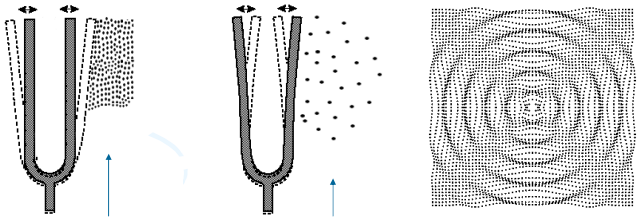
What is Sound?

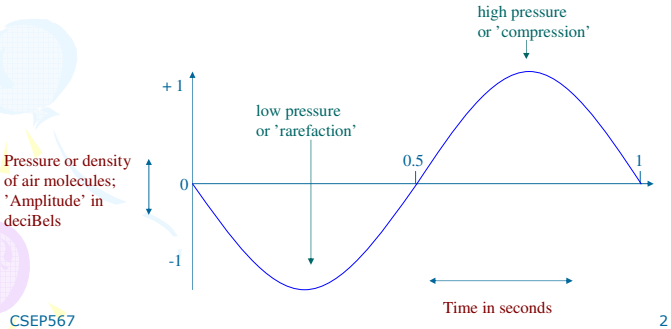
As the tines move back and forth they exert pressure on the air around them.
(a) The first displacement of the tine compresses the air molecules causing high pressure.
(b) Equal displacement of the tine in the opposite direction forces the molecules to widely disperse themselves and so, causes low pressure.
(c) These rapid variations in pressure over time form a pattern which propogates itself through the air as a wave. Points of high and low pressure are sometimes reffered to as '**compression'** and '**rarefaction**' respectively.



(a) compression (b) rarefaction (c) wave propagation of a tuning fork as seen from above

Sine Waves

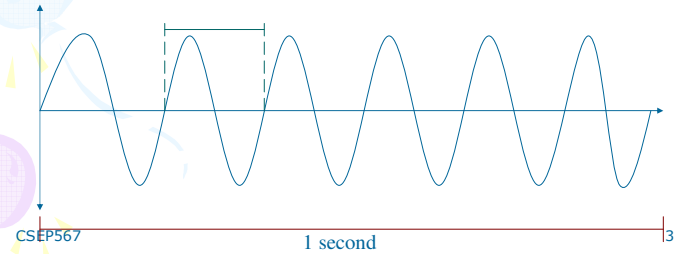
The **sine wave** or **sinusoid** or **sinusoidal signal** is probably the most commonly used graphic representation of sound waves.



Sine Waves

The specific properties of a sine wave are described as follows.

Frequency = the number of cycles per second (this wave has a frequency of 6 hertz)
Amplitude = variations in air pressure (measured in decibels)
Wavelength = physical length of 1 period of a wave (measured in metres per second)
Phase = The starting point of a wave along the y-axis (measured in degrees)



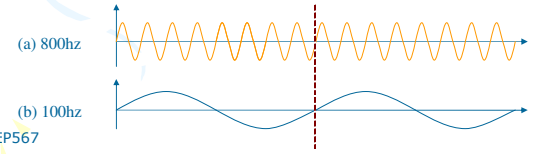
Frequency

Frequency refers to the number of cycles of a wave per second. This is measured in **Hertz**. So if a sinusoid has a frequency of 100hz then one period of that wave repeats itself every 1/100th of a second. Humans can hear frequencies between 20hz and 20,000hz (20Khz).

1) Frequency is closely related to, *but not the same as!!!*, pitch.

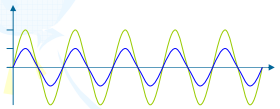
2) Frequency does not determine the speed a wave travels at. Sound waves travel at approximately 340metres/second regardless of frequency.

3) Frequency is inherent to, and determined by the vibrating body – not the amount of energy used to set that body vibrating. For example, the tuning fork emits the same frequency regardless of how hard we strike it.

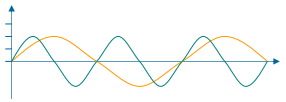


Amplitude

- Amplitude describes the size of the pressure variations.
- Amplitude is measured along the vertical y-axis.
- Amplitude is closely related to *but not the same as!!!*, loudness.



(a) Two signals of equal frequency and varying amplitude



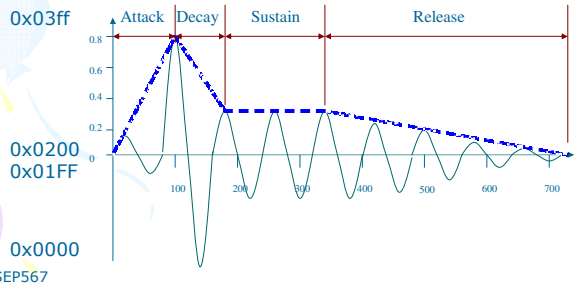
(b) Two signals of varying frequency and equal amplitude

Amplitude Envelope

The amplitude of a wave changes or 'decays' over time as it loses energy.

These changes are normally broken down into four stages;
Attack , **Decay**, **Sustain** and **Release**.

Collectively, the four stages are described as the **amplitude envelope**.



Quantization