LET'S GET LOUD
AUDIO BASICS

For a better understanding of some sound principles, take a look at:
Nine Components of Sound (http://filmsound.org/articles/ninecomponents/9components.htm)
Basic Sound Principles (http://www.roundbackguitarforum.com/workshop/Sound-FAQ-Links.pdf)
Jisc Digital Media's "The Physical Principles of Sound" *This source was used to create the below quick sheet.

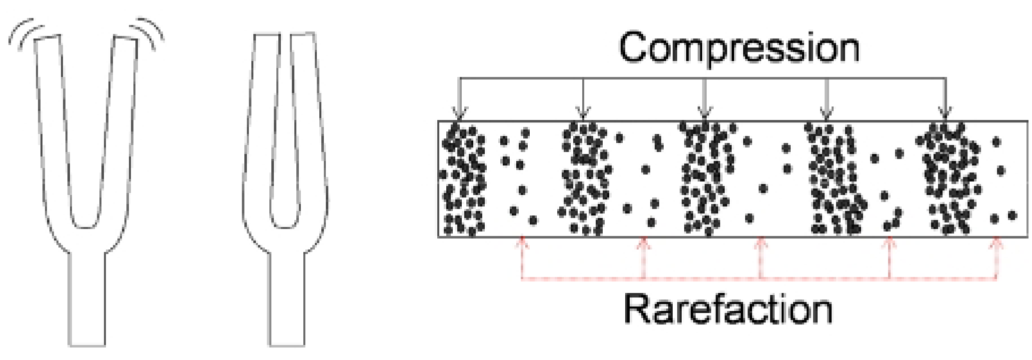
Sound
Sound is the disturbance of air. When an object is acted upon, the movement displaces molecules in the air. This knocking around of molecules creates the sound we hear.

Sound Is Shaped By:
The sound source - material, shape
How the source is acted upon - hit, plucked, dropped, etc.
The environment and mediums the sound travels through to the listener. For example, a shout heard in a canyon sounds different than if heard in a small room, or through a pair of speakers.
The listening conditions applied by the listener: position listener is in relation to source; quality of ear (age can affect ears ability to hear)

Sound Waves
Sound pressure travels in waves. Imagine a set of adjoining springs which is fixed at each end. When the spring at the farthest end is pulled taut and released, this spring will then push the adjoining spring, after which it will be pulled apart back to it's initial state of equilibrium. This push and pull force is then transferred along all of the adjoining springs. The region where a spring is pushed is called a compression, and the region where it is pulled apart is known as a rarefaction.

Diagram 1 shows the vibrating system of a tuning fork and the impact on the surrounding molecules. This method of propagation is expressed as a longitudinal wave (see *Diagram 2*) and is an accurate model for how sound travels through air.

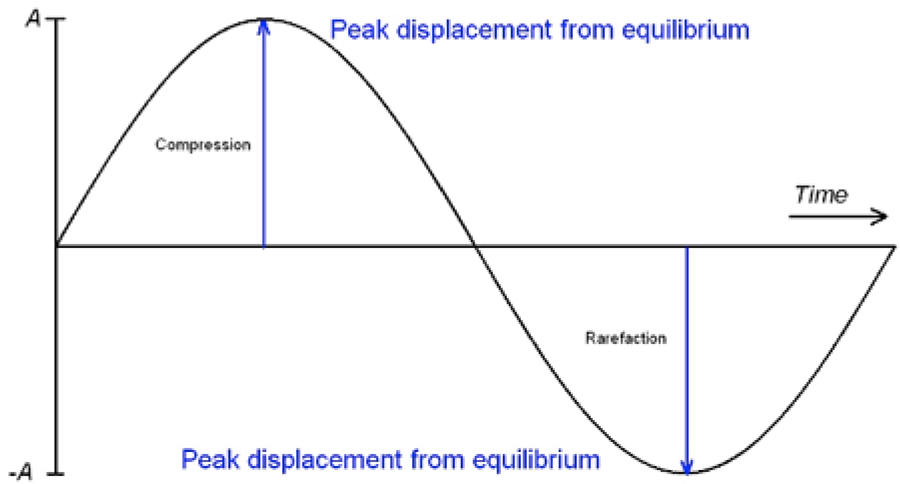
Diagram 1



A tuning fork propagates sound waves longitudinally. Upon excitement the prongs expand and contract creating periodic disturbance. This can be seen as periods of compression and rarefaction of molecules, until the prongs return to their natural state.

Sound travels through solids in a different manner. Imagine the spring model, as discussed, where the centre most spring is pulled from side to side, as opposed to pushed and pulled. This lateral movement causes lateral disturbance along both directions of the spring alignment, known as transverse waves. Propagation of this type is found in the vibrating systems of instruments, such as strings.

Diagram 2



Although similar in shape to a sine wave, the diagram represents the displacement from equilibrium over time creating a longitudinal sound wave.

The periods of compression in a wave contain the content that is audible to our ears. Within the range of human hearing, sound waves travel at such a speed whereby we perceive there to be a constant tone. This is similar to a light bulb that flickers on and off so fast, that our eyes perceive there to be only constant light.

Amplitude

Amplitude is the measurement of sound level displacement above and below the equilibrium pressure. It is measured in the amount of force applied over an area and as such is relative to the energy or intensity of a sound. As a result, amplitude is also relative to the perceived volume of sound, although it is not a unit or a meter of volume. Diagram 2 shows the amplitude of a wave plotted against time.

Phase

As mentioned above, phase is the angle of displacement at the starting point of the wave, i.e. when t=0. Phase is expressed as Theta or 'i'. Phase is measured in degrees as the offset or onset (before or after) angle from 0. The wave in Diagram 2 above begins at point A = 0 on the vertical (y) axis.

Frequency and Pitch

The frequency of a wave is derived from the amount of cycles (or periods) per unit of time (seconds). Frequency is a logarithmic scale, measured in Hertz

Frequency is the physical basis for differences in musical pitch.
How is pitch different from frequency? Pitch is a perceived quality regarding how 'high' or 'low' a musical note is.

Some of the Experiments we did today:

1. **Paper Cup Phone** Explains how sound travels and why cup phones/tin can phones works (http://www.sciencekids.co.nz/projects/stringphone.html)
2. **Cup Amplifiers** (http://lifehacker.com/5912474/the-best-free-diy-smartphone-volume-boosts