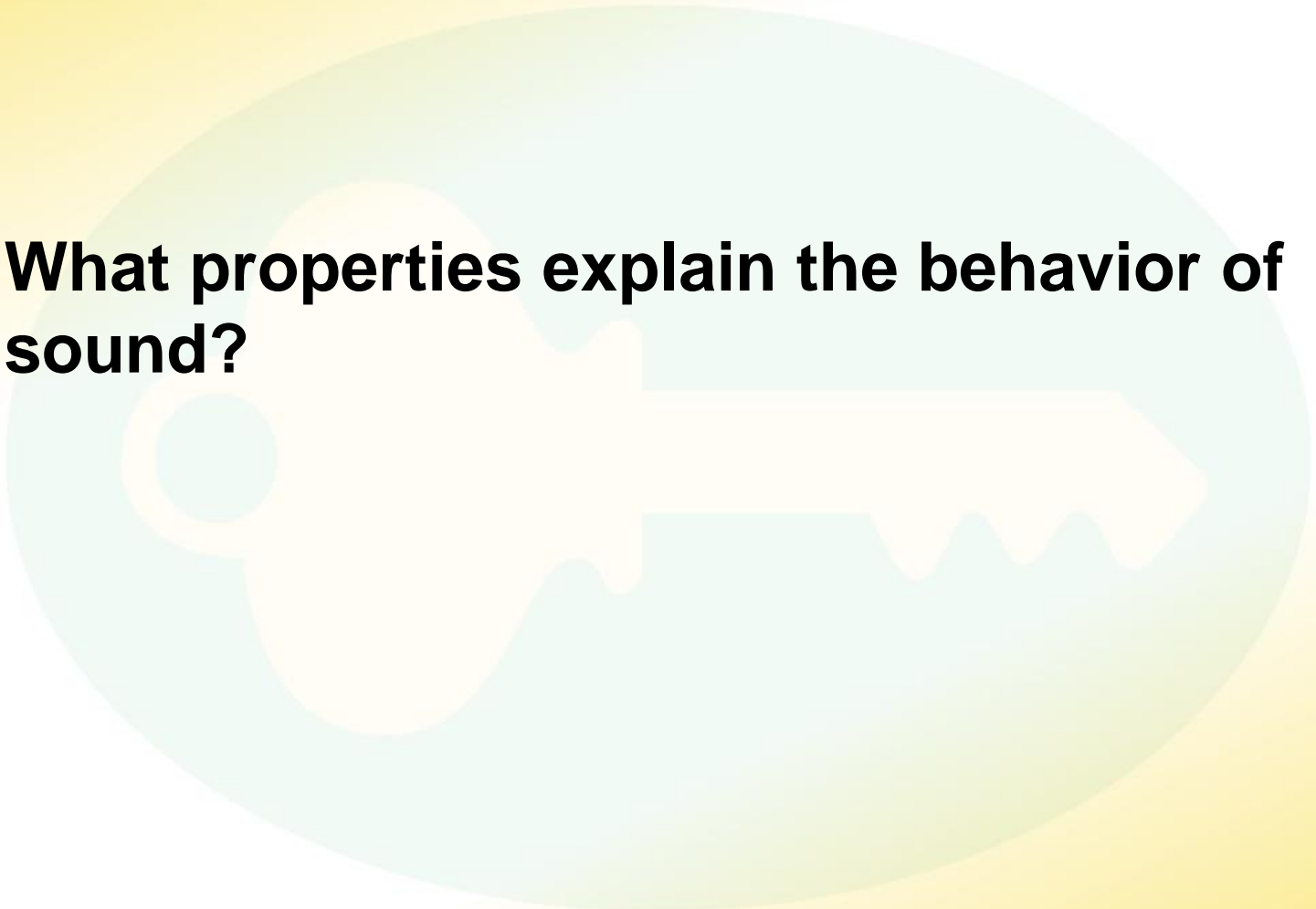


## Properties of Sound Waves



**What properties explain the behavior of sound?**



# Properties of Sound Waves

Speed of Sound	
Medium (at 1 atm)	Speed (m/s)
Dry air, 0°C	331
Dry air, 20°C	342
Fresh water, 0°C	1401
Fresh water, 30°C	1509
Salt water, 0°C	1449
Salt water, 30°C	1546
Lead, 25°C	1210
Cast iron, 25°C	4480
Aluminum, 25°C	5000
Borosilicate glass, 25°C	5170

# Properties of Sound Waves

## Intensity and Loudness

**Intensity** is-

- Sound intensity depends on-
- The **decibel** (dB) is-

# Properties of Sound Waves

Lengthy exposure to-

Sound Intensity Level	
Sound	Intensity Level (decibels)
Threshold of human hearing	0
Whisper	15–20
Normal conversation	40–50
Street noise	60–70
Inside a bus	90–100
Operating heavy machinery	80–120
Rock concert (in audience)	110–120
Threshold of pain	120
Jet plane (taking off)	120–160

## Properties of Sound Waves

**Loudness** is-

- The loudness-
- Loudness-

## Properties of Sound Waves

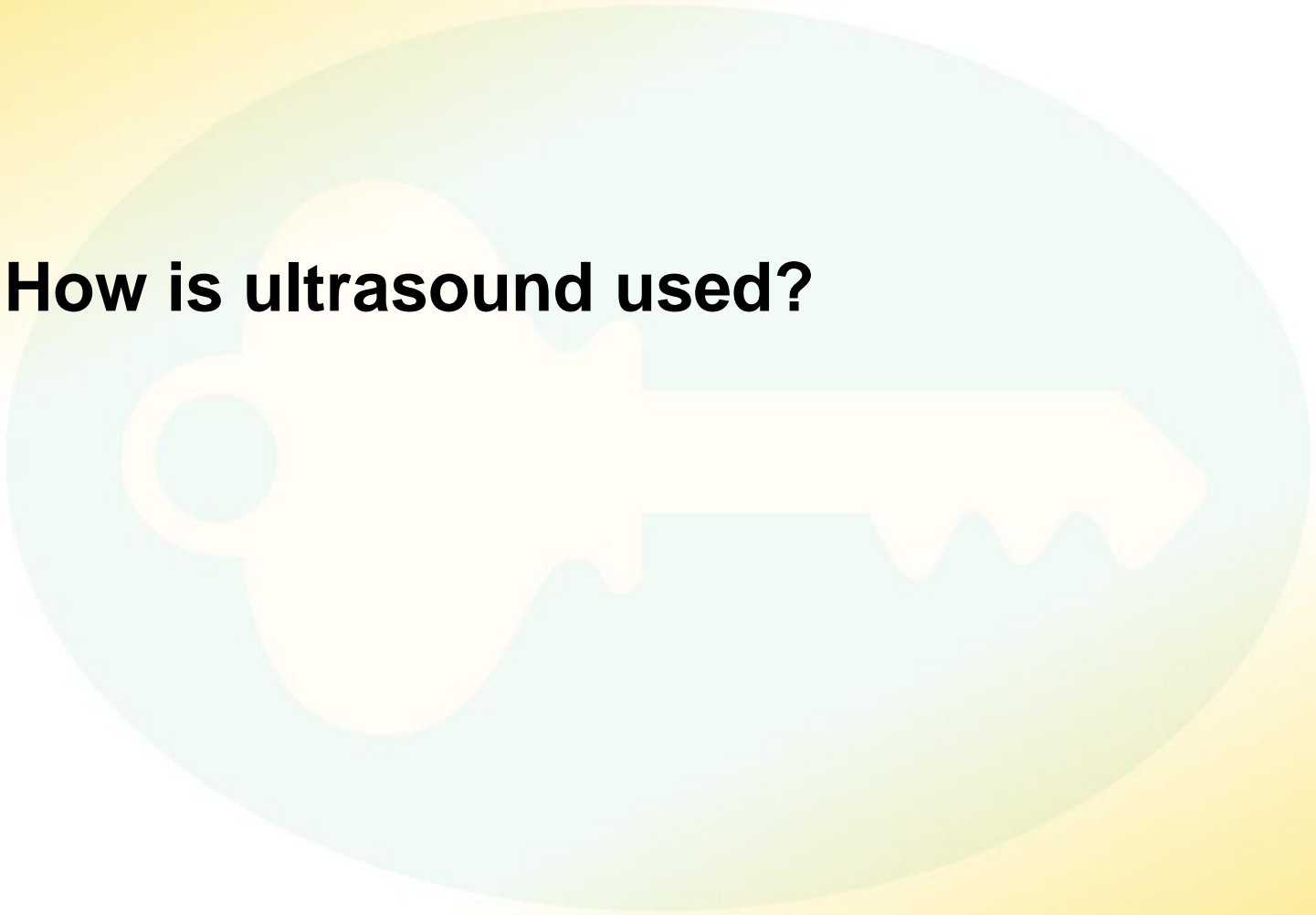
**Pitch is-**

- High-frequency sounds-
- Pitch-

# Ultrasound



**How is ultrasound used?**



## Ultrasound

Most people-

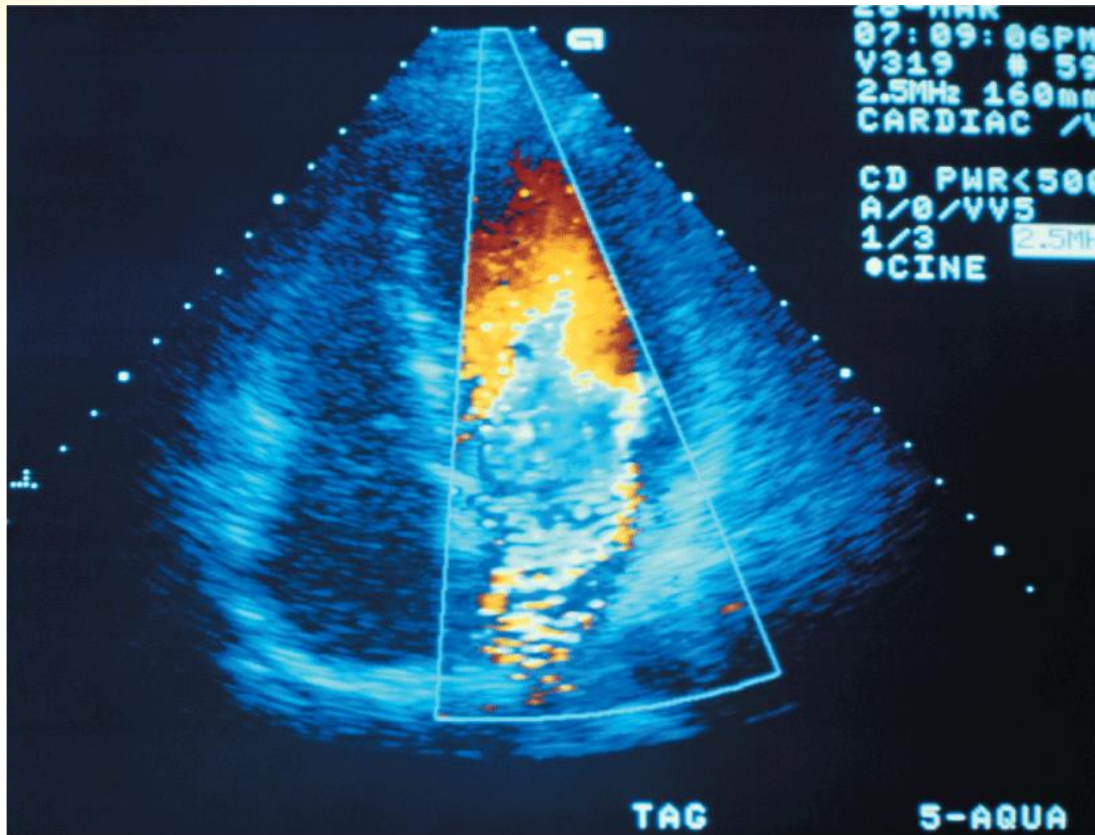
- Infrasound is-
- Ultrasound is-



# Ultrasound

Ultrasound-

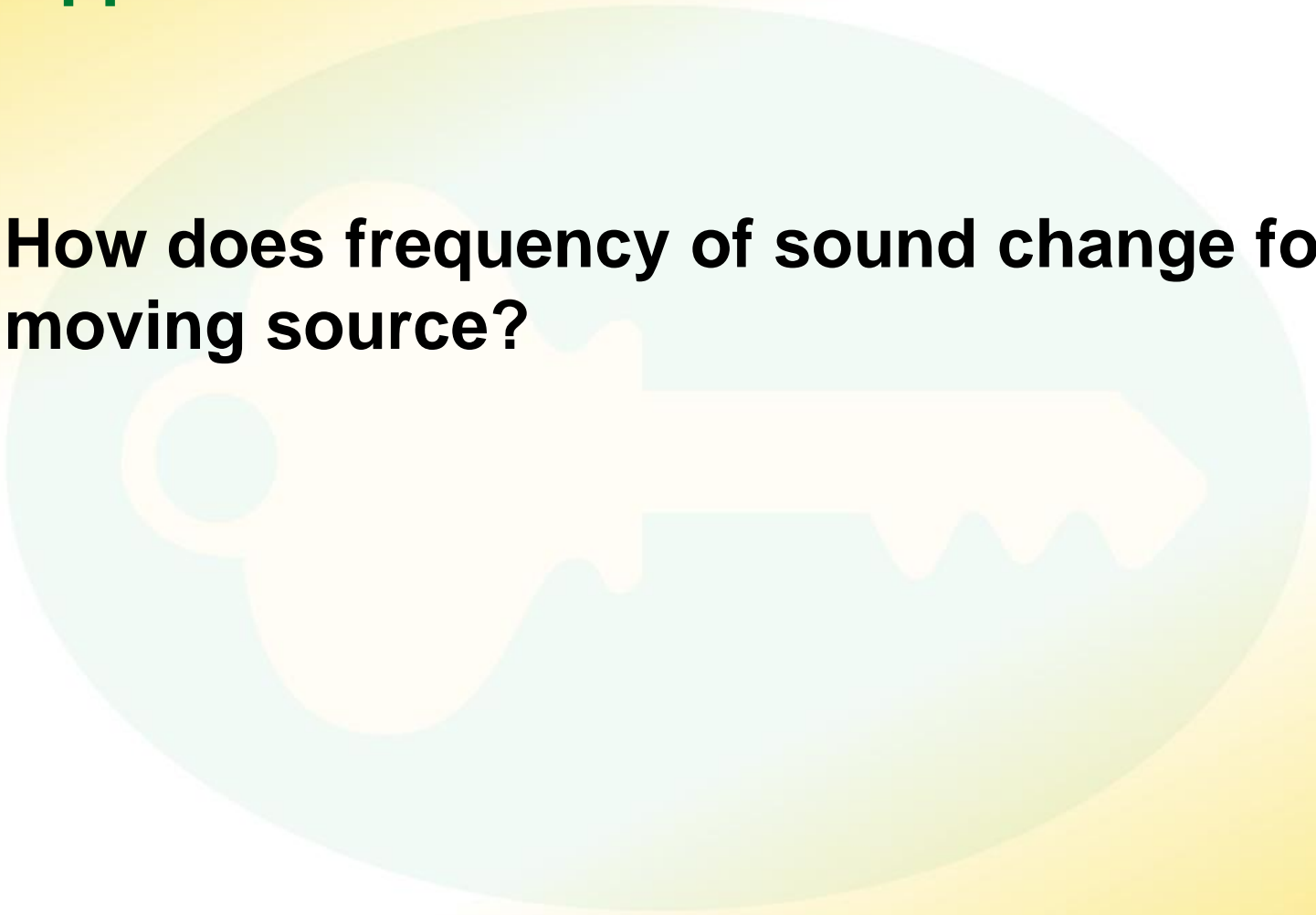
**DOK Question:** Hypothesize how this picture is made.



## The Doppler Effect



**How does frequency of sound change for a moving source?**



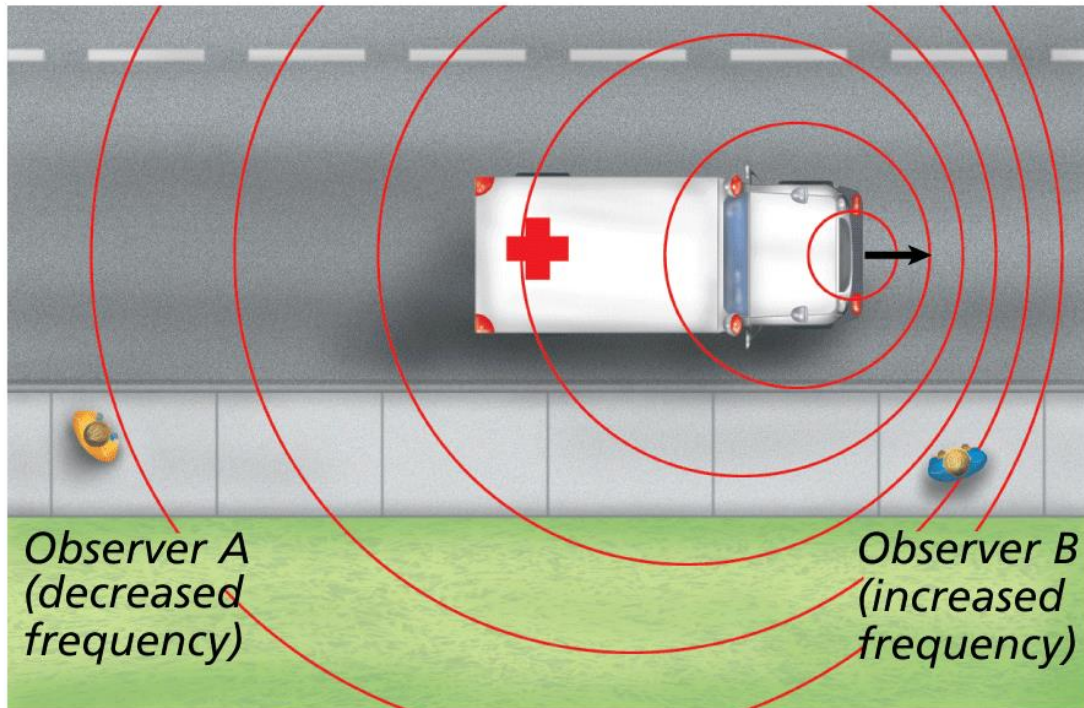
## The Doppler Effect

The Doppler effect is-

## The Doppler Effect

Observer A-

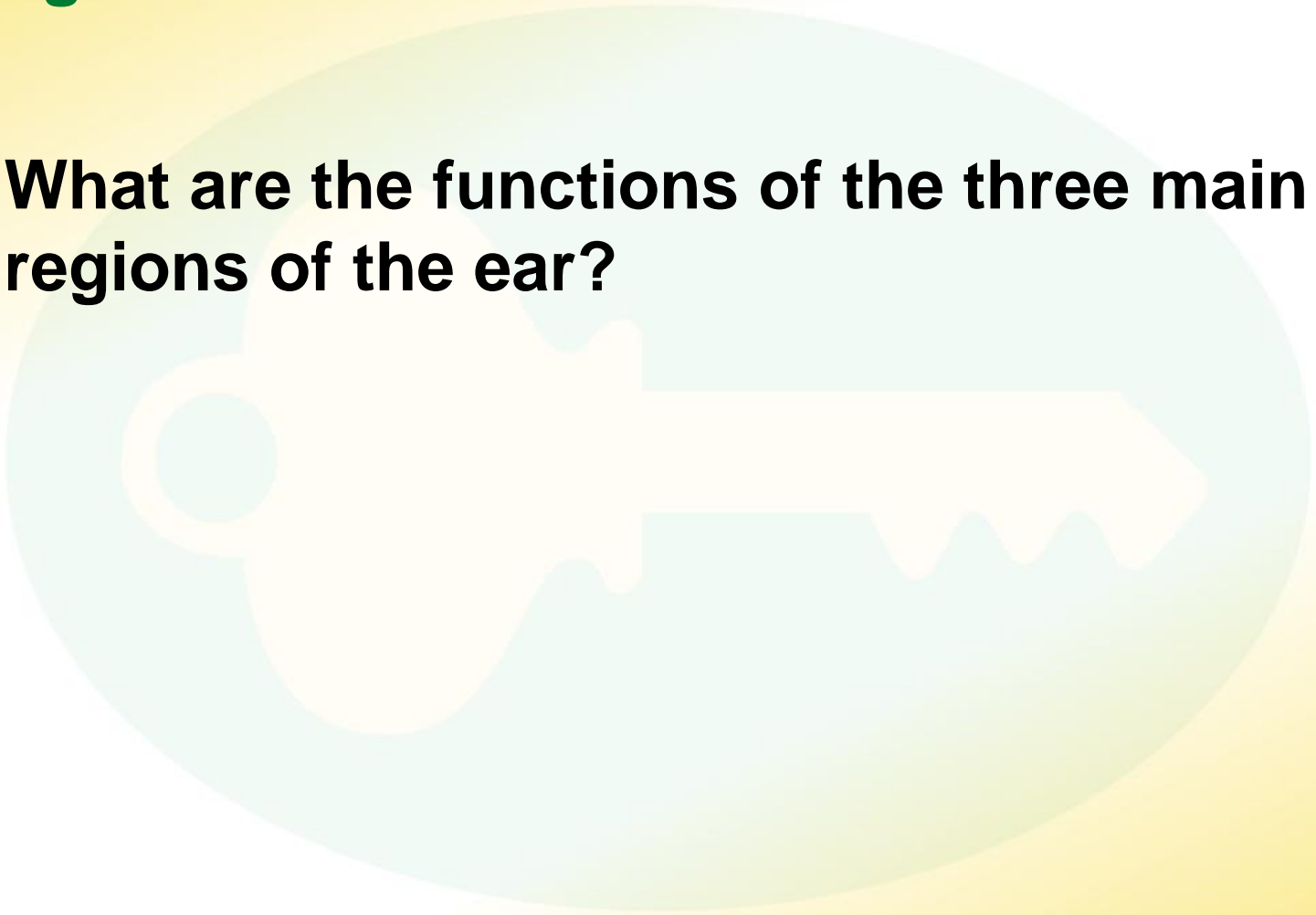
**DOK Question:** Hypothesize how this picture explains the Doppler Effect.



## Hearing and the Ear



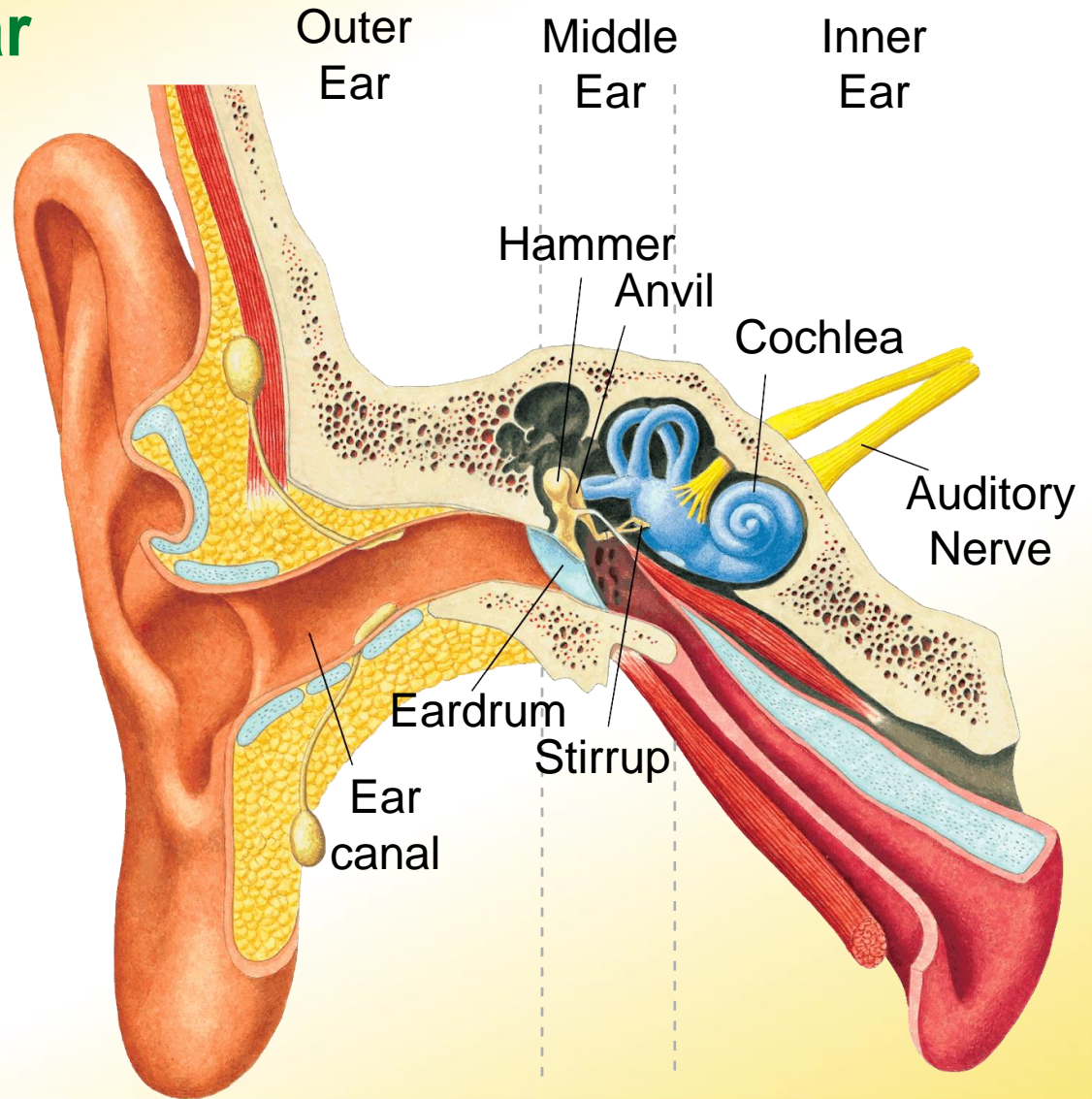
**What are the functions of the three main regions of the ear?**





# Hearing and the Ear

Your ear is-



# Hearing and the Ear

## Outer Ear

- The part of the ear-
- Sound waves-
- The eardrum-

## Hearing and the Ear

### Middle Ear

The middle ear contains three tiny bones—

- The hammer-
- The anvil -



# Hearing and the Ear

## Inner Ear

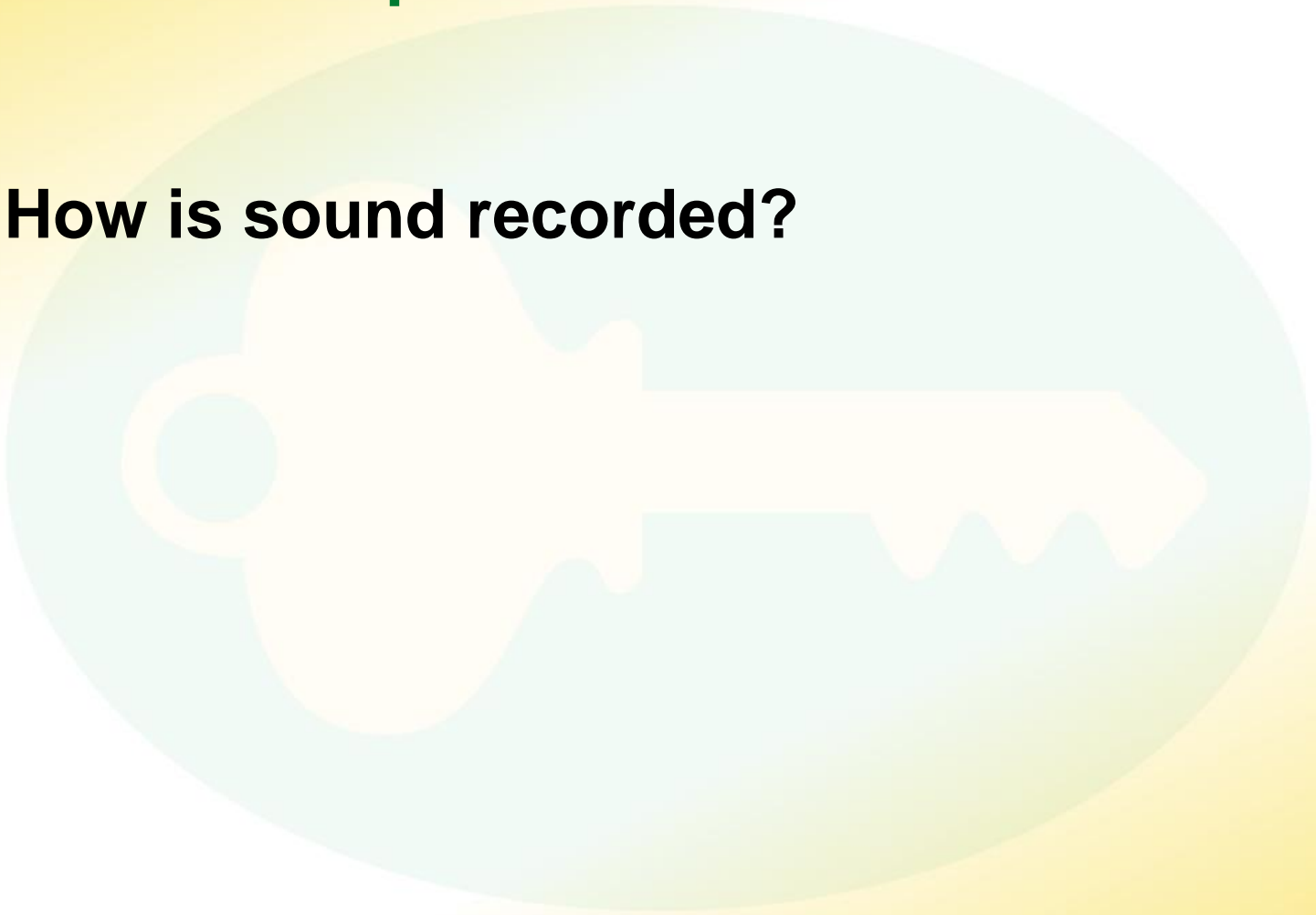
### Vibrations-

- The inside of-
- As the fluid in-

## How Sound Is Reproduced



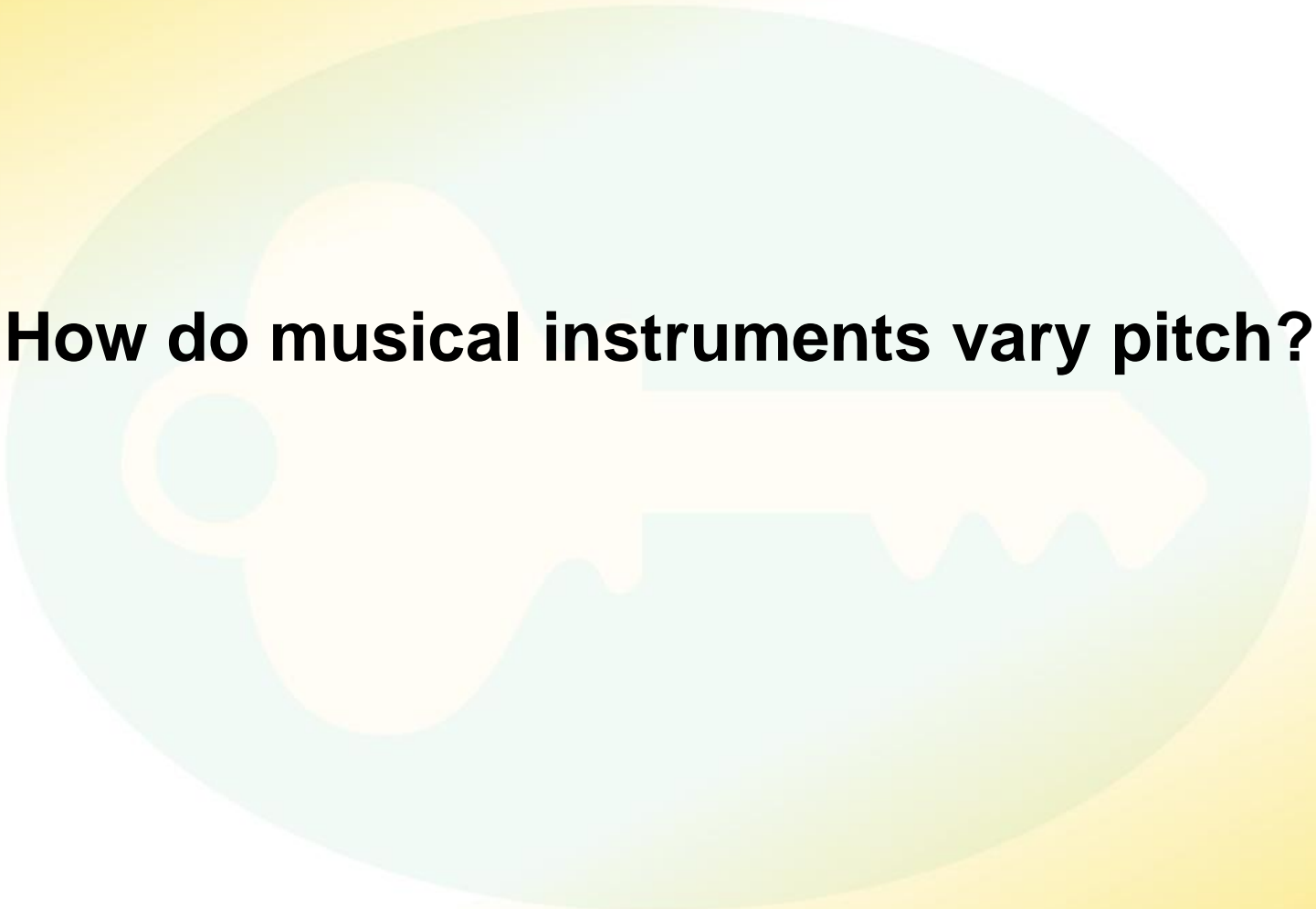
**How is sound recorded?**



# Music



**How do musical instruments vary pitch?**



## Music

**Resonance is-**

- One wave-
- Resonance-

## Assessment Questions

1. The intensity of sound waves is measured in units of
  - a. hertz (Hz).
  - b. decibels (dB).
  - c. joules (J).
  - d. meters (m).

## Assessment Questions

2. Most musical instruments vary pitch by
  - a. changing the amplitude of sound waves.
  - b. reflecting sound from surfaces in a room.
  - c. changing the frequency of a standing wave.
  - d. using the Doppler effect.

## Assessment Questions

3. The Doppler effect is
  - a. a change in sound frequency caused by motion of the sound source relative to the listener.
  - b. used in a variety of applications including sonar and ultrasound imaging.
  - c. a technique for determining the distance to an object under water.
  - d. the rate at which a wave's energy flows through a given area.

## Assessment Questions

4. What part of the human ear acts as an amplifier to increase the motion of the eardrum?
- a. ear canal
  - b. middle ear
  - c. inner ear
  - d. auditory nerve