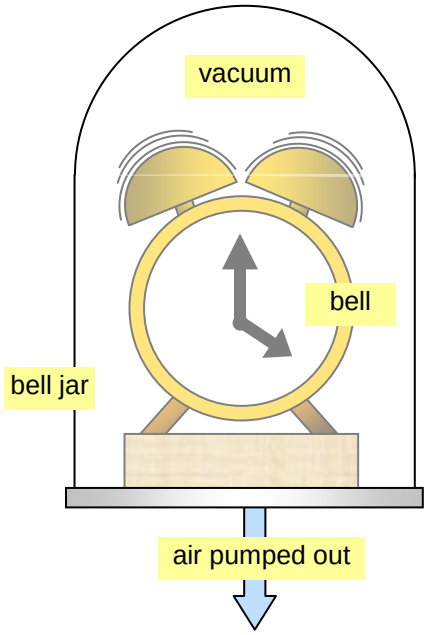
Sound Waves

(taken from: www.schoolphysics.co.uk)

Sound waves travel through the air by the air molecules vibrating backwards and forwards. This 'backwards and forwards' motion of the molecules in a sound wave means that sound waves are **LONGITUDINAL WAVES**. The faster the vibration the higher the pitch of the note and the bigger the vibration the louder the note.



You can prove quite easily that the sound waves can't travel through a vacuum by putting a bell inside a bell jar and ringing it. If there is air inside the jar you can hear the noise outside but once the air is pumped out of the bell jar no sound can get out.

On the Moon where there is almost no air sound would not travel from one place to another. You could see an explosion but not hear it.

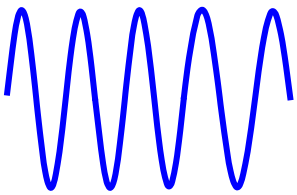
There are many ways of making the air vibrate, here are just a few:

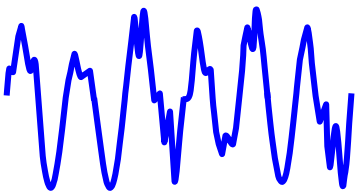
playing a guitar	banging a tin sheet
playing a flute	singing
firing a gun	screaming

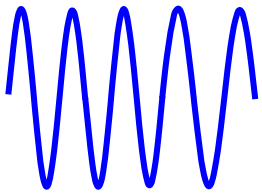
Now some of these sounds you would say were pleasant and some rather unpleasant. What is the difference between noise and music? It's a matter of opinion, but we can say what is a pure note and what is not. We can do this by looking at the trace that the sound makes on the oscilloscope screen.

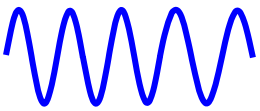
On the oscilloscope a noise will look like a ragged jumble of ups and downs, usually with sharp peaks and troughs.

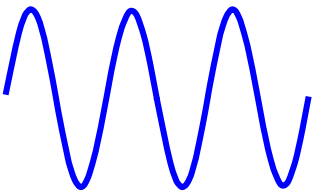
A pure note will be a smooth wave with no quick changes. The size and shape of the wave produced by a pure note will depend on the pitch of the note and how loud it is.

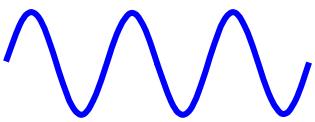

A "pure note"


noise


A loud, high pitched note


A soft, high pitched note


A loud, low pitched note


A soft, low pitched note

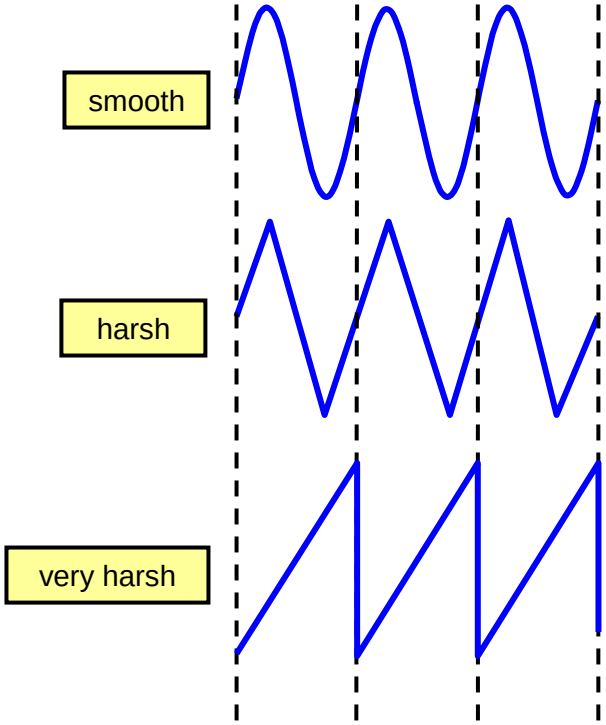
The range of hearing, singing, and the quality of notes.

You can very easily find the range of hearing of your ears by using an oscillator, it will turn out to be from the lowest audible note at about 50Hz to the highest at about 20 000Hz. To give you an idea what these notes would sound like, a man can sing down to about 64Hz and up to about 500Hz, while a woman has a range from 200Hz to about 900Hz.

Middle C on a piano is 256Hz. The older you get the less well you will hear the high pitch notes. Obviously middle C sung by a man will sound different from middle C sung by a woman, and if played on different instruments it will sound different each time.

These slightly different sounds all have the same pitch or frequency it's just the shape of the wave that is different. The more jagged the wave the harsher the sound.

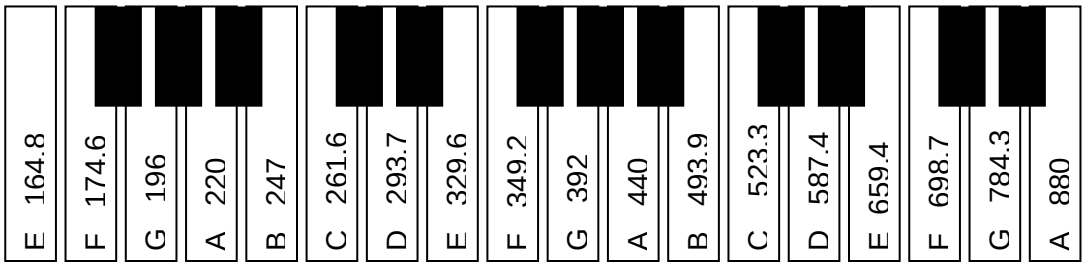
It is the combination of different types of sound that gives different sorts of music its own characteristic sound! If possible try singing into a microphone connected to an oscilloscope and see if you can make a pure note. It is very difficult and depends on the syllable that you try to sing. You will find that "oooo" is probably the best.



Musical notes

The frequency of notes in music have a precise relationship with each other. It is these ratios between one note's frequency and the next that makes combinations of notes pleasant to listen to. Notice that if you increase the pitch by one octave the frequency doubles. Using a 'key note' we can build up the whole scale.

(For more detail see 16-19/Sound/Text/Music and physics)



(Note: the frequencies shown on the keys are based on the musicians scale with A = 440 Hz)