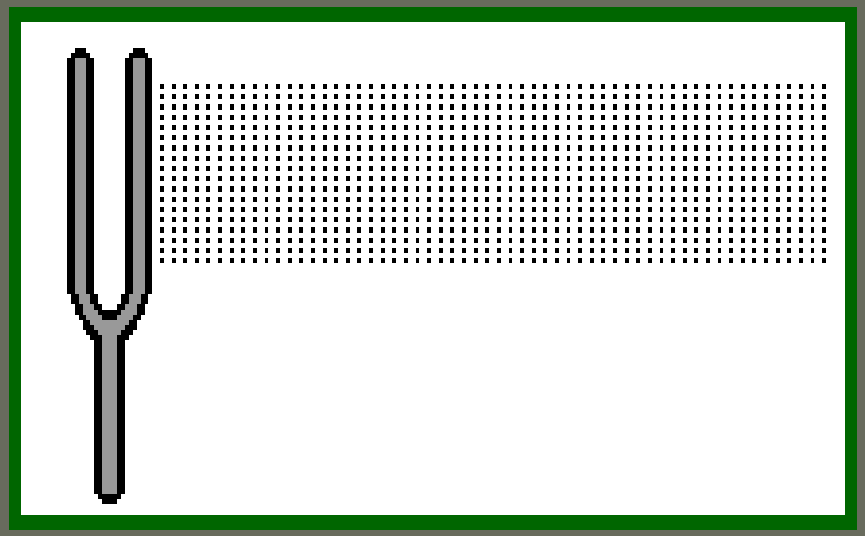
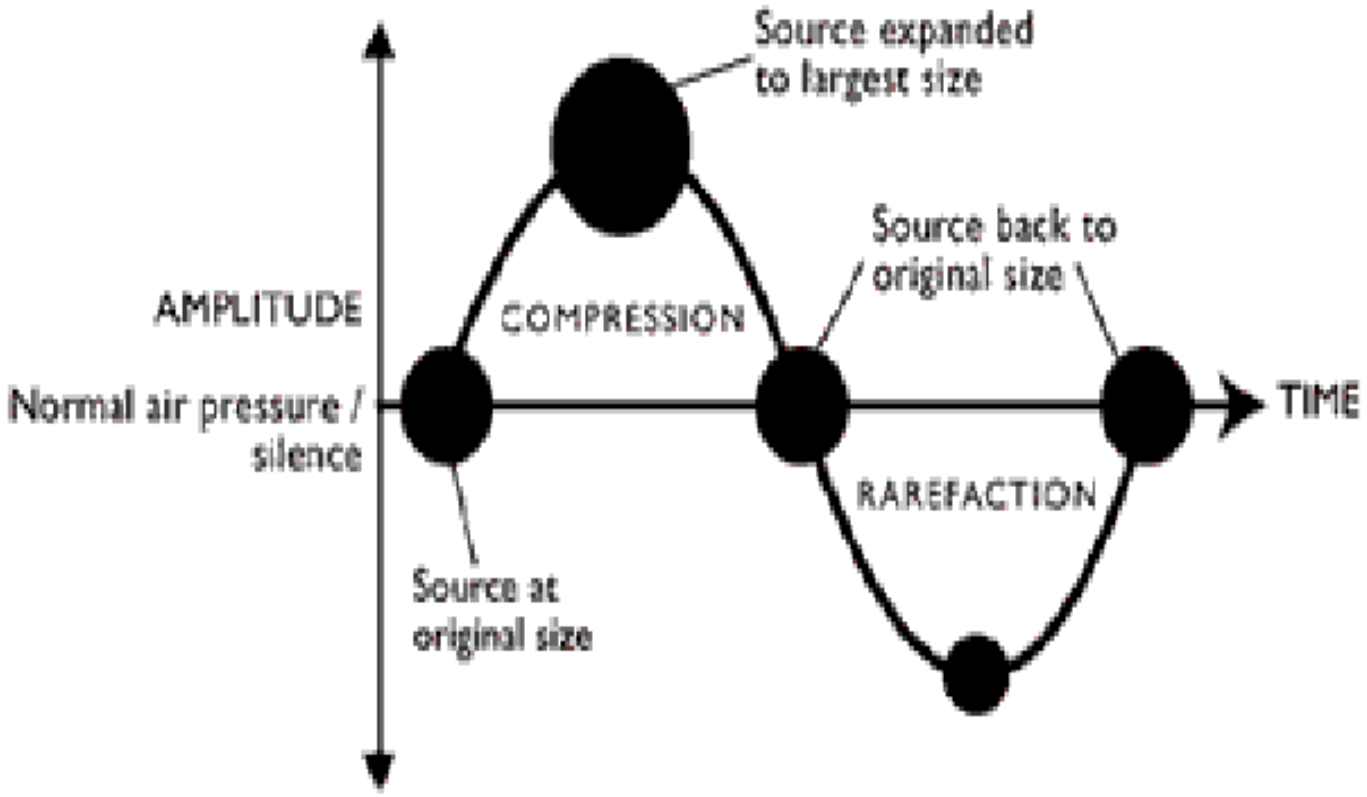
Sound

- When something vibrates in the atmosphere, it moves the air particles around it. Those air particles in turn move the air particles around them, carrying the pulse of the vibration through the air.



CYCLE OF SOURCE (A SPHERE) **VIBRATION**

(Compression and Rarefaction)



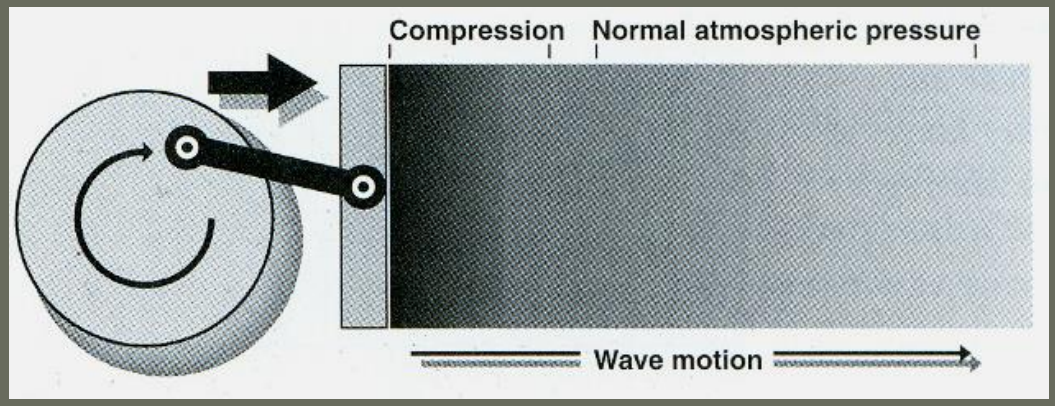
- When a sound source is made to vibrate, it causes the air particles surrounding it to be alternately compressed and rarefied

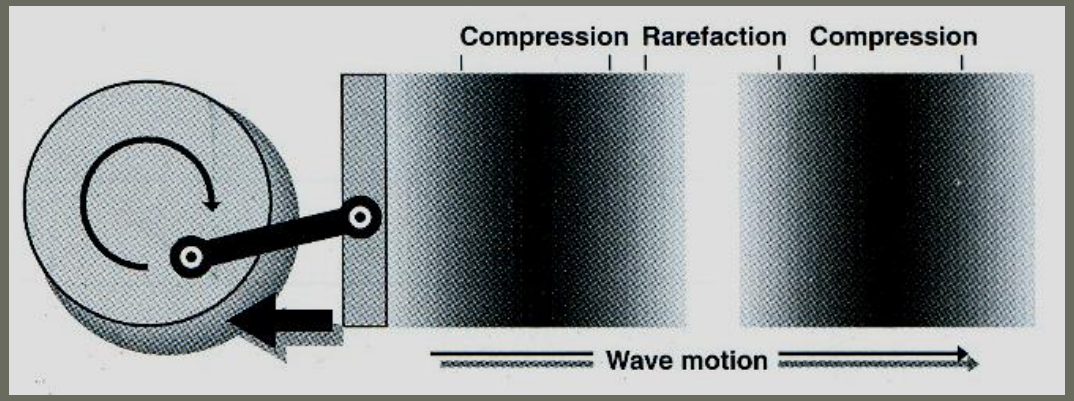
- when air particles press together, causing a region of higher than normal pressure called compression.

- when the adjacent particles are moving a part to create a partial vacuum causing a region of lower than normal pressure called rarefaction

Nature of Sound

- Longitudinal wave motion consisting of a train of compressions and rarefactions
- When sound waves strike the ear drum these are converted into electrical signals
- The auditory nerves carry these signals to the brain which interprets them into what we call sound
- Being a wave motion, sound has all the characteristics of a wave





Characteristics of a wave include

- Amplitude
- Frequency
- Wavelength
- Velocity
- Phase

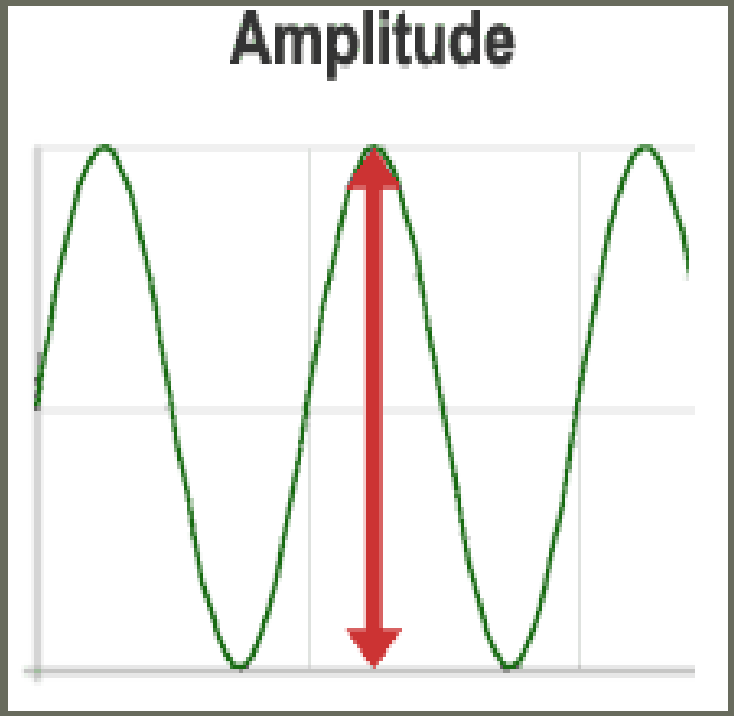
Characteristics of a wave include

Amplitude

Intensity of compressions and rarefactions produced in the medium.

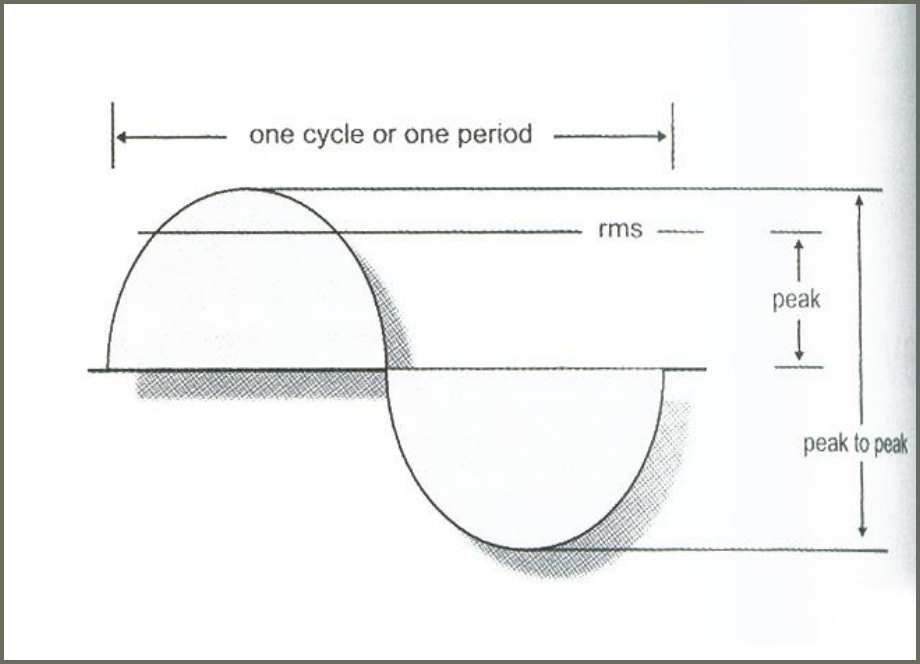
or

the distance above or below the centre line of a waveform



- Amplitude is measured in decibel.
- which was named after the inventor of the telephone, Alexander Graham Bell
- Peak amplitude refers to the positive and negative maximums of the wave.
- Root Means Squared Amplitude (RMS) is average of peak values equal to the signal level perceived by our ear

RMS=0.707 x peak value



Characteristics of a wave include

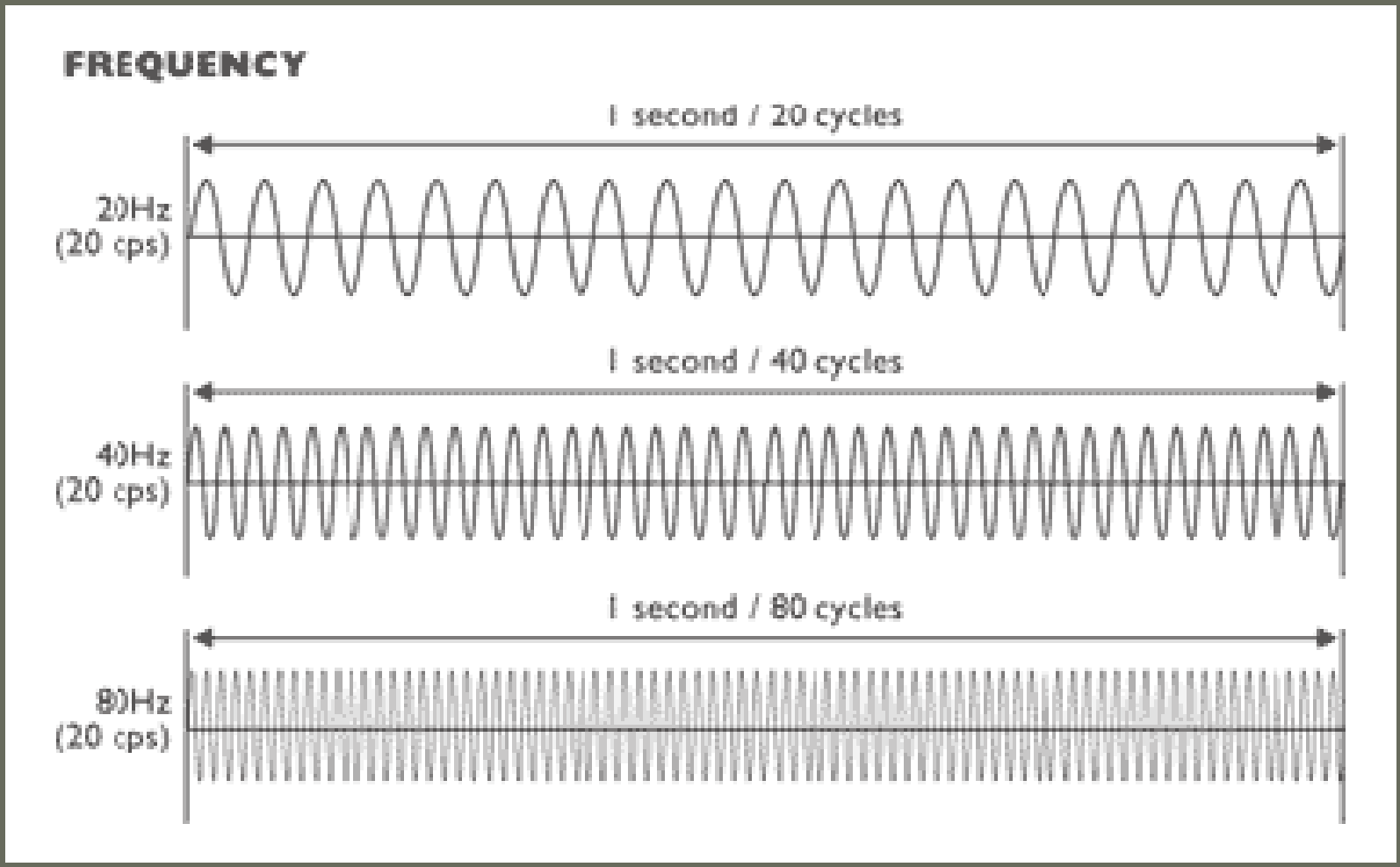
Frequency

Number of successive compressions and rarefactions occurring in one second, and is expressed in Hertz.

or

The number of cycles that occur over the period of one second is know as a Hertz

Frequency: no of cycles per second



$$\text{frequency} = \frac{1}{\text{period}}$$

- Period is the amount of time required for one complete cycle of sound

- Period =T

$$\text{period} = \frac{1}{\text{frequency}}$$

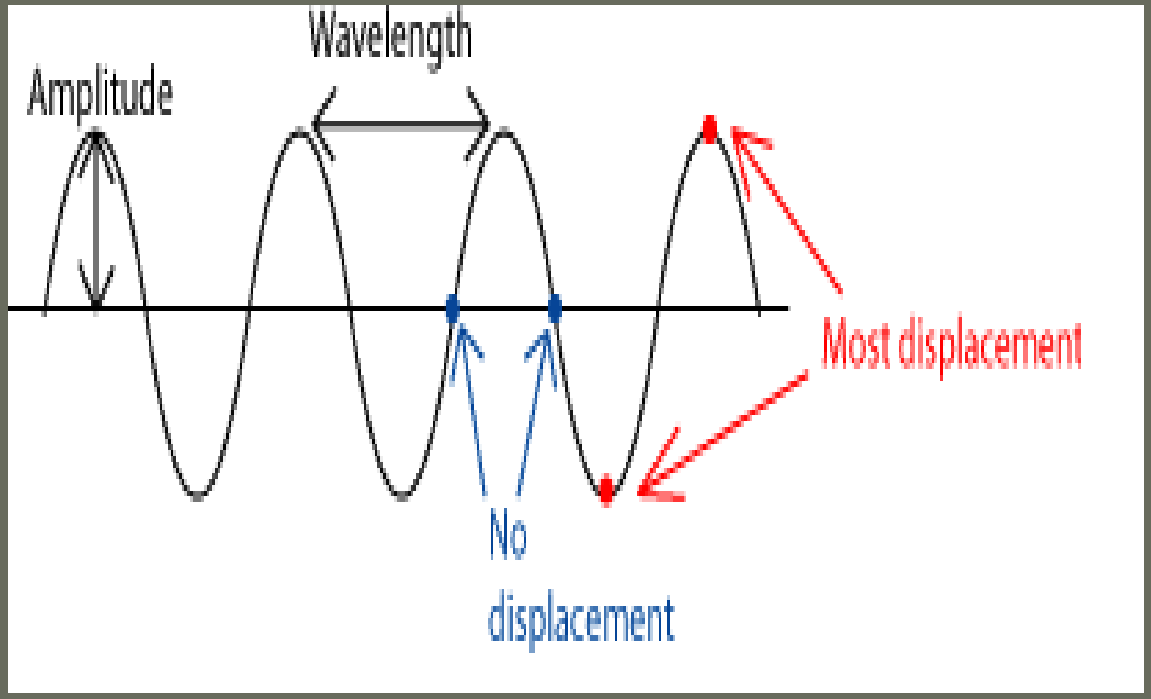
Characteristics of a wave include

Wavelength

Distance between a compression and it's adjacent rarefaction

Or

Distance traveled by one cycle of variation



Formula

$$\text{Wavelength} = \frac{\text{sound velocity}}{\text{sound frequency}}$$

Thus,

1. High frequency sounds have shorter wavelength than low frequency sounds.

- We are more sensitive to tones in the middle frequency(3KHz to 4KHz).
- Loudness and volume are not same.
- A volume control is used to adjust the overall sound level over the entire frequency range of the audio spectrum(20Hz to 20KHz).
- A loudness switch increases the low frequency and high frequency range of the spectrum while not affecting the mid range.

Characteristics of a wave include

Velocity

Distance traveled by a sound wave in one second . Velocity of sound in air is

344m/s at 20º C or 332m/s at 0ºC

v = distance/ time

$v = \lambda/T = f\lambda$, $f = 1/T$

Phase

- The relative displacement in time between waves of the same frequency

  1. Direct wave

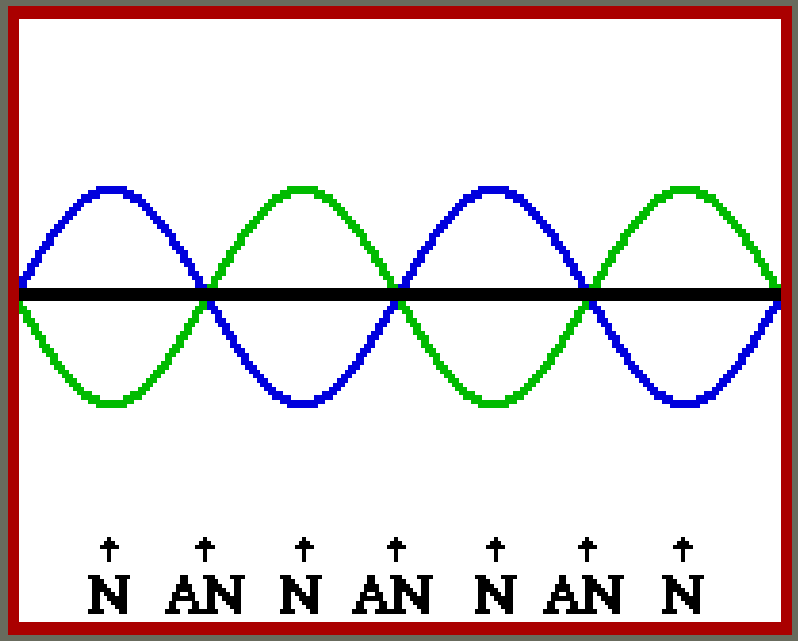
  2.Reflected wave

When the direct sound strikes a reflective surface, part of that wave passes through the surface while that surface material absorbs part of it. The rest is reflected as a delayed wave.

The direct and reflected wave may be wholly in phase with each other: the result is that they will either reinforce each other or cancel each other.

Standing wave

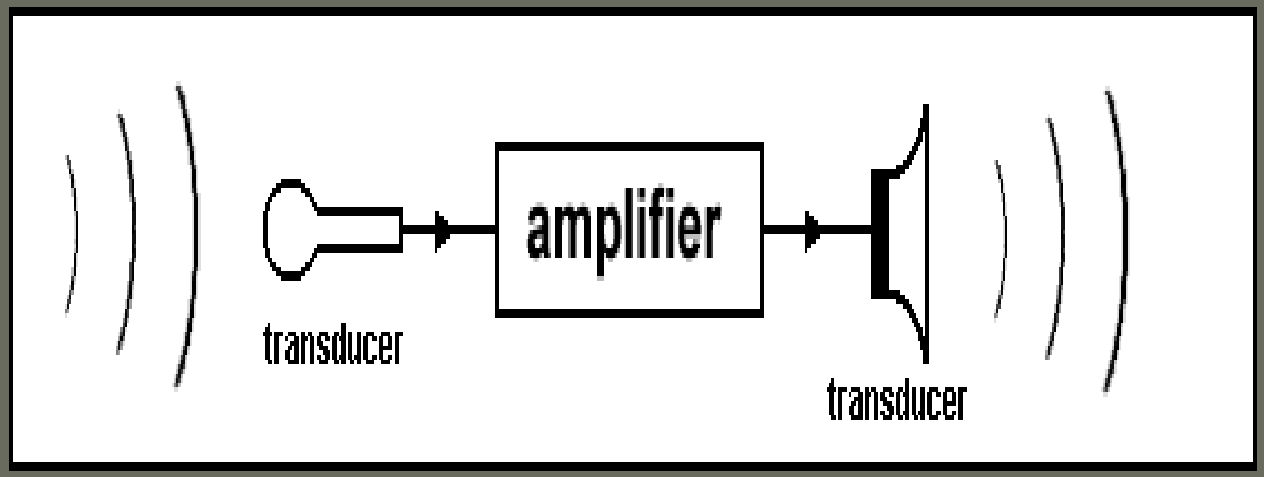
- Standing waves are produced whenever two waves of identical frequency interfere with one another while traveling opposite directions along the same medium.
- Standing wave patterns are characterized by certain fixed points along the medium which undergo no displacement. These points of no displacement are called *nodes* (nodes can be remembered as points of no displacement).
- **Midway between every consecutive nodal point are points which undergo maximum displacement. These points are called anti-nodes; the anti-nodal nodal positions are labeled by an "AN"**



Acoustic envelop

- The envelope of a waveform describes the way its intensity varies in the time that the sound produced and dies away.
- 4 basic section- attack, decay, sustain, release
- Attack time is the time takes for the sound to rise to maximum level.
- Decay is the time to start decreasing
- Sustain is the maximum level to mid level.
- Release is the time it takes for a sound to fall below the noise floor.

Sound Systems



- **Transducer** - A device which converts energy from one form into another. The two types of transducers we will deal with are microphones (which convert acoustical energy into electrical energy) and speakers (which convert electrical energy into acoustical energy).

- **Amplifier -** A device which takes a signal and increases it's power (i.e. it increases the amplitude).

The Field of Audio Work

- Studio Sound Engineer
- Live Sound Engineer
- Musician
- Music Producer
- DJ
- Radio technician
- Film/Television Sound Recordist
- Field Sound Engineer
- Audio Editor
- Post-Production Audio Creator