

Waves

3. Wave Effects

CONCEPT 1

LESSON GUIDE

ULTRASOUND

PRECISE LEARNING POINTS

KNOW

I know what frequency of a sound is and can state the range of human hearing (same as 4.1.1).

APPLY

I can apply my knowledge of frequency to describe what ultrasound is.

EXTEND

I can extend my knowledge to explain applications of ultrasound.

NOTES

Because sounds are vibrations, we can measure the rate of vibration, or number of vibrations per second. The more vibrations per second, the higher the frequency. The lowest note on a piano keyboard has a frequency of around 32 vibrations per second. If you could see the piano string vibrating, it would go back and forth 32 times each second. We call this 32 hertz or 32 Hz. The tops note on the piano is over 4000 vibrations per second – 4000 Hz. The pitch of a note is determined by the frequency of the vibrations that make it.

When you listen to yourself speak you sound a certain way. When you hear a recording of yourself (on your phone or computer) you sound different. This is because when you hear yourself speak you have the vibrations through the air from your mouth as well as the vibrations through the bones in your head. When you hear yourself on a recording you are only hearing the vibrations caused by the loudspeaker of the device. The device may not be able to playback all of the frequencies of your voice. This is also noticeable in the quality of phone conversations. To help reduce the data your phone needs to send after you speak into its microphone, only frequencies from around 500 Hz to around 2000 Hz are recorded. We can still make each other out during the conversation but the quality of the sound is reduced.

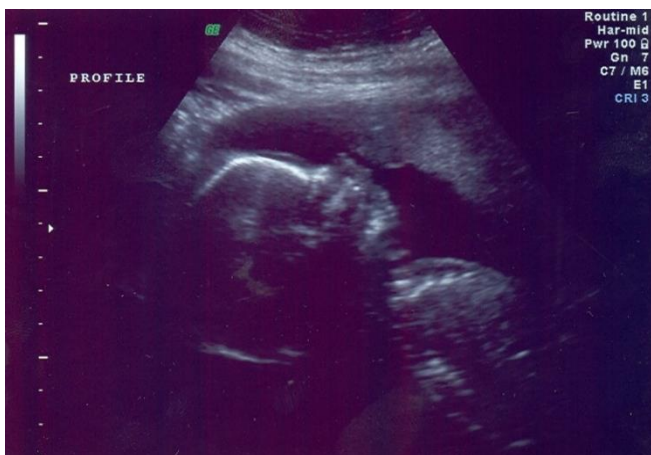
Although humans can't hear anything much higher than 20 000 Hz (this number gets smaller with age or injury), some animals can. Bats use frequencies around 40 000 Hz to navigate and cats hear some of these notes and try to catch them!

Frequencies that are higher than those that humans can hear are referred to as **ultrasound**. These are still sound waves but their frequencies are inaudible to humans. A dog whistle produces sounds around 25 000 Hz or even higher. Humans cannot hear this sound but dogs can.

Ultrasounds have a number of applications. They can be used to clean jewellery or from teeth. Ultrasonic baths cause the cleaning liquid to vibrate a large number of times per second to remove dirt from jewellery within the liquid. Ultrasonic toothbrushes make the bristles vibrate a large number of times per second and it is claimed these remove plaque from teeth better than regular brushing. Ultrasound may



assist muscle growth following injury or stress. They do so by stimulating blood flow and reducing tension in the muscles.



One of the more well-known applications is using ultrasounds to transmit into a pregnant woman's womb and to receive reflections from the foetus'. This builds up a scan call a sonogram.