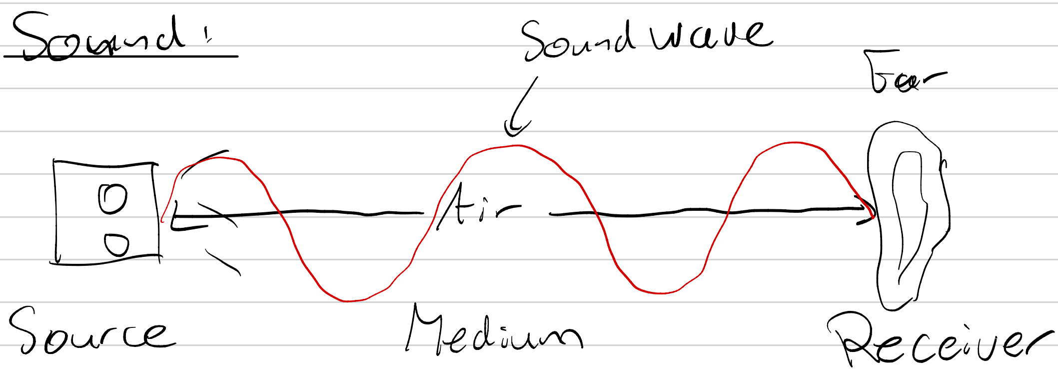
The vibration of the source that was been transported via a medium to the receiver.



Important: There can only be sound if you have a medium, a source and a receivor.

Difference between light and sound waves



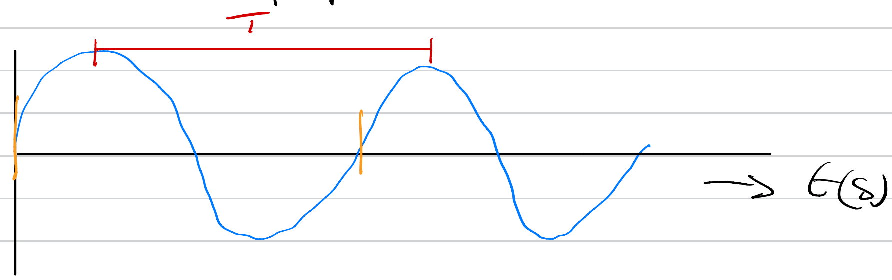


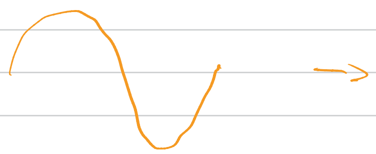
Light travels 300.000 km/s
Sound travels 343 m/s

The amount of sound waves is the frequency

Wave:

An indication of how much an object vibrates or what the properties of the sound are.





Frequency: The amount of soundwaves every second given in [Hz] (Hertz)

$$f = \frac{1}{T}$$

f = Frequency in [Hz]
1 = Indication that it's 1 second
T = Vibration period in [s]

What is the frequency of a pendulum with 15 vibrations in 20 seconds?

$T = \frac{15}{20} = 0{,}75$ Vibrations per second

$f = \frac{1}{T} = \frac{1}{0{,}75} = 1{,}33$ Hz

$3 = \frac{6}{2}$ if $F = \frac{1}{T}$ then $T = \frac{1}{F}$ → $\left(2 = \frac{6}{3}\right)$

Homework answers:

1.) F in (Hz)
T in (s)

2.) $T = \frac{1}{2} = 0{,}5\ s$

$f = \frac{1}{T} = \frac{1}{0{,}5} = 2\ Hz$

3.) $T = 3{,}5\ s$

$f = \frac{1}{T} = \frac{1}{3{,}5} = 0{,}29\ Hz$

4.) $f = 0{,}5\ Hz$
$T = ?$

$f = \frac{1}{T} \rightarrow 3 = \frac{6}{2}$

$T = \frac{1}{f} \rightarrow 2 = \frac{6}{3}$

5.) $f = 2035\ Hz$
$T = ?$

$T = \frac{1}{f} = \frac{1}{2035} = 0{,}0004914\ s$

If 1 second is 1000 ms
then $\rightarrow \frac{0{,}0004914}{1000} = 0{,}4914\ ms$

6.) $T = 60\ ms = \frac{60}{1000} = 0{,}06\ s$

$f = \frac{1}{T} = \frac{1}{0{,}06} = 16{,}67\ Hz$

7.) $\frac{1000}{5} = 200$

$T = \frac{1}{200} = 0{,}005\ s$

$f = \frac{1}{0{,}005} = 200\ Hz$

8.) $T = \frac{5}{10} = 0{,}5$

$f = \frac{1}{T} = \frac{1}{0{,}5} = 2\ Hz$

Homework answers:

1.) $F = 55\ Hz$

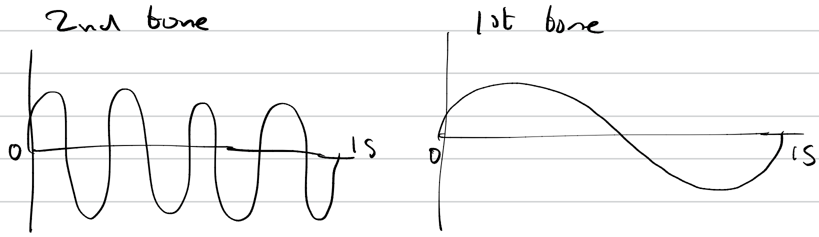
a.) $F = \frac{1}{T}$ $\quad 3 = \frac{6}{2}$ $\quad 3 \cdot 2 = 6$

$T = \frac{1}{F} = \frac{1}{55} = 0{,}0181818\ s = 0{,}018\ s$

b.) $T = \frac{1}{1100} = 0{,}000909090 9\ s$

$\frac{0{,}018}{0{,}009} \approx 20$ pictures per wing flap.

2.)

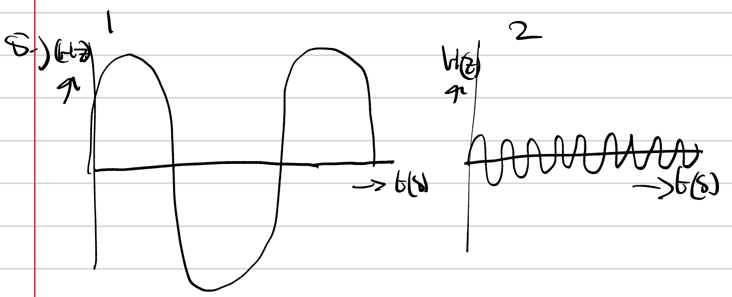


I need to have more vibration in the same second, thus the vibration time is smaller.

3.) Mosquito

4.)
a.) the vibration time is faster and therefore higher frequency ↗
b.)
c.) More power is a higher amplitude and therefore a higher volume

5.)



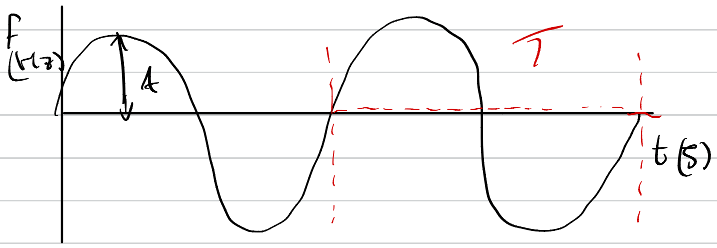
6.)
a.) No, I didn't change the tone
b.) Yes, the softer the sound, the lower the amplitude.

Waves:

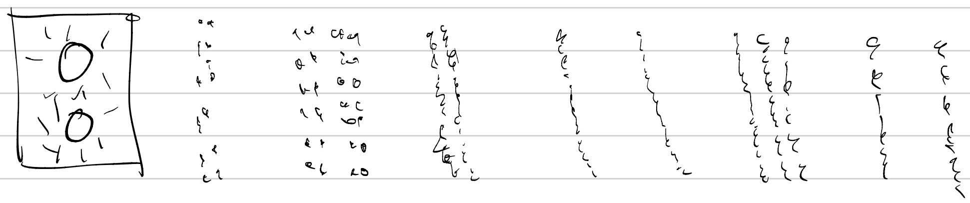
Definition: The illustration of a vibration

2 Different waves:

1.) Transverse Wave: A wave that stretches verbical



2.) Longitudal wave: A wave that stretches horizontal



How fast is a wave?

To calculate the velocity of a (Sound) wave, We use the following formula:

$$V_{wave} = \frac{\Delta x}{\Delta t}$$

$$V_{wave} = \frac{x_{end} - x_{begin}}{t_{end} - t_{begin}}$$

V_{wave} is the velocity (speed) of a wave in [m/s]
Δx is the travelling distance of the wave in [m]
Δt is the travel time of the wave in [s]

Δ -> Greek symbol capital Delta, means difference between 2 points.

Question: It takes 8 seconds for the sound of a lighting-strike to reach your ears, The distance to travel was 2,4km. Calculate the velocity of the sound.

What do you notice?

$\Delta X = 2{,}744 \text{ km} = 2744 \text{ m}$
$\Delta t = 8 \text{ s}$

① $V_{wave} = \frac{\Delta X}{\Delta t} = \frac{2744}{8} = 343 \text{ m/s}$

② $V_{wave} = \frac{X_{end} - X_{beg}}{t_{end} - t_{beg}} = \frac{2744 - 0}{8 - 0} = 343 \text{ m/s}$

$V_{wave} = 343 \text{ m/s}$

This is the velocity of sound in Air of 20°C.

Recap question:

With an echo we can determine how deep the sea is. This is via a sound pulse. We measure how long it takes for the soundwaves to come back. It takes, in this case, 0,59 seconds.

How deep is the sea? You can assume that sound travels 1510 m/s in sea water.

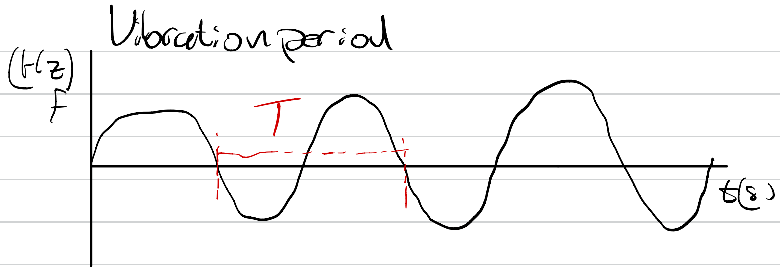
$\Delta t = \frac{0{,}59}{2} = 0{,}295 \text{ s}$

$V_{wave} = 1510 \text{ m/s}$

$V_{wave} = \frac{\Delta x}{\Delta t}$ $\qquad 3 = \frac{6}{2}$

$\Delta x = V_{wave} \cdot \Delta t$

$\Delta x = 1510 \cdot 0{,}295 = 445 \text{ m}$



Wavelength is the amount of meters a wave has.

We can also calculate how fast a sound wave is via the wavelength.

$$V_{wave} = \frac{\lambda}{T}$$

V_{wave} is the velocity (speed) of the wave in [m/s]
λ is the wavelength of the wave in [m]
T is the vibration period in [s]

λ is lambda, Greek symbol for wavelength.

$$T = \frac{1}{f}$$

$V_{wave} = \frac{\lambda}{T}$ and $T = \frac{1}{f}$

↳ $V_{wave} = \frac{\lambda}{\frac{1}{f}}$

↳ $$V_{wave} = \lambda \cdot f$$