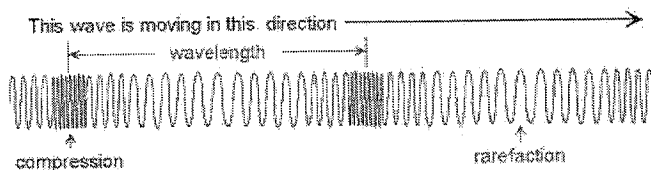


Name: _____

Sound Guided Notes

Sound originates because of a _____ object. Sound travels in the form of _____ waves. The frequency of a vibrating object is the frequency of sound waves produced. Pitch is how high or low frequency appears to be. High pitched sounds have a high vibrational frequency. Low pitched sounds have a _____ vibrational frequency. Typical hearing range: 20 - 20,000 Hz. Broader for a young person; shrinks (especially at the upper end) for an older person. Infrasonic - sound with _____ too low to be heard by the human ear. Ultrasonic - pitch is above 20,000 Hz.



Particles move _____ and _____ in a longitudinal wave. The medium doesn't move in a wave, the energy or pulse does. Sound needs a _____ to travel through. Sound will not travel in space! Why?

Sound travels at different _____ in different media. Sound travels fastest in solids and slowest in gases. Why do you think this occurs?

The speed of sound is slower than the speed of light. Sound travels at 340 m/s at 20°C. The speed of sound depends on 1. Medium, 2. _____, 3. Elasticity of material. How far away is a storm if you note a 3-second delay between a lightning flash and the sound of thunder?

Loudness - is the perceived sensation of sound. When we speak of loudness, we are actually talking about the _____ which is measured in decibels (____). Loudness differs for different people. Sound intensity increases by factors of 10!

Forced vibration - the vibration of an object due to another object. Examples: tuning fork struck with a rubber mallet and ringing vs. striking tuning fork and placing it against a white board. The white board, due to its larger surface area creates a larger disturbance with air molecules and amplifies the sound. Why would an acoustic guitar be louder than an electric guitar that isn't plugged in when the strings are plucked?

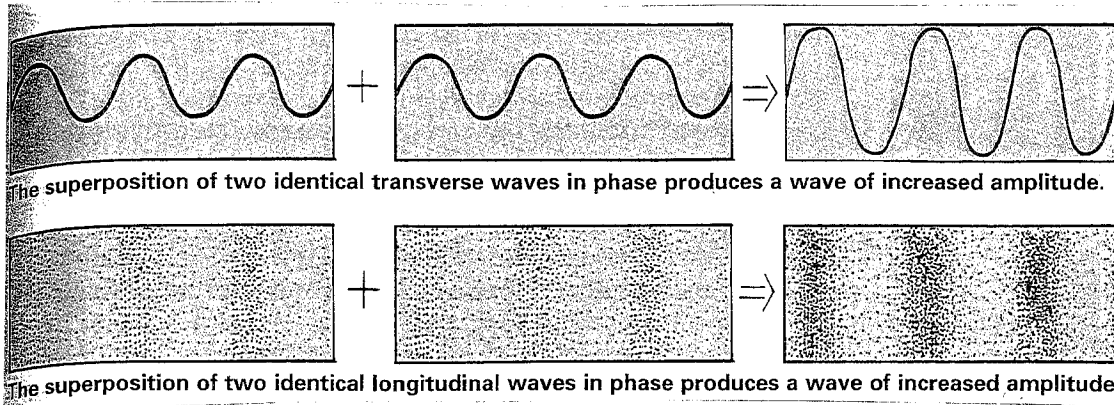
Source of Sound	Level (dB)
Jet engine, at 30 m	140
Threshold of pain	120
Loud rock music	115
Old subway train	100
Average factory	90
Busy street traffic	70
Normal speech	60
Library	40
Close whisper	20
Normal breathing	10
Hearing threshold	0

Table 26.1

Forced vibration is connected to natural frequency which all objects possess. Most objects from atoms to planets have a natural springiness to them and vibrate at particular natural frequencies. Natural frequency is the minimum energy which is required to produce a forced vibration.

Resonance - occurs when the frequency of a forced vibration on an object matches the object's natural frequency and a dramatic increase in _____ results. In order for an object to resonate it has to have elastic properties that will bring it back to its starting position. A common situation where resonance occurs is on a _____. The force of the pump is important but most important is the timing of when you pump your legs. The pump of the legs or push by someone, if delivered in rhythm with the natural frequency of the swinging motion, will result in a larger amplitude (higher swing). Other examples of resonance include striking a tuning fork next to another and causing the second one to vibrate, tuning a radio to capture a signal, and resonance with bridges: Most notably the Tacoma Narrows Bridge: a steady 40 mph wind which resonated with the natural frequency of the bridge and caused it to collapse over several hours only months after being built. 1831: English troops marching over a foot bridge caused the bridge to collapse when their rhythm matched the bridges natural frequency. It is common for troops to "break step" when crossing bridges now.

Interference: occurs when waves _____. Interference effects intensity or loudness! Think about places where destructive interference can play a role on how well you hear someone. *Antinoise technology in headphones for construction workers.



Beats - The _____ variation in the loudness of sound. Two sound sources of slightly different frequencies produce beats as there is overlap (_____ in sound intensity) at certain moments and times where the sounds offset. For example, if you walk side by side with someone who has a different stride, there will be times when you are both in step with each other and other times when you are both out of step. Sounds produced from two different sources work the same way. To figure out the beat frequency between two sounds, simply find the difference between each object's frequency. This will tell you how often the sound waves interfere. What is the beat frequency when a 262 Hz and 266 Hz tuning fork are sounded together? A 262 Hz and a 272 Hz?

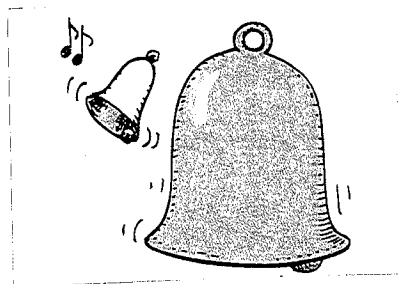


Figure 26.9 ▲ The natural frequency of the smaller bell is higher than that of the big bell, and it rings at a higher pitch.