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Need-to-Know Terms



Waves: a repeating disturbance that transfers energy through matter or space.

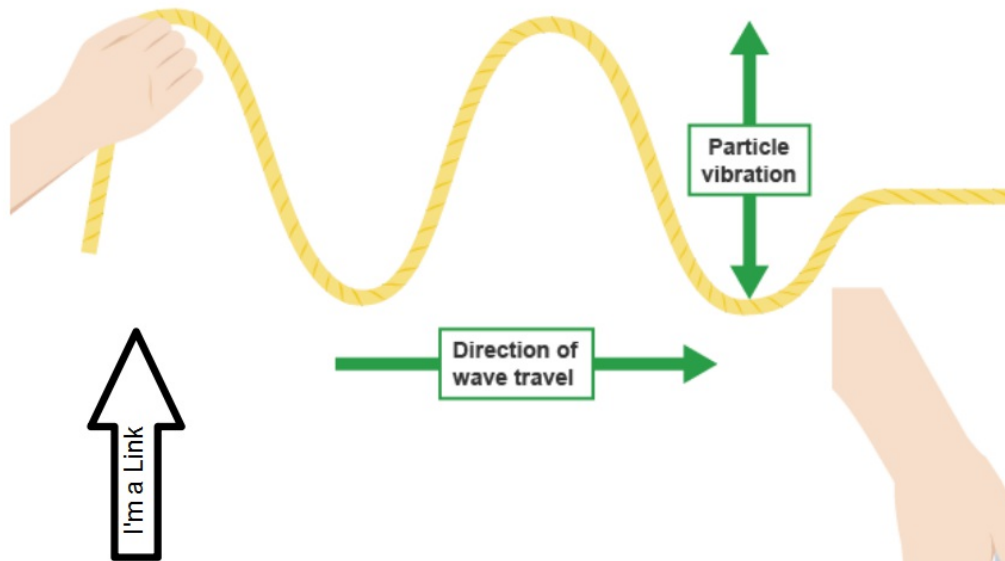
Medium: matter through which a wave travels

Mechanical Waves



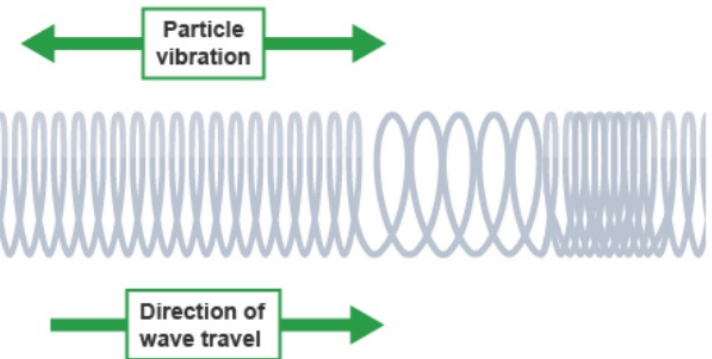
Transverse Waves

Transverse Wave: the particles in a medium move at right angles (perpendicular) to the direction that the wave travels



Longitudinal Waves

Longitudinal Waves: matter in the medium moves back and forth along the same direction that the wave travels



Wave Properties



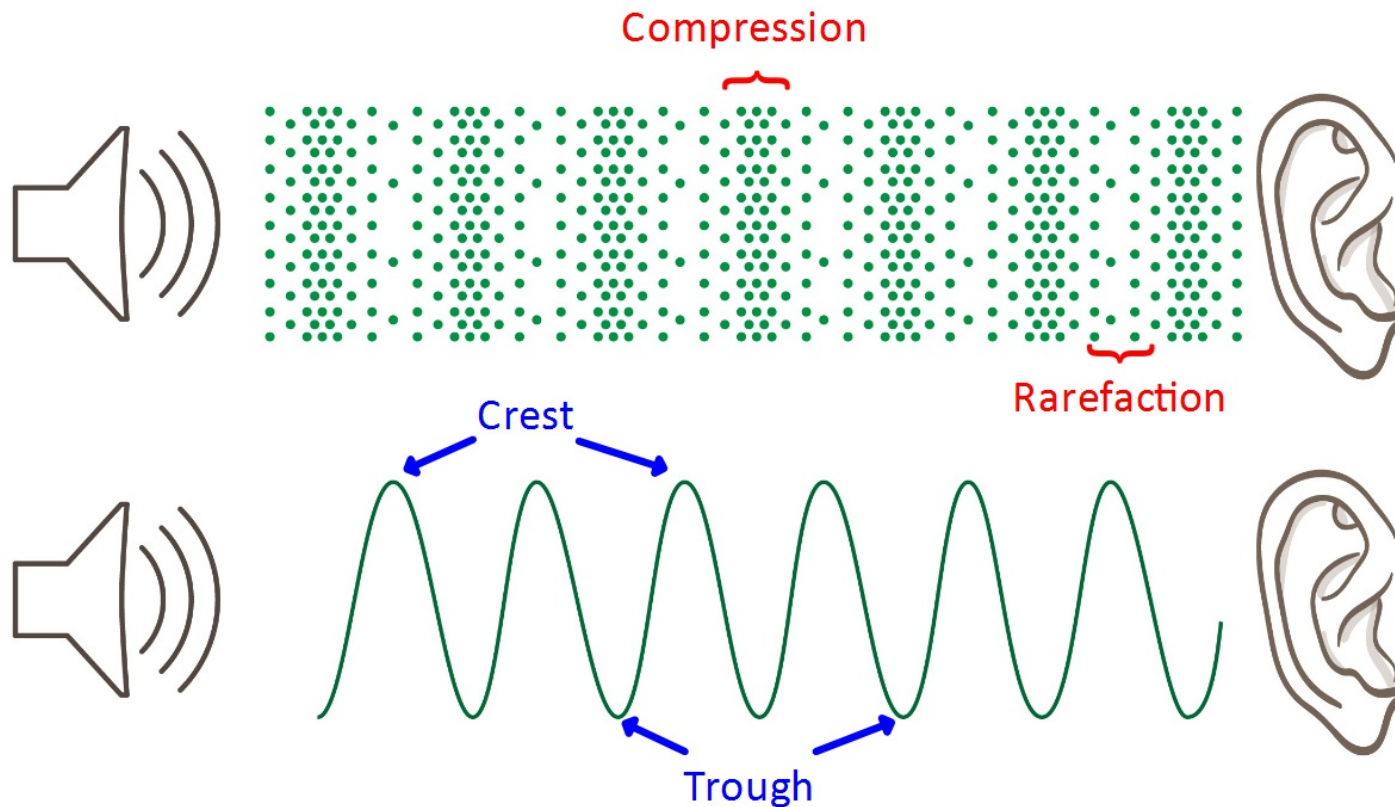
Parts of a Wave

Longitudinal waves

- **Compression:** the more dense region of a longitudinal wave
- **Rarefaction:** the less-dense region of a longitudinal wave

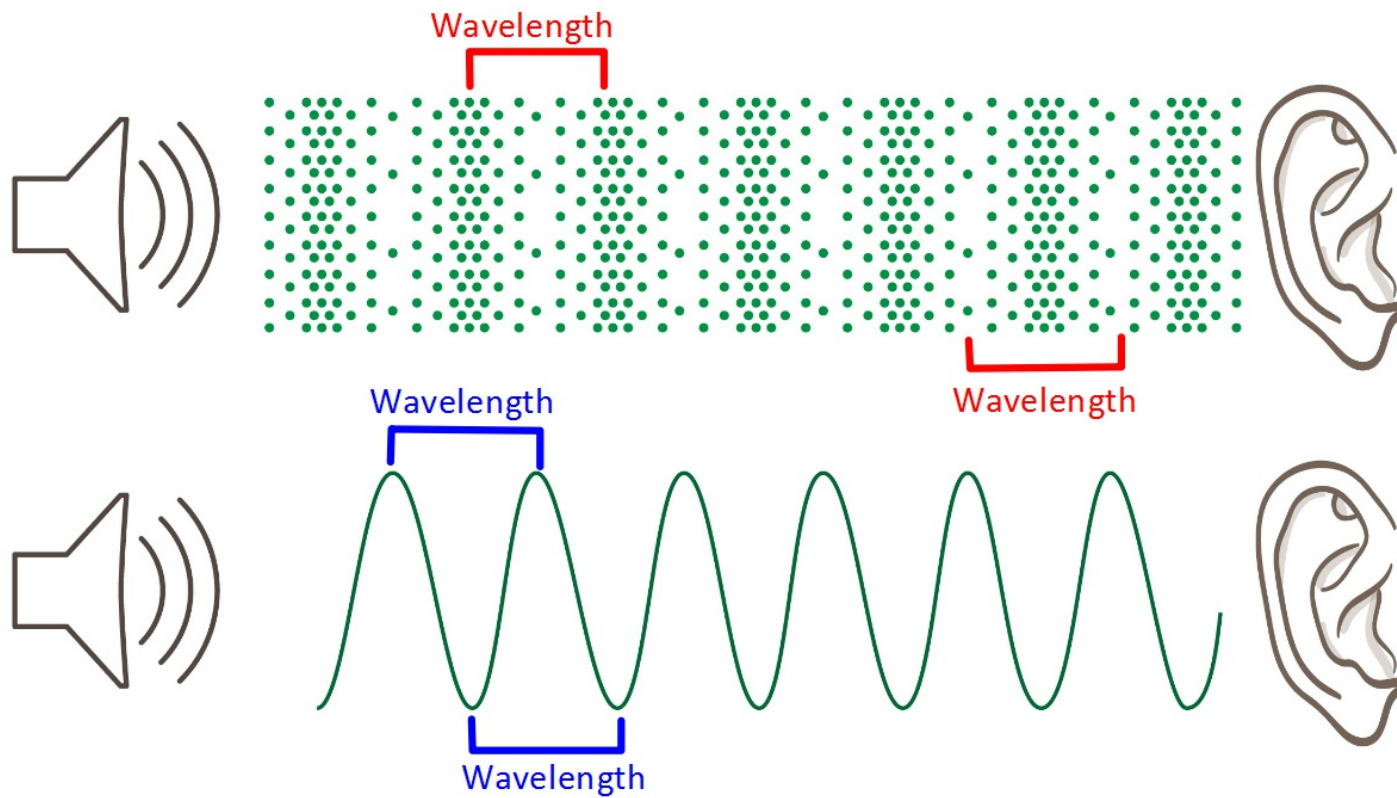
Transverse waves

- **Crests:** the high points of a transverse wave
- **Troughs:** the low points of a transverse wave



Wavelength

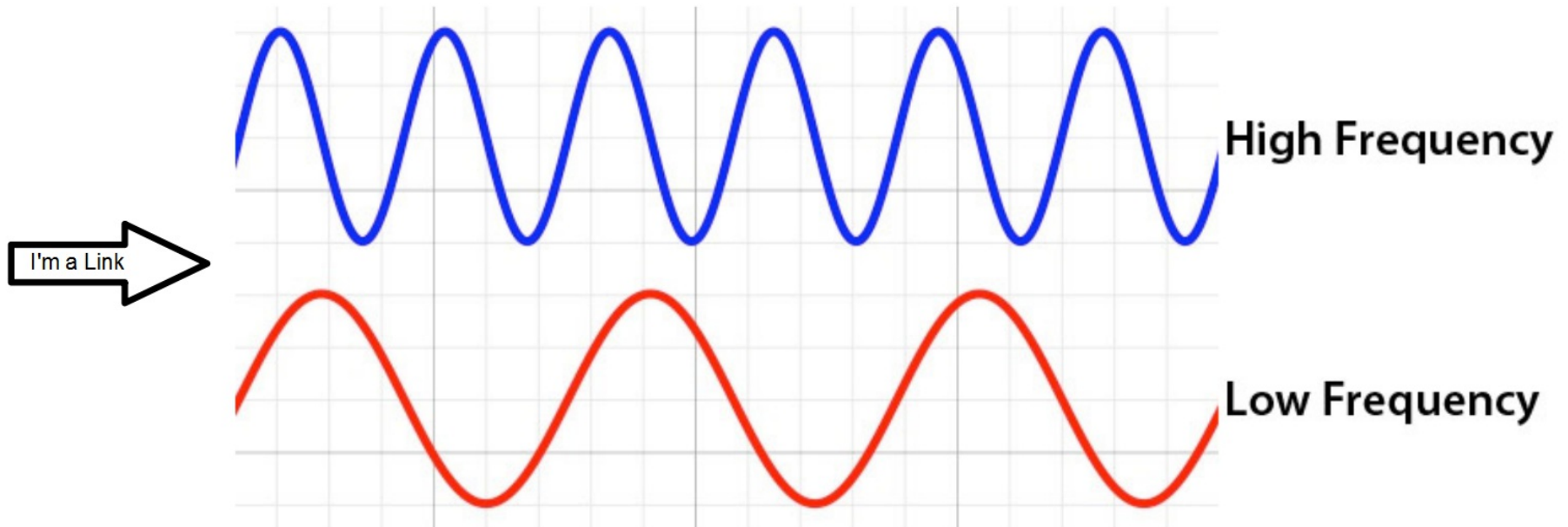
Wavelength: is the distance between one point on a wave and the nearest point just like it.



Frequency and Period

Frequency: is the number of wavelengths that pass a fixed point each second.

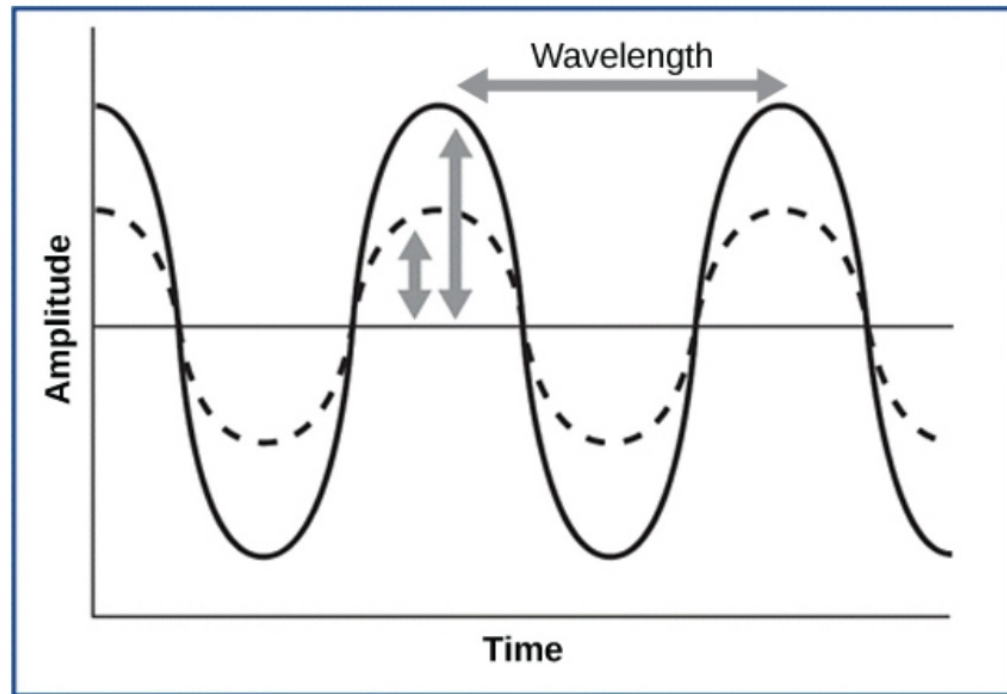
Period: is the amount of time it takes one wavelength to pass a point.



Amplitude

Amplitude: is a measure of the size of the disturbance from a wave.

- Larger the disturbance = greater energy of the wave
- More energy of the wave = louder the sound



Behavior of Waves

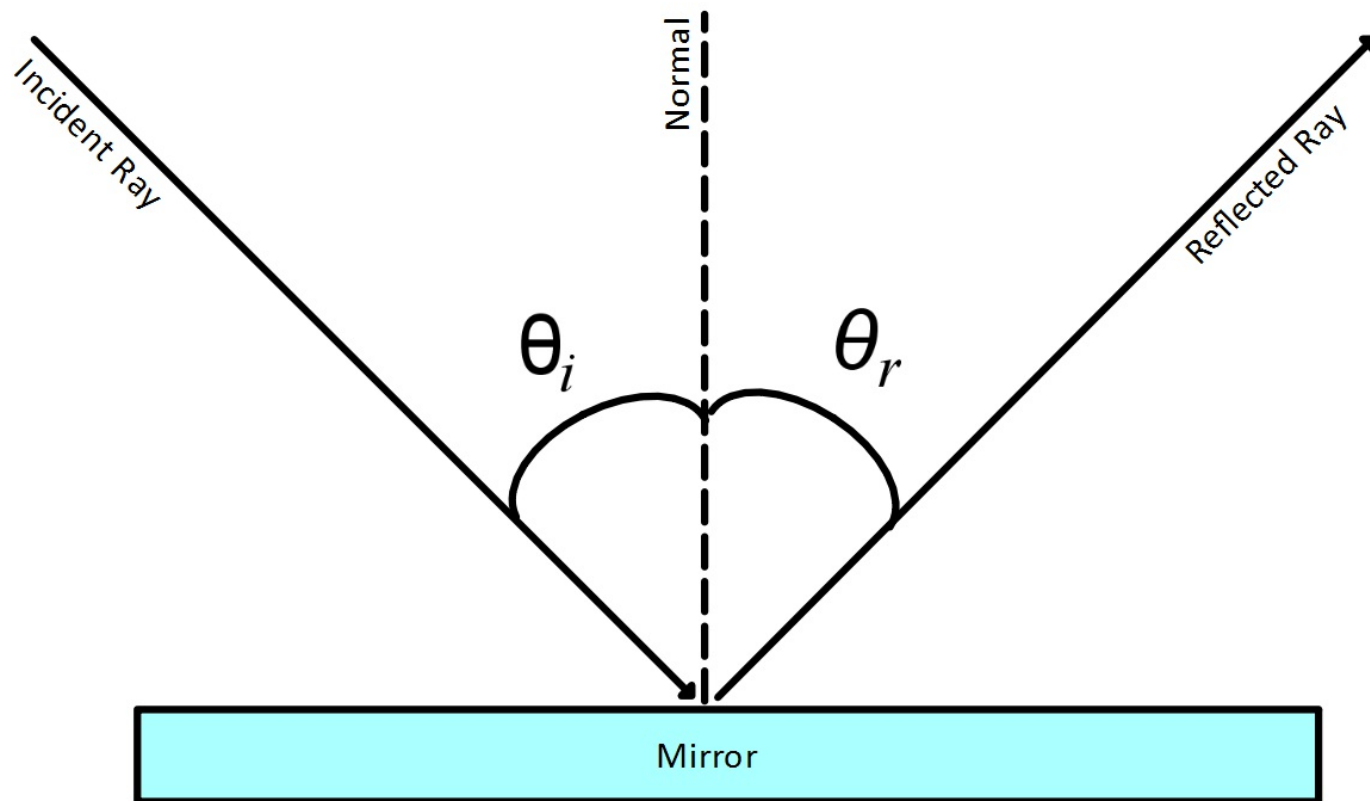
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Reflection

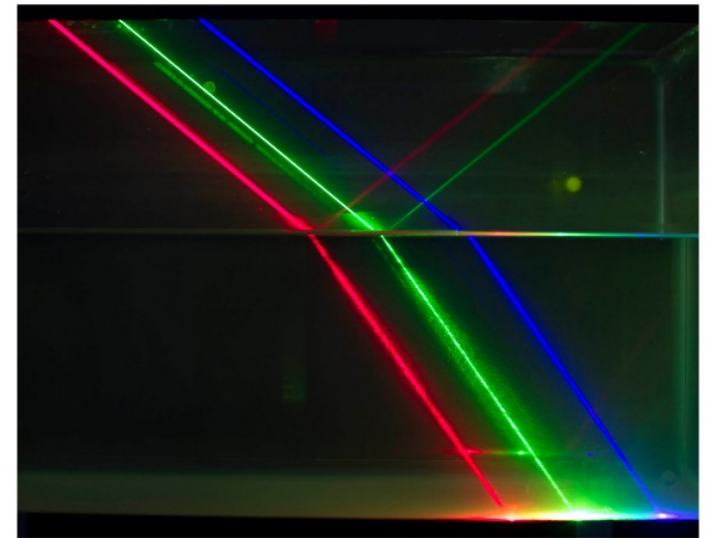
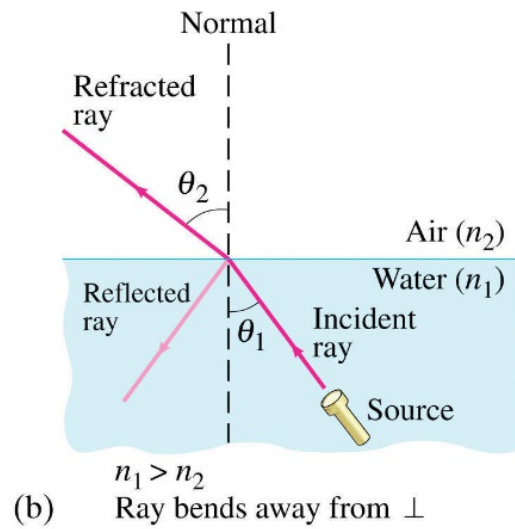
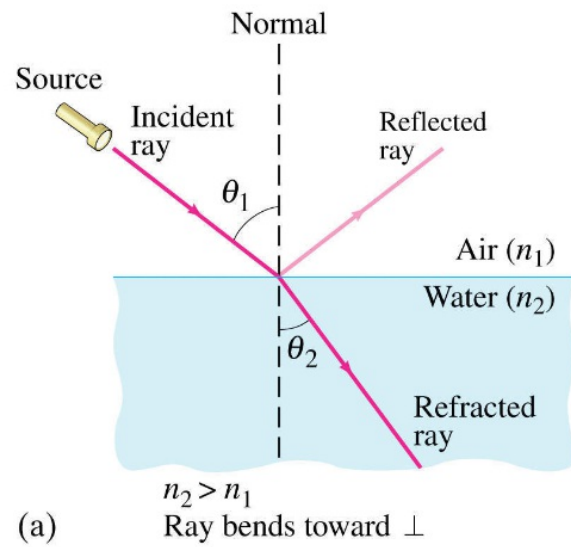
- Occurs when a wave strikes an object and bounces off it

The Law of Reflection
Angle of Incident = Angle of Reflection



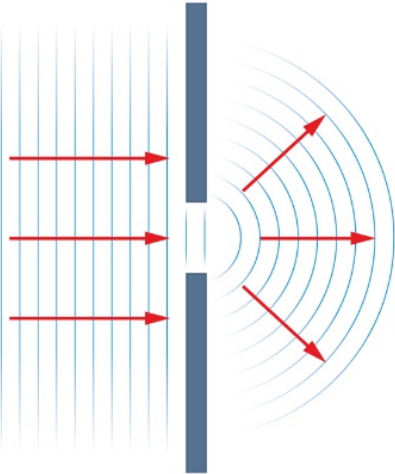
Refraction

Refraction: is the bending of a wave caused by a change in its speed as it travels from one medium to another

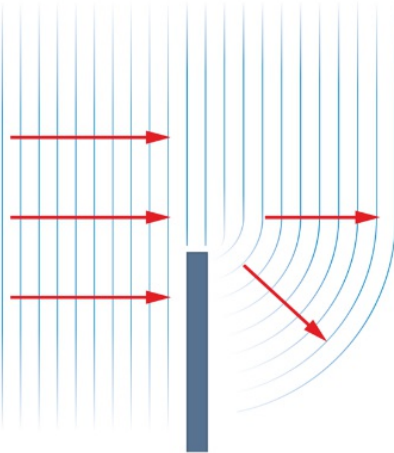


Diffraction

Diffraction: is the bending of a wave around an object.



as the wave goes through the gap it spreads out

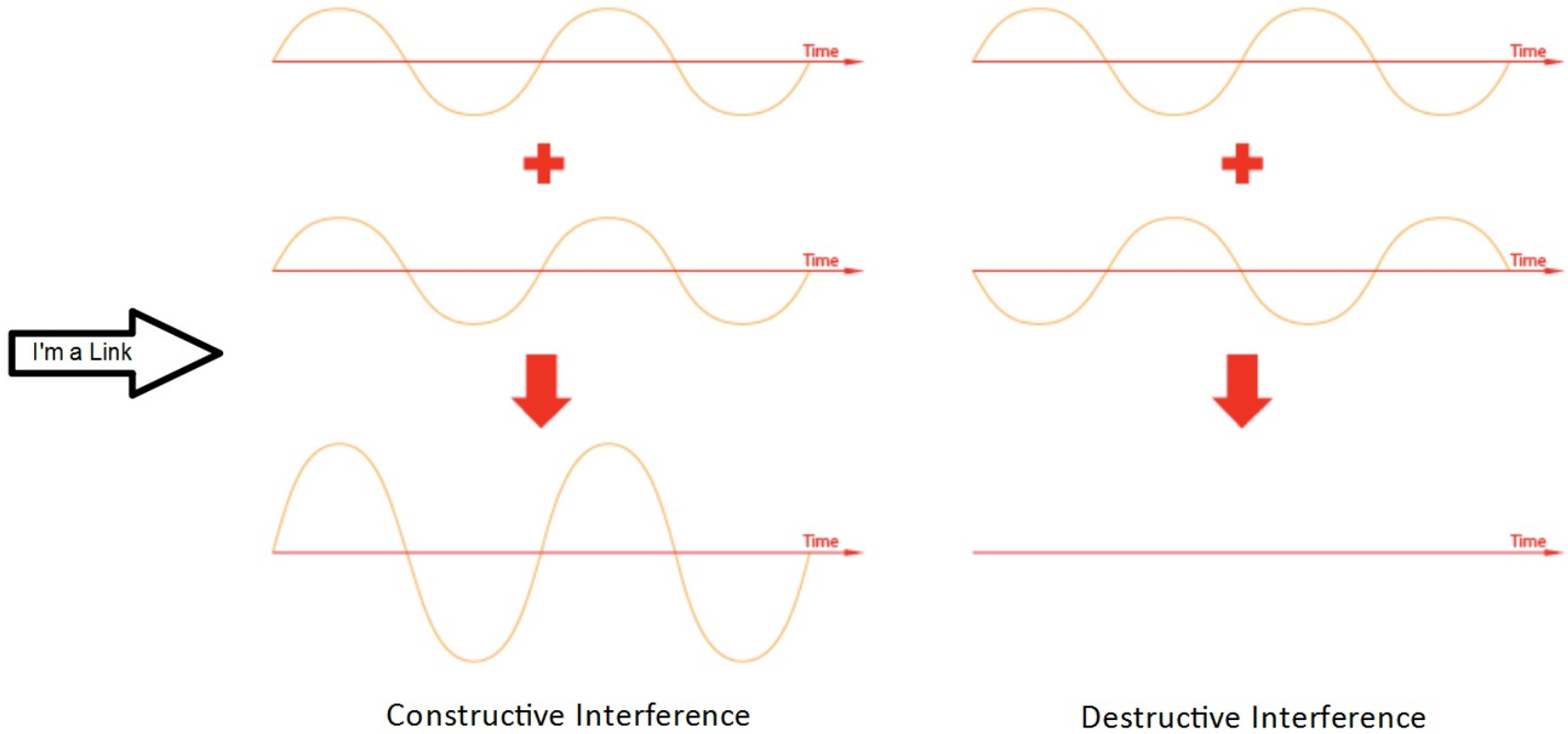


the same thing happens if it goes around an obstacle



Interference

Interference: the process of two or more waves overlapping and combining to form a new wave.

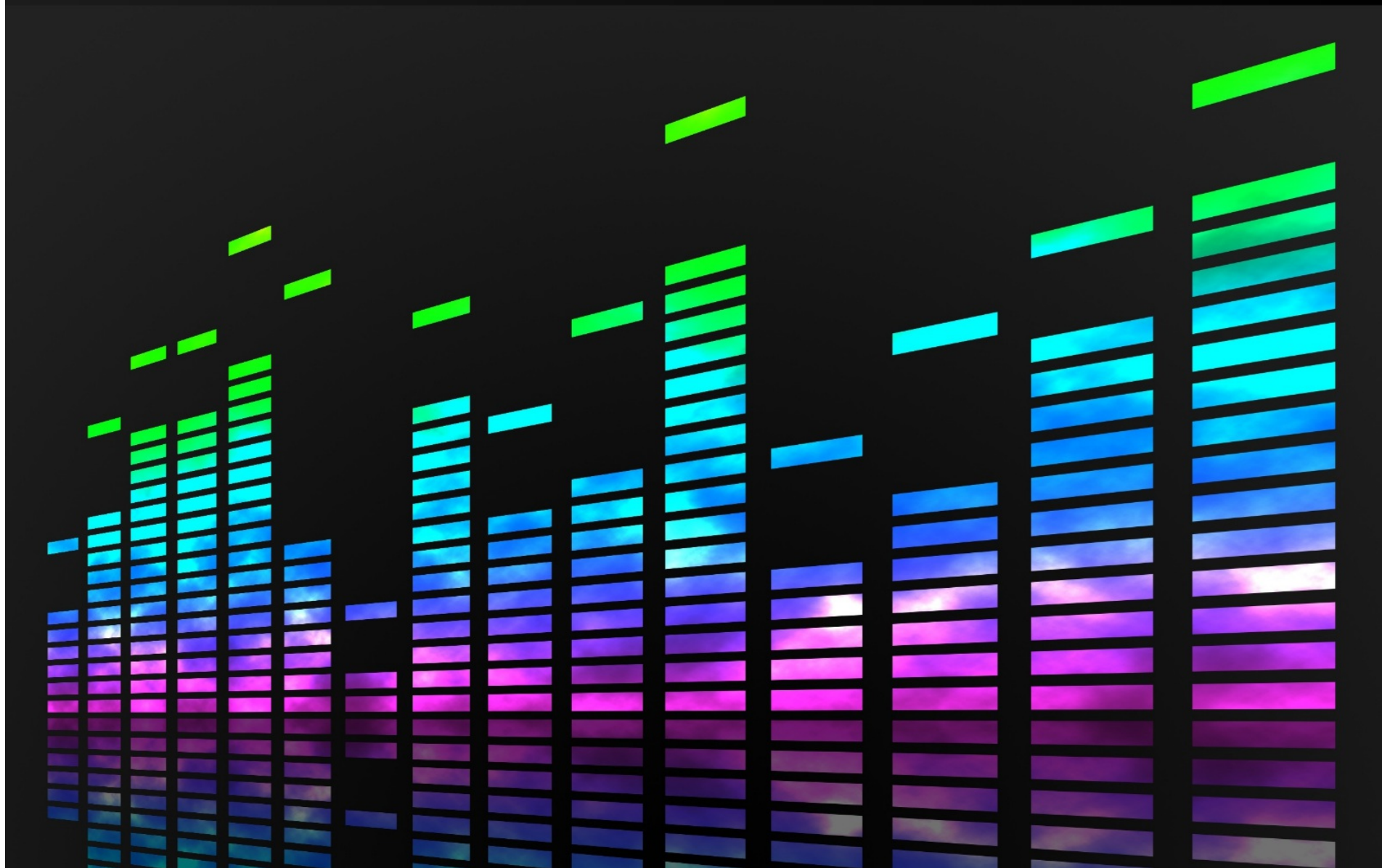


Resonance

Resonance: is the process by which an object is made to vibrate by absorbing energy at its natural frequencies



Sound



The Nature of Sound

- Sound has to travel through a medium (matter); sound cannot travel through a vacuum
- Greater the density of the medium = a faster speed of sound through that medium
- Greater the temperature of the fluid (gas/liquid) = a faster speed of sound through that fluid

Speed of Sound in Different Mediums	
Medium	Speed of Sound (m/s)
Air (0°C)	330
Air (20°C)	340
Cork	500
Water (0°C)	1,400
Water (20°C)	1,500
Copper	3,600
Bone	4,000
Steel	5,800

Properties of Sound



Intensity and Loudness

- **Intensity:** is the amount of energy that passes through a certain area in a specific amount of time
- **Loudness:** the human perception of sound volume and primarily depends on sound intensity
- **Decibel: (dB)** is a unit of sound intensity.

Dangerous Decibels

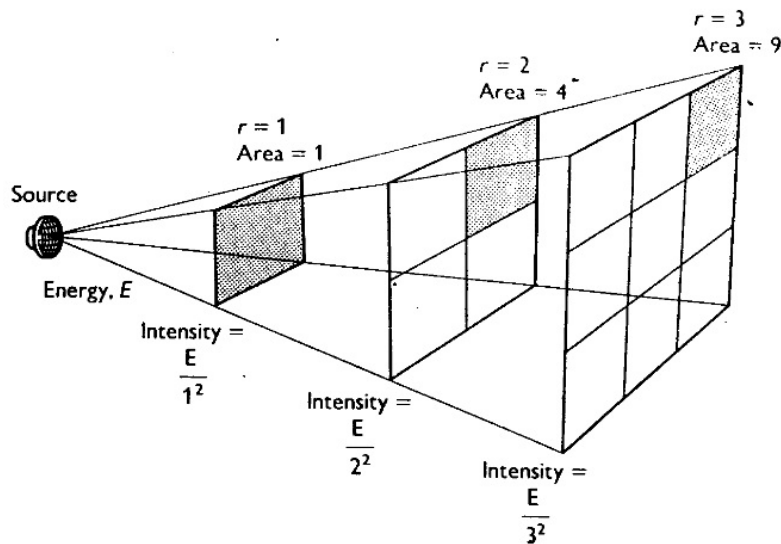
What is a Decibel?

A decibel is a measurement of sound pressure

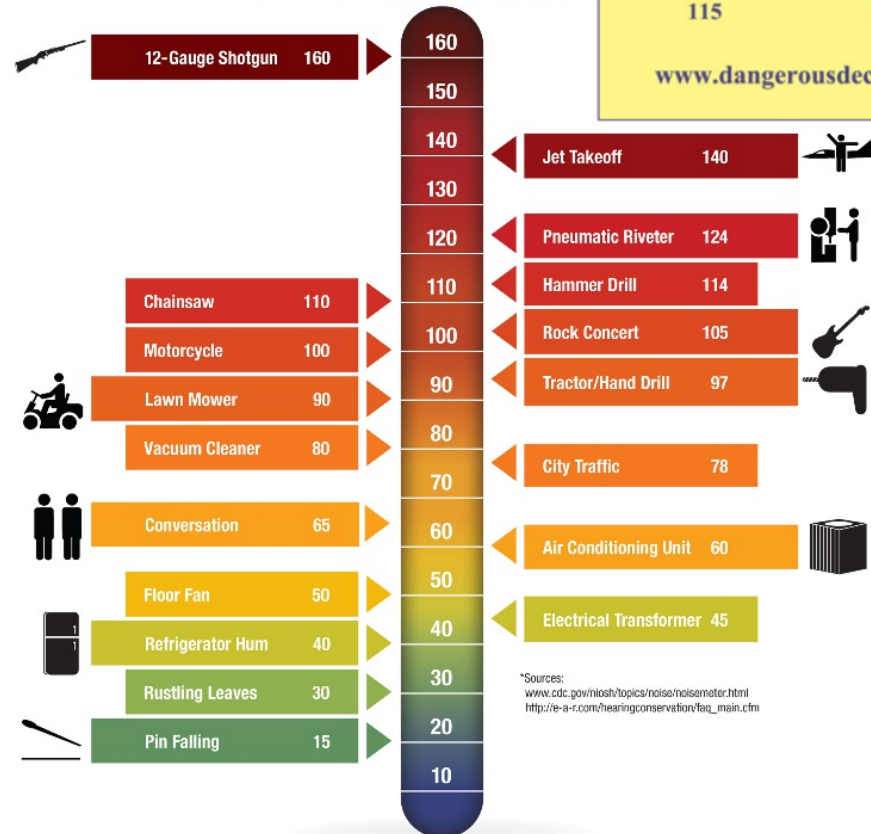
How long can you safely listen to these sounds?

Decibel Level	Length of Time
85	8 hrs.
88	4 hrs.
91	2 hrs.
94	1 hr.
97	30 min.
100	15 min.
115	30 sec.

www.dangerousdecibels.com



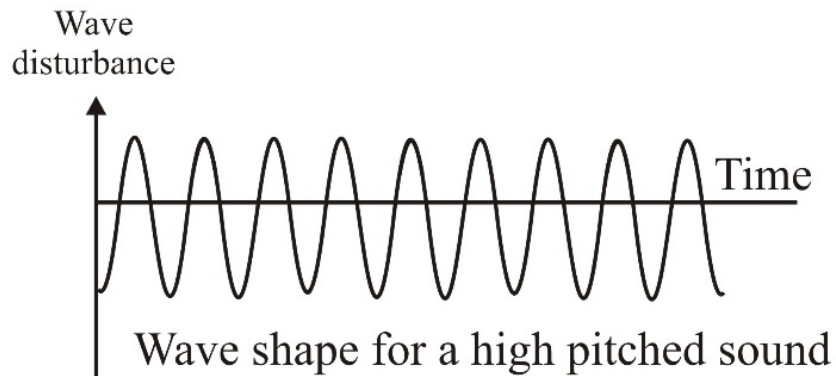
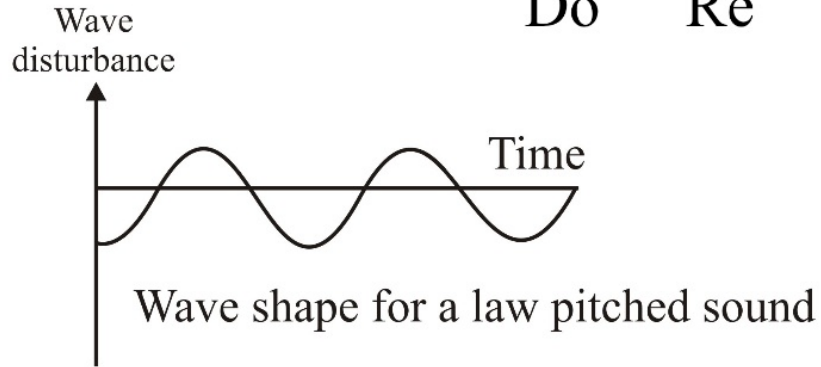
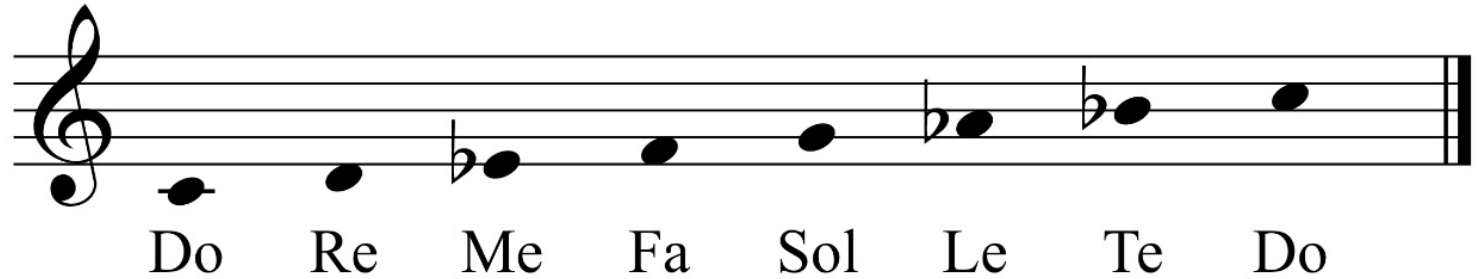
Decibel Scale (dBA)*



*Sources:
www.cdc.gov/niosh/topics/noise/noisemeter.html
http://e-a-r.com/hearingconservation/faq_main.cfm

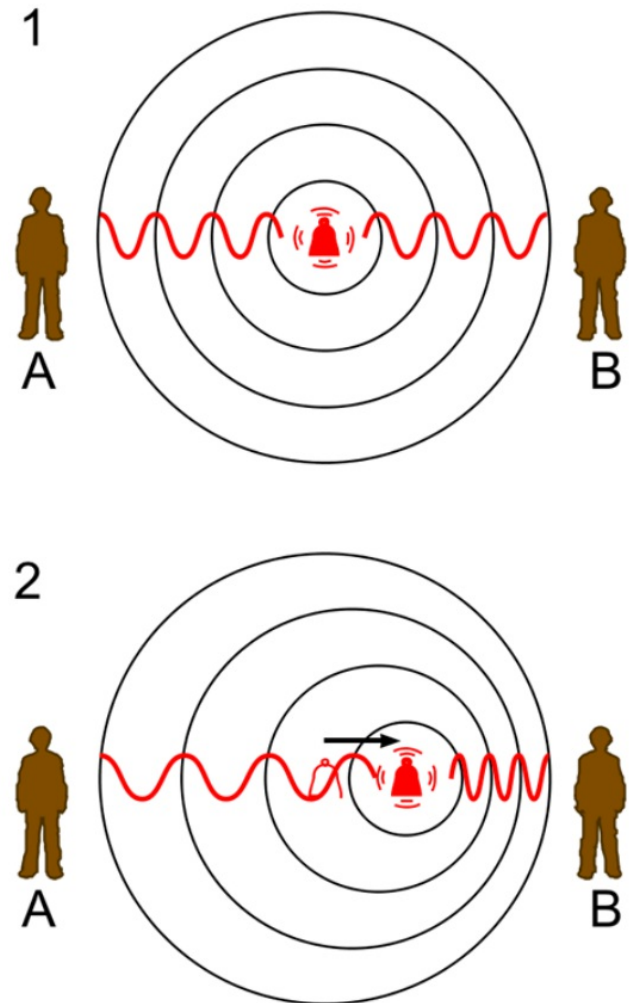
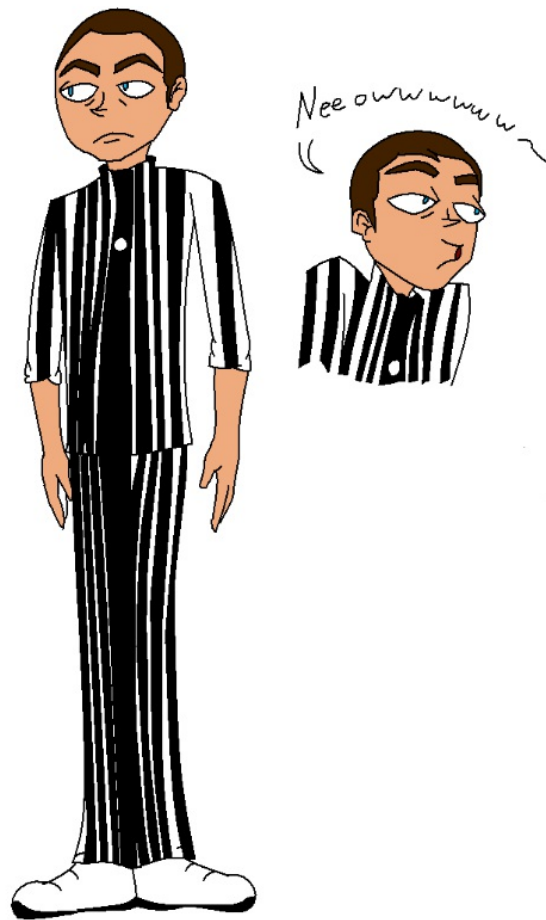
Pitch

Pitch: is how high or low a sound seems to be; is directly related to a wave's frequency



The Doppler Effect

Doppler Effect: the change in wave's frequency due to a wave source moving relative to an observer or an observer moving relative to a wave source



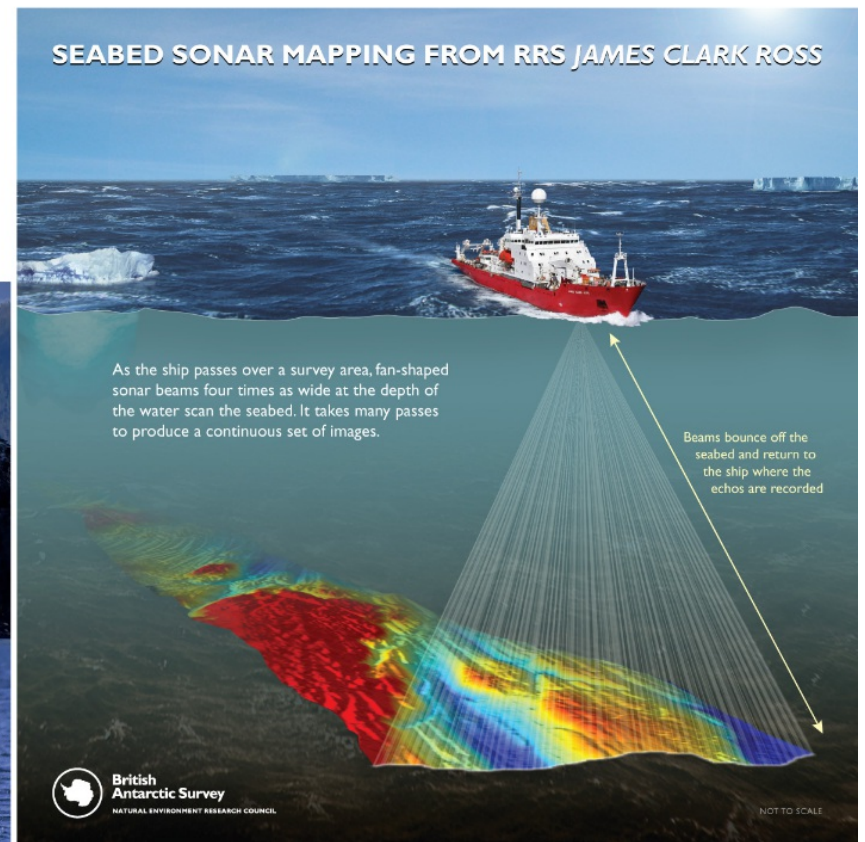
Using Sound



Acoustics: the study of sound.

Echolocation: is the process of locating objects by emitting sounds and then interpreting the sound waves that are reflected from those objects.

Sonar: is a system that uses the reflection of underwater sound waves to detect objects.



Ultrasound: is sound with frequency about 20,000 Hz and cannot be heard by humans.

Ultrasound in Medicine

- Medical professionals use ultrasound to examine many parts of the body.
- Medical professionals can also use ultrasonic imaging, which is much safer than X-ray imaging, to monitor a human fetus
- Ultrasound can also be used to break up kidney stones.

