

The Uses Ultrasonics

Ponder this...

When I ask you to describe what sound is, what comes to mind:

A dog barking?

A television with the volume turned up?

Music playing inside a car?

The hum of traffic outside it?



The magic of sound

By the end of this presentation you should be able to answer the following:

- What is sound?
- What are the types of sound?
- How can ultrasound be used to help us in everyday life?
- Why are there different ways to measure with ultrasonic devices?



What is sound?

Sounds is the movement of energy in vibrations that travel through the air/water as sound waves.

When the vibrations move through air they disturb it causing it to expand and contract.

Sound also can bounce off objects, changing the direction and strength of the vibrations.



Vocabulary

The **wavelength** represents variation in air pressure and is the distance over which the wave's shape repeats.

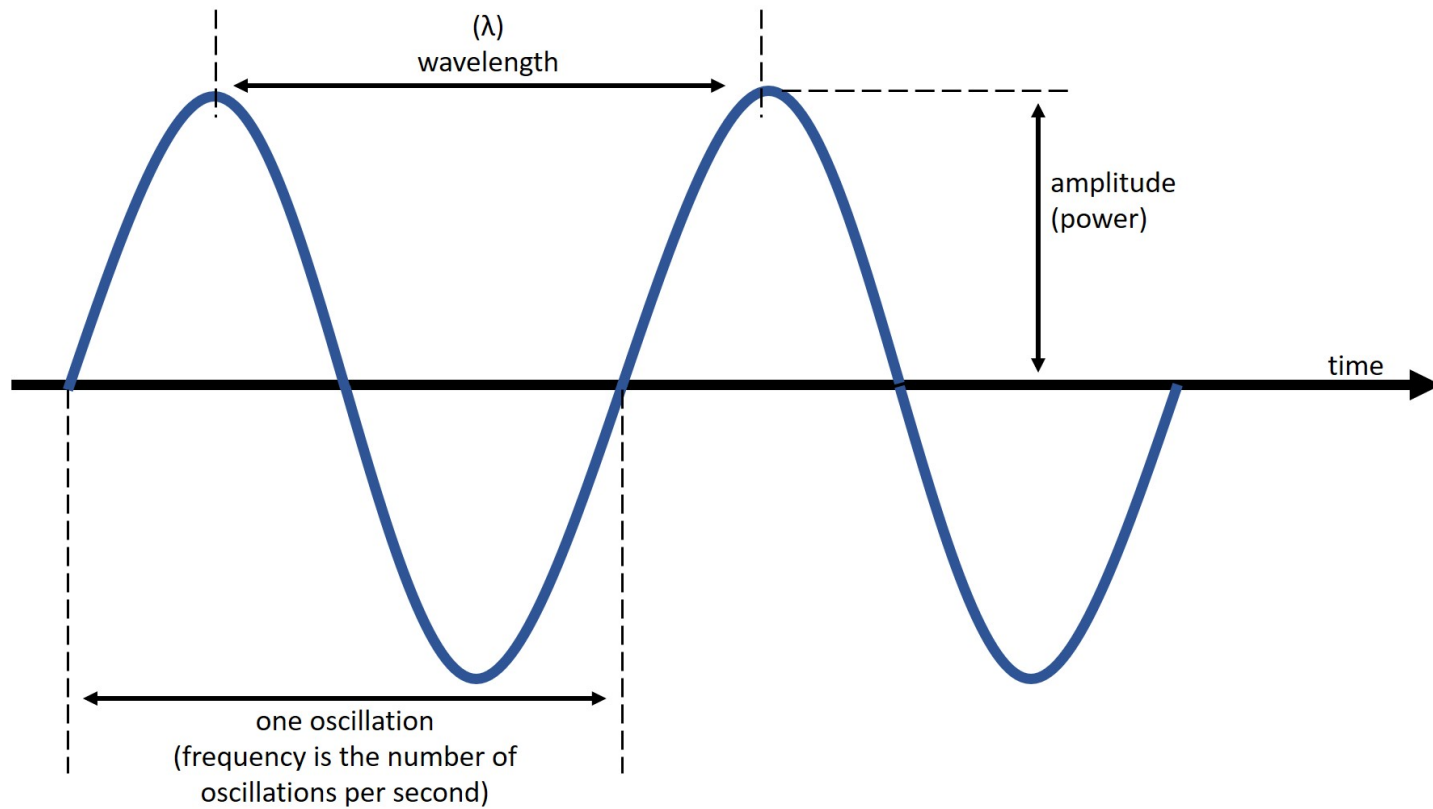
An **oscillation** of a wave is defined how long it takes for a wave to move from starting position, one position to the next and back to the start.

Amplitude refers to the intensity or power of the sound wave, and relates to volume.

The **frequency** of a wave is defined as number of oscillations the wave completes in a certain amount of time (usually seconds).

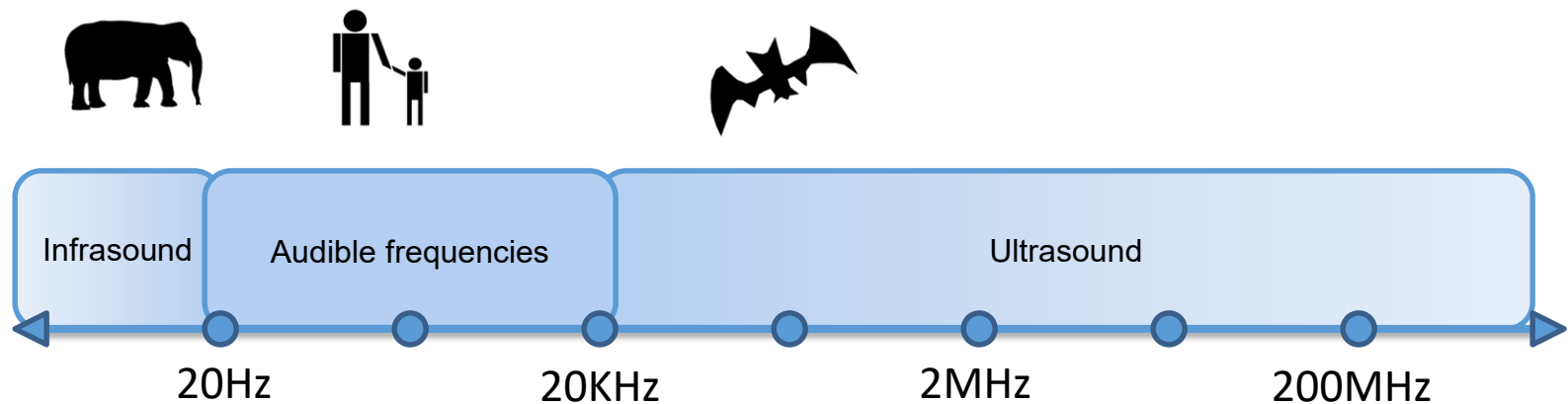
The unit of measurement for sound is a **hertz (Hz)**, and it is based on how many oscillations occur per second.

Image of a sound wave



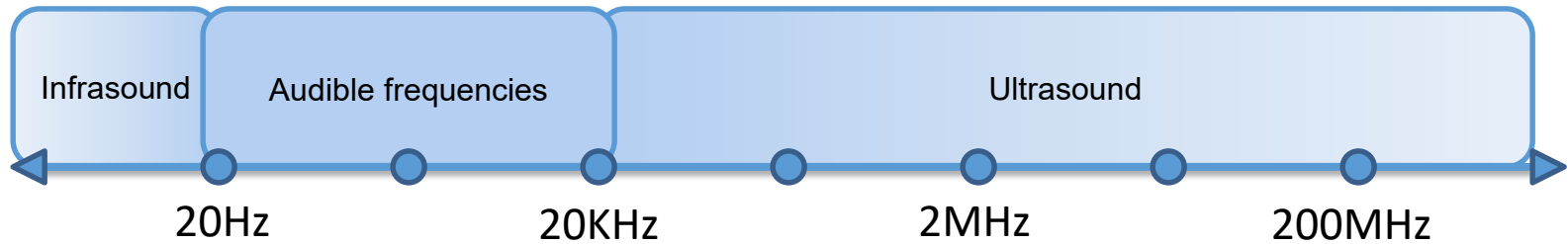
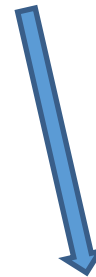
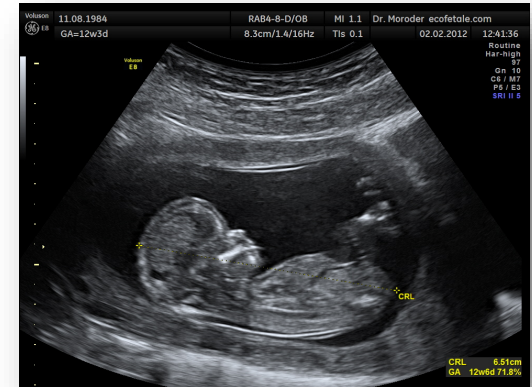
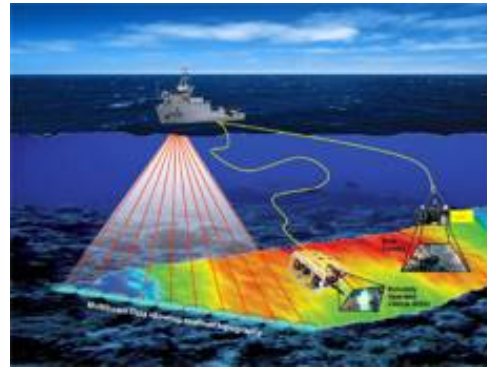
Sound comes in many frequencies

Can humans hear *all* types of sounds?



No, *audible* frequencies are what we can detect.

Ultrasonic applications



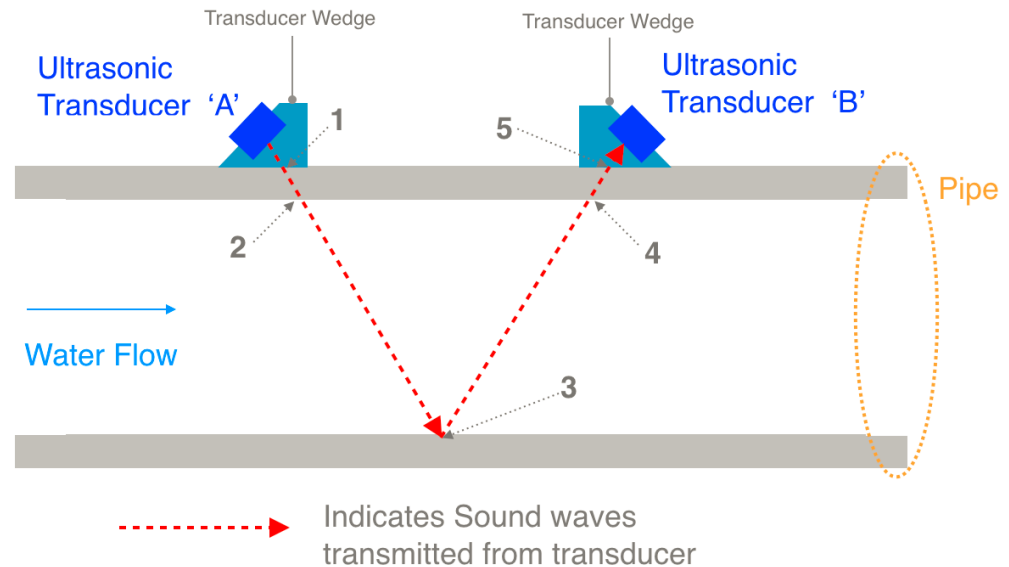
When sound travels

- As sound travels it can be *reflected*, *refracted*, or *focused*.
- Reflection and refraction occur when the waves interact with a medium of differing properties. Focused sound may use a piece of technology to direct it.
- Sound travels at slower speeds in gases than liquids; it travels the fastest in solids.
 - Sound travels at 343 m/s in air; it travels at 1,484 m/s in water; and at 5,120 m/s in iron.

Producing ultrasound waves

One way to replicate ultrasound wave frequencies is with a transducer.

Depending on the direction, the transducers may be positioned at an angle rather than perpendicular to the object being tested.



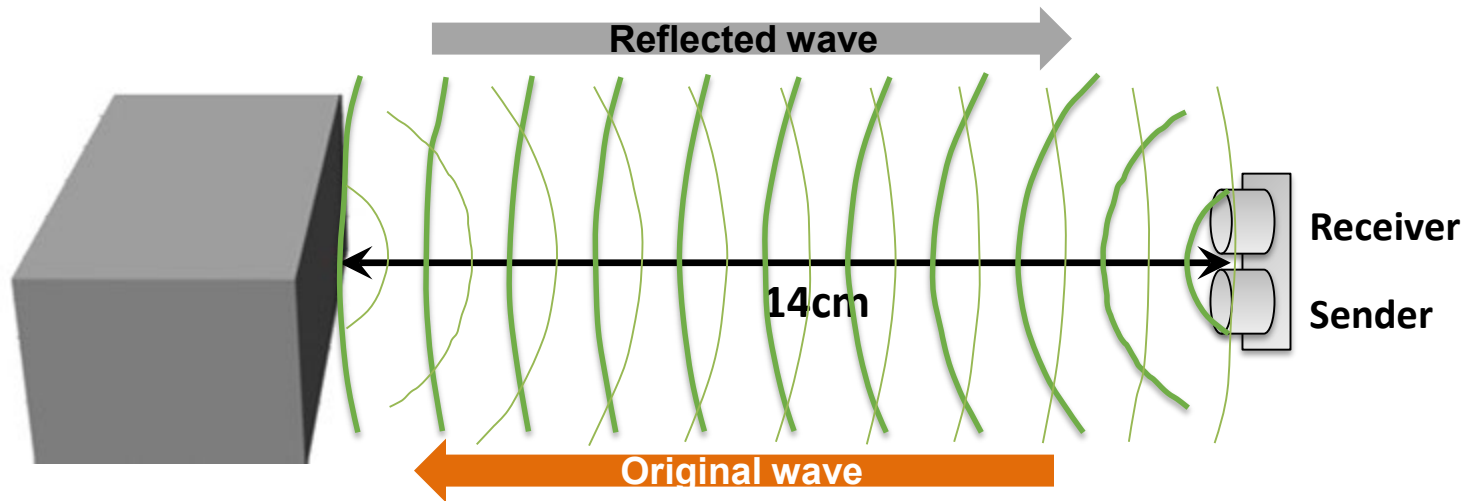
Uses of Ultrasonics

There are so many uses in the real world using ultrasonic devices. Many of these applications require that sound travel through a medium other than air. Examples include:

- Diagnostic and medical imaging
- Communication and echolocation; SONAR
- Engineering Design

Measuring distance with sound

Ultrasonic waves can be used to accurately measure distances with special sensors.



In air, sound travels at a constant speed, which means we can measure distance by seeing how long it takes for a sound to hit an object and bounce back to the sensor.

Why use a sensor



Anti-reverse port(JST-XH) for HC-SR04 V2.0



With the use of sensors like the ones above and the use of computer programming, many opportunities are available for humans to accurately measure distance at a faster more reliable pace than our use of a ruler or tape measure.

Let's go back to those questions...

Turn and talk to your partner.

- What is sound?
- What are the types of sound?
- How can ultrasound be used to help us in our lives?
- Why are there different ways to measure with ultrasonic devices?

Extension: How might we use ultrasonic sensors that measure distance to our advantage in our lives?