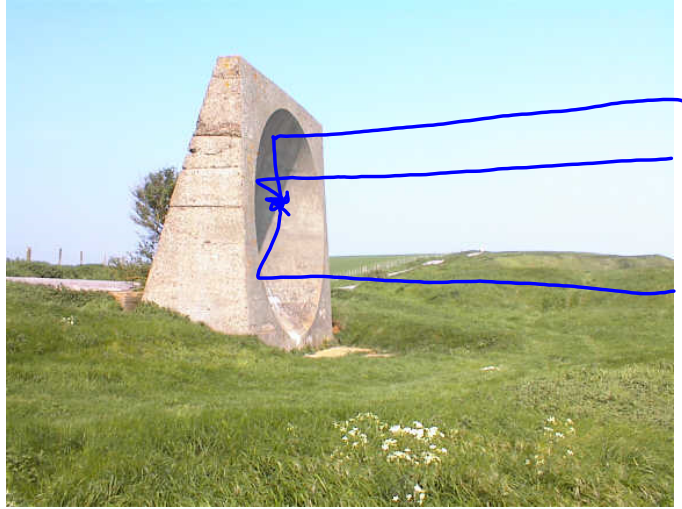


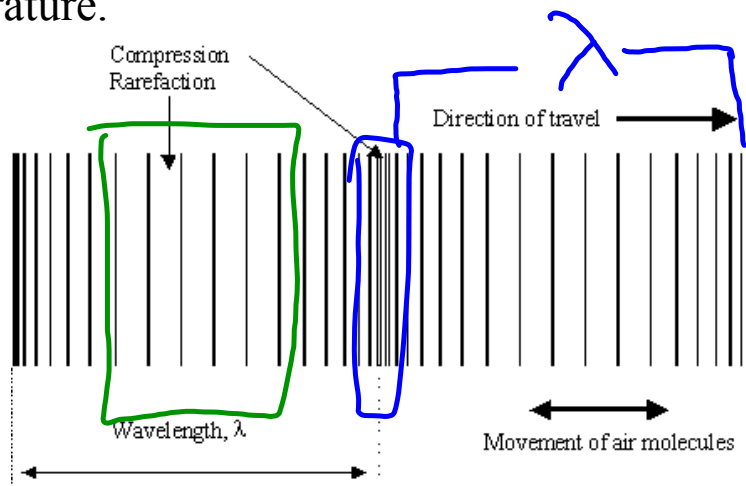
Sound and Hearing

Ch ~~13~~ 15 & 16



Longitudinal Waves

- Medium goes in the same direction of wave movement
- Has compression and rarefaction
- **Wavelength** is equal to one compression and one rarefaction.
- **Frequency** is the number of compressions that pass a point in a second.
- **Amplitude** is the amount of compression.
- **Velocity** of sound depends on the medium and its temperature.



Properties of Sound waves

- Longitudinal waves

$$v = \lambda f$$

- **speed**- travels at different speeds in different media
 air- 343m/s fresh water- 1510m/s Salt water- 1550m/s
 Aluminum- 5000m/s

15.2 chart

Intensity- intensity of a wave's energy flowing through an area measured in Decibels, dB

$$I_{int} = \frac{\text{Power}}{4\pi r^2} \quad I = \frac{P}{A}$$

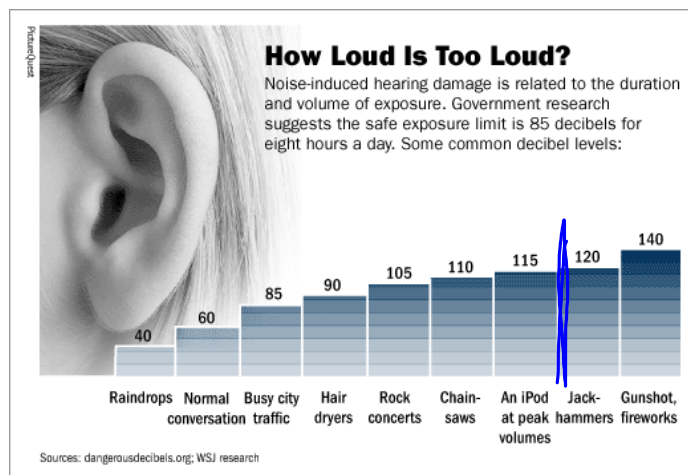
$$Int = P/4\pi r^2$$

Loudness- physical response to sound

Pitch- frequency of sound as you hear it. **Pitch** is the highness or lowness of a sound.

The higher the frequency, the higher the pitch.

- Sensitivity of the human ear ranges from 20 Hz to 20,000 Hz.
- **Ultrasonic** waves are higher than 20,000 Hz.
- **Infrasonic** waves are lower than 20 Hz.
- ****Sound you can feel is infrasonic.**



high pitch

ruebens tube

A CRACKER

■ The noise made by the pistol shrimp is not caused by the claws hitting each other - as scientists used to believe - but by a jet of water created by the impact

■ This tiny stream spurts out at 60mph, creating a low pressure 'bubble' in its wake. When this collapses, it makes a bang louder than a rocket launch or jet engine

■ For a tiny fraction of a second, temperatures in the bubble soar to more than 4,426C (8,000F)

■ The popping also creates a




flash of light which lasts for a billionth of a second

■ Divers say that colonies of the shrimp sound like sizzling fat
 ■ When rivals meet, they

compete by seeing which can make the loudest noise

■ If a shrimp's larger 'snapping' claw is damaged in a fight, the smaller one grows to replace it

The Doppler Effect

 Change in frequency due to motion of source, listener, or both

Example nascar, or fire truck ^{doppler effect} ^{doppler effect 2}

Sonic Boom- breaking of sound barrier

<http://www.kettering.edu/~drussell/Demos/doppler/doppler.html>



^{sound barrier} ^{bull whip sound} ^{bull whip} ^{whip crack}

Instruments

alter pitch by changing frequency of standing waves

change tension, length, and amplitude

• **Resonance**- increased amplitude over time because of additive energy.

Like a swing, or trampoline

• **Music** uses specific pitches and sound quality that follows a regular pattern.

• **Noise** has no pattern and no definite pitch.

Harmonics

$$F_n = n(v/2L)$$

glass voice

violin waves

bridge collapse 2

Beats- the up and down sound of dissonance.

beat frequency how many times you hear the beat per second

fb= the difference in frequency between the two sounds



A satellite is 100km above a car sends down a radio wave at 95.1 MHz. You are standing 100m away from the car, how long does it take for the sound to get to your ear from the satellite?



- Ch 14 pg 470 MC: 22
8, 9, 23
 - Ch 15 pg 502 MC: 20, 22
11, 12, 13, 21, 47
 - Ch 16 pg 532 MC: 20, 21, 22
7, 28, 29, 31, 33
 - Ch 17 pg 568 MC 19, 21
3, 5, 10, 11, 12, 14, 15, 21, 22, 28, 29
 - Ch 18 pg 604 MC: 16, 17, 18
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Attachments

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sound barrier

bull whip sound

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doppler effect 2

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