

Chapter 26 Sound

Compressions and Rarefactions

Media which transmits sound

Air sound travels about 340 m/s

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Speed of sound in various substances

Medium	Velocity	
	(m/s)	(ft/s)
Aluminum	4877	16000
Brass	3475	11400
Brick	4176	13700
Concrete	3200 - 3600	10500 - 11800
Copper	3901	12800
Cork	366 - 518	1200 - 1700
Diamond	12000	39400
Glass	3962	13000
Glass, Pyrex	5640	18500
Gold	3240	10630
Hardwood	3962	13000
Iron	5130	16830
Lead	1158	3800
Lucite	2680	8790
Rubber	40 - 150	130 - 492
Steel	6100	20000
Water	1433	4700
Wood (hard)	3960	13000
Wood	3300 - 3600	10820 - 11810

Air = 340 m/s

Air = 1090 ft/s

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Loudness:

The intensity of a sound is proportional to the square of the amplitude of the sound wave.

Sound	Decibel
Jet engine at 30 m	140
Threshold of pain	120
Loud rock music	115
Old Subway Train	100
Busy street traffic	70
Normal Speech	60
Library	40
Close whisper	20
Normal breathing	10
Hearing threshold	0

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Natural Frequency - a frequency at which the minimum energy is required to produce forced vibrations.

Resonance - Dramatic increase in amplitude when energy is supplied at the natural frequency of an object.

(Frequency of transmitter = frequency of receiver)

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Beats: When two waves have slightly different frequencies they alternately interfere constructively and destructively. This causes periodic changes in loudness called beats.

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Interference

Constructive Interference

Destructive Interference

Beats: When two waves have slightly different frequencies they alternately interfere constructively and destructively. This causes periodic changes in loudness called beats.

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Quick Review:

1. Sound starts with a vibrating material object.
2. Compressions - Rarefactions
3. Needs a medium in which to travel
4. Amplitude - loudness
5. Frequency - pitch
6. Natural Frequency - depends on material and shape.
7. Resonance - Applying energy at a natural frequency of an object causes vibrations of increased amplitude.
8. Interference - where two or more waves meet in space and add up. (Constructive or Destructive)
9. Beats - alternate constructive / destructive interference when two slightly different frequencies interfere.

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1. Does sound travel better in air or in a vacuum?
2. Does sound travel faster in cool air or warm air?
3. Does sound travel faster in air or in steel?
4. Suppose three tuning forks of frequency 260 Hz, 262 Hz and 266 Hz are available. What beat frequencies are possible for pairs sounded together?

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