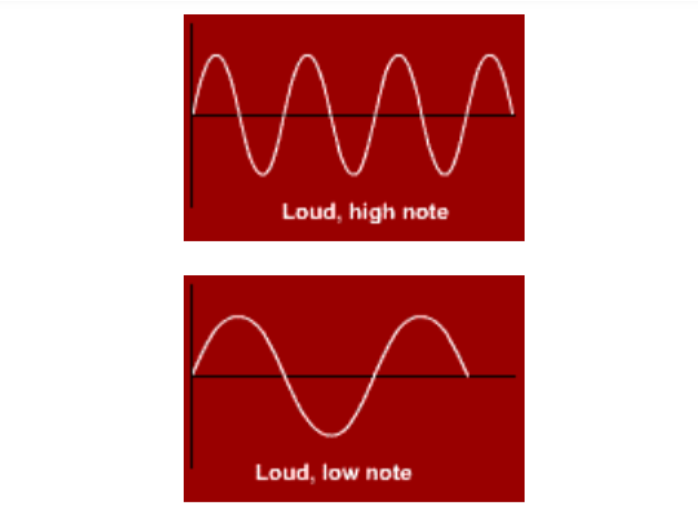
SIMPLE MUSICAL INSTRUMENTS

How is sound produced?

- For sound to occur you need a **vibrating source** and a **medium**, and to detect it, you need a **receiver**.
- There are many natural vibrating sources - vocal cords, stretched strings, reeds - but to create vibration there must be a certain amount of **surface tension** in the vibrating body.
- To reach the receiver, the vibrations need a **medium of transmission** such as **air or water**.
- Vibrations from the sound source disturb molecules in the medium. The molecules move at the same rate as the sound source. As the vibration travels through the medium each molecule hits another and returns to its original position.
- Regions of the medium become alternately **more dense** and **less dense**. The variation in pressure in the medium is sensed by a receiver such as the **human ear** or recording device and is called a sound wave.

Flow of longitudinal sound waves

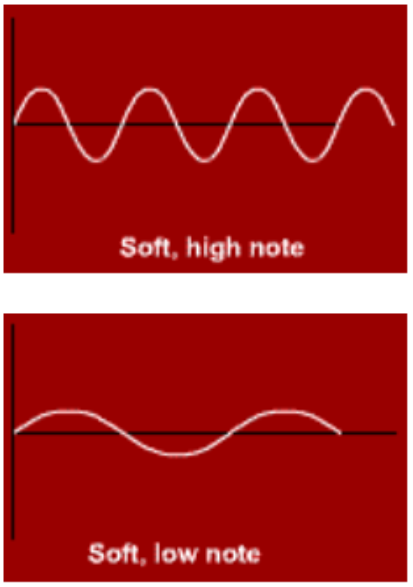
- Sound travels in the same way whether it is music or noise. The difference between music and noise is that **musical sounds** are organised into patterns that have pitch and rhythm whereas noise is just random, disorganised sounds.
- A particular musical note is determined by the number of times that the musical instrument vibrates per second resulting in a sound wave. The number of times that a sound wave vibrates in a second is called its frequency.
- Scientists measure the frequency of sounds in **cycles** per second and express the measurement in **Hertz**.
- The human ear can detect a range of frequencies. There are frequencies that are too low to detect but can be heard by other creatures, such as whales, and there are frequencies that are too high for us to hear, such as those produced by bats when trying to avoid other objects.



Loud high note vs loud low note diagram

How are louder and softer notes made?

- Louder notes are made by bigger vibrations and softer notes are made by smaller vibrations, although the number per second, or frequency, of vibrations may remain the same. The loudness of a musical note does not necessarily change its frequency.



Soft high note vs soft low note diagram

- The pitch is the degree of highness or lowness of a musical note. The pitch depends on how rapid the vibrations are i.e. how high the frequency is. A higher pitch has a higher frequency.

- The diverse sounds made by the instruments in each section of an orchestra are due to **harmonics**. These are higher and quieter sounds that are mixed in with the main note. They are not heard separately but add to the **tone** of the sound.

How is an instrument tuned?

- To tune any two instruments, the sound waves from both of them must be at the same frequency. If the frequencies differ very slightly, the two sound waves interfere, making another sound wave that undulates in volume or 'beats'.
- The beat frequency is the number of volume undulations heard per second. It is found by subtracting the lower frequency from the higher one. When two instruments are in tune, the beat frequency should be zero. This is an extremely useful tool for tuning instruments accurately by ear.

Three types of Instruments

Stringed instruments

- The pitch of a stringed instrument depends on the **tension** and the length of the string.
- In most stringed instruments the pitch gets higher when the player moves their hand closer to the bottom of the string making the vibrating area shorter.
- In many stringed instruments, the strings themselves only produce a small fraction of the sound that is heard. The rest is due to resonance from the body of the instrument vibrating in sympathy with the strings.

Wind instruments

- These instruments work by using vibrating columns of air that amplify an initial sound.
- In all wind instruments, the **length of the column** of air determines the general pitch of the instrument.
- In order for a column of air to vibrate, something must start it going. The small sound produced by blowing over the top of each panpipe tube is greatly amplified within the tube, in much the same way as the body of a stringed instrument amplifies the sound from the string.

Percussion instruments

- The sound of a percussion instrument comes from striking two things together. They can be the simplest type of instrument because usually very few parts are needed to produce an amplified sound.