

Ultrasound Notes

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Ultrasound: sound waves with a frequency above 20000 Hz or 20 kHz.

What is ultrasound used for?

Ultrasound has many uses in modern life, the most well-known of course is ultrasound baby scans. Ultrasound has the following uses:

Foetal scanning – ultrasound waves can be used to see a foetus in the womb and show the development of the foetus. Most exam boards will accept medical scanning instead of foetal scanning.

Note: a question could ask why x rays not used to see a foetus in the womb. For this question we should have an answer that mentions that x rays are ionising and could be harmful to the foetus.

Diagnosing conditions – ultrasound waves can be used to find the cause of swelling or blockages in parts of the body. It can also be used to find tears in muscles or issues with tendons.

Treating some conditions – ultrasound waves can be used to break up kidney stones and gallstones. The wave vibrations are used to shake the stone until it cracks into smaller pieces. These stones can also be removed surgically or passed naturally if they are small enough.

Finding cracks in materials – ultrasound waves can be used to find cracks in metals, for example the turbine blades of a jet engine. Turbine blades with cracks can be found and removed before they become a problem.

How can Ultrasound waves be used to produce an image?

Before we describe how ultrasound waves can be used to produce an image, it's important to remember that all waves can be reflected and absorbed by a material. For most waves of course there is a bit of both, some of the wave is reflected and some is absorbed. How much of reflection or absorption depends on the density of the material the wave is travelling through.

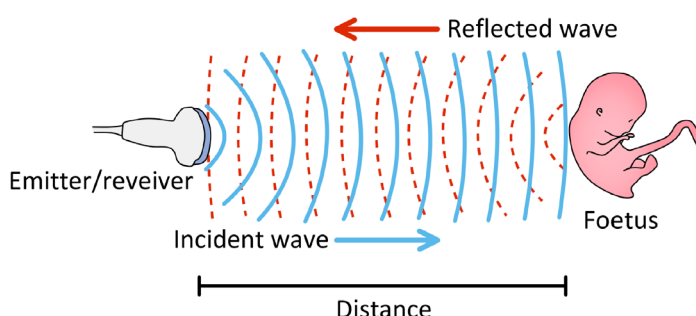
For simplicity, we can break the process of ultrasound waves being used to produce an image into stages.

Stage 1: the ultrasound scanner produces ultrasound waves, which then pass into the body.

Stage 2: The ultrasound waves are partially reflected at tissue boundaries in the body, such as the boundary between fluid and soft tissue. The person doing the scan can adjust the settings so that the majority of the waves are reflected from the boundary that they want to see.

Stage 3: the reflected waves are detected by a receiver. The receiver has a transducer which converts the ultrasound waves into electrical signals.

Stage 4: The ultrasound scanner uses the time it takes for the reflections to return and the speed of sound to calculate the distance from the transducer to the tissue boundaries. This information is used to create a two-dimensional image of the tissues and organs.



Note: the same concept is used by ships sonar to detect the sea floor under the ship. Sonar uses normal sound waves we can hear.